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VEGETATION RESPONSE TO CLEARING OF EXOTIC INVASIVE PLANTS ALONG THE SABIE RIVER, SOUTH AFRICA



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October 2006

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DECLARATION

I hereby certify that the research submitted in compliance with the requirements for the degree of Masters in Science in the School of Animal, Plant and Environmental Sciences at the University of the Witwatersrand is the result of my own original investigation, except where acknowledged.

Richard David Garner **Date**

A dissertation submitted to the University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Masters of Science.
October, 2006

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ABSTRACT

The Reconstruction and Development Programme's Mpumalanga Working for Water Programme (WWP) has cleared exotic and commercial weed species from the riverine environment since 1994. This study serves as an assessment of the impact and modification caused as a result of invasion and the subsequent clearing of the exotic vegetation on flora in the riverine zone of the Sabie River Catchment. The experimental design compares the before and after clearing effects and includes altitude and invasion intensity variables. The investigations included: *in situ* soil seed banks, environmental modification, vegetation structure, species diversity and effectiveness of clearing.

Clearing and invasion by exotic species altered soil chemical, physical and ground cover parameters. The extent of these modifications was dependent on the extent of invasion and clearing done within the community. Clearing of exotic species however, acted as an additional disturbance to that caused by invasion. Environmental modifications that occurred with clearing and invasion within the study were positively related to percentage soil organic matter, and ground cover (soil, litter, vegetation).

Invasion by exotic species alters the vegetation structure, the extent of which was directly related to the invasion intensity. The main source of vegetation structure modification is attributed to tall growing exotic species such as *Eucalyptus grandis* and *Solanum mauritianum*. Both of these species dominated the indigenous vegetation, *E. grandis* by expanding the upper canopy and *S. mauritianum* by dominating the mid canopy. Clearing of invasive vegetation resulted in an additional disturbance proportional to the extent of invasion intensity. Invasion did not result in any large changes to the vegetation at low intensity but clearing at this intensity increased the disturbance and altered the vegetation structure.

Soil seed banks were limited in the number of species and dominated by two exotic species. The soil seed bank of woody species related positively to the community species richness. The total soil seed bank density did not relate to invasion intensity or clearing thereof but propagules of individual species within the soil seed banks did. The seeds of the exotic species, *Acacia mearnsii* and *S. mauritianum*, illustrated burial as prerequisite for persistence in the soil seed bank. *A. mearnsii* and *S. mauritianum* seeds were found to have half-life's of up to 25 years and 13 months

respectively.

The species richness and diversity varied only marginally because of invasion and clearing. Species alpha diversity increased with clearing due to weedy and pioneer species establishment. Beta diversity effectively highlights the species turnover with clearing and invasion.

Success in eradication of exotic species had mixed results. Clearing of high invasion sites was effective but in lower invasion categories a number of exotic individuals were missed. Clearing effectiveness was good for certain species such as *E. grandis* and *Pinus patula*, but poor for others such as *S. mauritianum*. Coppicing is a significant issue for *E. grandis* and *S. mauritianum.* The persistence of individuals (coppicing & missed individuals) coupled with very large persistent seed banks has repercussions for the clearing programme, as it may prevent effective eradication.

Initially the WWP has been successful in removing exotic vegetation, however there is a failure to address the regenerative properties of some exotic species. Unless a rigid schedule of follow up clearing treatments occurs, an even larger invasion problem could exist.

Key words: *Acacia mearnsii,* clearing, *Eucalyptus grandis*, exotic species, soil seed banks, regeneration, *Solanum mauritianum*, species diversity, vegetation structure, environmental modification.

TABLE OF CONTENTS

DECLARATION ii

ACKNOWLEDGEMENTS iii

ABSTRACT iv

TABLE OF CONTENTS vi

LIST OF FIGURES xi

LIST OF TABLES xvii

LIST OF APPENDICES xxi

CHAPTER 1: INTRODUCTION *1*

1.1 Disturbance in Plant Communities 1

1.1.1 Defining Disturbance 1

1.1.2 Implications of disturbance to community diversity and structure 3

1.2 Invasion of plant communities by exotic plants: a source of disturbance 4

1.2.1 Definitions and classification of exotic and weed species 4

1.2.2 Entry of exotic plant species into the South African environment 6

1.2.3 Invasion history in South Africa and its implications for invasion pressure 8

1.2.4 Differential invasion within the ecosystems/biomes of South Africa 9

1.2.5 Impacts of exotic plant invasions on communities 9

1.3 Clearing of exotic species from plant communities 10

1.3.1 Exotic species control 10

1.3.2 Motivation for clearing of exotic plant species 11

1.3.3 Clearing of exotic plant species in Mpumalanga and the Sabie River Catchment 12

1.4 Plant species diversity 13

1.4.1 Definitions of species diversity 13

1.4.2 Diversity measures 13

1.4.3 Measurement of plant species diversity 15

1.4.4 The nested plot technique 16

1.5 Vegetation regeneration after disturbance 17

1.5.1 Mechanisms of vegetation regeneration 18

1.5.2 Succession in disturbed plant communities 20

1.6 Motivation for the assessment of exotic species removal 20

CHAPTER 2: STUDY SITE LOCATION, DESCRIPTION AND EXPERIMENTAL DESIGN 22

2.1 Geographical location of study area and plots 22

2.2 Climate 22

2.3 Geology 22

2.4 Vegetation of the Eastern Escarpment silvicultural zone 23

2.5 Invasion on the Eastern Escarpment 26

2.6 Important fauna present along the Sabie River 26

2.7 Silviculture in the study area 26

2.8 Typical disturbance types for silvicultural riverine ecosystems 29

2.9 Positioning of plots along river corridors 29

2.10 Plot design (modified-Whittaker nested plots) 32

CHAPTER 3: THE IMPACTS OF INVASION AND CLEARING ON THE ENVIRONMENT 33

3.1 Introduction 33

3.1.1 Environmental changes resulting from exotic plant invasions 33

3.1.2 Environmental changes resulting from removal of exotic plants 34

3.1.3 Aim and objective 35

3.2 Materials and Methods 35

3.2.1 Sampling methods 35

3.2.2 Statistical analyses 36

3.2.3 Multivariate statistics for site heterogeneity 37

3.3 Results 39

3.3.1 Multivariate analysis of soils data 39

3.3.2 Ground cover in relation to invasion intensity and clearing 50

3.3.3 Changes in soil chemical content with clearing and invasion intensity 54

3.3.4 Differences observed in soil physical properties 55

3.4. Discussion 60

3.4.1 Ground cover 60

3.4.2 The soil environment **63**

3.4.3 The "biological" environment **64**

3.5 Conclusions **65**

CHAPTER 4: CHANGES IN VEGETATION STRUCTURE IN RESPONSE TO INVASION AND CLEARING OF EXOTIC PLANTS **66**

4.1 Introduction **66**

4.1.1 Effects of invasion on vegetation structure and composition **67**

4.1.2 The effects of clearing on vegetation structure and composition **67**

4.1.3 The success of clearing exotic species from communities **67**

4.2. Materials and Methods **67**

4.2.1 Determination of vegetation aerial cover and height classes **67**

4.2.2 Pre-clearing invasion intensity **67**

4.2.3 Success in clearing exotic vegetation **7**

4.2.4 Plant growth forms **72**

4.2.5 Clearing success for *S. mauritianum* **72**

4.2.6 Statistical analyses of data **72**

4.3 Results **74**

4.3.1 Invasion intensity **74**

4.3.2 Vegetation aerial cover changes with clearing and invasion **75**

4.3.3 Vegetation structure differences with invasion and clearing **86**

4.4 Discussion **90**

4.4.1 The effect of invasion on aerial cover **90**

4.4.2 Clearing effects on aerial cover **91**

4.4.3 Exotic species eradication by clearing **93**

4.4.4 *S. mauritianum* clearing **93**

4.4.5 Vegetation structure variables affected by clearing **94**

4.5 Conclusion **95**

CHAPTER 5: EFFECTS OF INVASION AND CLEARING OF EXOTIC SPECIES ON SOIL SEEDBANKS ***97***

5.1 Introduction **97**

5.1.1 Germination cues **97**
5.1.2 Seed size and appearance **97**
5.1.3 Seed attrition **98**
5.1.4 The role of seed banks in cleared and invaded communities **98**
5.1.5 Clearance and regeneration from soil-stored seed banks **99**
5.2 Materials and Methods **99**
5.2.1 Field sampling **99**
5.2.2 Soil seed bank sampling **99**
5.2.3 Soil seed bank recovery **100**
5.2.4 Seed bank longevity of *S. mauritianum* and *A. mearnsii* **100**
5.2.5 Seed persistence experiment viability testing **101**
5.2.6 *S. mauritianum* seed production **102**
5.2.7 Tetrazolium staining **102**
5.2.8 Statistical analyses of data **102**
5.3 Results **103**
5.3.1 Soil seed bank species composition **103**
5.3.2 Soil seed bank distribution **104**
5.3.3 Regeneration potential of *S. mauritianum* and *A. mearnsii* **108**
5.3.4 Seed production of *S. mauritianum* **119**
5.4 Discussion **121**
5.4.1 Soil seed bank species composition **121**
5.4.2 Soil seed bank distribution **122**
5.4.3 Regeneration potential of *S. mauritianum* and *A. mearnsii* **123**
5.5 Conclusion **125**
CHAPTER 6: CHANGES IN SPECIES RICHNESS AND DIVERSITY IN RESPONSE TO INVASION AND CLEARING ***126***
6.1 Introduction **126**
6.1.1 Invasion by exotic species **126**
6.1.2 Clearing of invasive species **127**
6.2 Materials and Methods **128**
6.2.1 Field sampling & identification **128**

6.2.2 Plant diversity **130**

6.2.3 Multivariate analysis **131**

6.3 Results **131**

6.3.1 Plant species richness **131**

6.3.2 Plant species diversity **133**

6.3.3 Beta diversity - Sorenson's coefficient of community **145**

6.3.4 Site associations by species composition **145**

6.4 Discussion **151**

6.4.1 Plant species richness **151**

6.4.2 Plant species alpha diversity – Simpson's index **153**

6.4.3 Beta diversity - Sorenson's coefficient of community **155**

6.5 Conclusion **156**

CHAPTER 7: CONCLUSIONS ***157***

7.1 Environmental Modification **157**

7.2 Vegetation Structure **158**

7.3 Soil Seed Banks **159**

7.4 Biodiversity **159**

7.5 Future Areas of Research **160**

7.6 Objectives and Hypothesis **161**

REFERENCES ***163***

APPENDICES **181**

LIST OF FIGURES

Figure 1.1 The three components of species diversity. α = species richness within a habitat; β = species turnover between habitats; γ = species turnover within habitats between geographic regions (after Bond, 1989). .....……..….14

Figure 2.1 Map of South Africa, highlighting the Mpumalanga Province (red). Sabie Town has been marked in for reference in locating the study areas (Figure 2.2.) …….23

Figure 2.2 Map of Sabie/Graskop, Mpumalanga, showing the location of study areas used for sampling in this study (Map courtesy of AA Motoring South Africa, 1997).……...24

Figure 2.3 Minimum and maximum average temperatures with mean rainfall for the Sabie FRC. Temperature and rainfall associations illustrate a summer rainfall pattern…….. ... …25

Figure 2.4 Geological map of the Sabie/Graskop area, illustrating the complex lithology of the region (Produced from the 1:1 000 000 Geological map of southern Africa, fourth edition, 1984.). .....……26

Figure 2.5 Forestry zones in South Africa in relation to annual rainfall >800 mm. Indigenous forests occur mostly in the areas within this rainfall zone (after Anonymous 1984)….. 28

Figure 2.6 Photographs of: (A) a typical area clear felled by the RDP Water Conservation programme illustrating the extent of environmental disturbance. (B) A typical uncleared invasion site of similar invasion intensity as that seen cleared in photograph (A). Both occurred on the banks of the Sabie river (1997) ...…… ….……..…30

Figure 2.7 Flow diagram of the experimental layout of plots showing altitude divisions followed by clearing treatments and invasion categories……..31

Figure 2.8. Placement of plots centrally within the 30 m cleared zone relative to the river……31

Figure 3.1 Centered and standardized PCA of soil chemical attributes for low altitude study sites using Euclidian distance measure showing two groupings of cleared (Red) and uncleared (Blue) sites. Soil chemical attributes included Na_2O, MgO, CaO, Cu, P_2O_5 and Al_2O_3. Eigen values for the 1st and 2nd axes were 0.388 and 0.221 respectively, explaining 60.9 % cumulative variance of species data. 41

Figure 3.2 Centered and standardized PCA's of soil chemical attributes for low altitude study sites using Euclidian distance measure illustrating three groupings (Red – low invasion uncleared

sites, Blue – cleared sites & Green – high invasion uncleared sites) based on site categories. High Invasion Cleared Plots illustrated no discernable grouping. Soil chemical attributes included Na_2O, MgO, CaO, Cu, P_2O_5 and Al_2O_3 Eigen values for the (A.) 1st and 3rd axes were 0.388 and 0.172 respectively explaining 56 % cumulative variance of species data, (B.) 1st and 4th axes were 0.338 and 0.132 respectively, explaining 51 % cumulative variance of species data, (C.) 2nd and 3rd axes were 0.221 and 0.172 respectively, explaining 39.3 % cumulative variance of species data. 43

Figure 3.3 Centered and standardized PCA of soil chemical attributes for high altitude study sites using Euclidian distance measure illustrating the clear grouping of sites based on soil physical attributes (Groupings of Green, Red, Black and Blue based on site categories of invasion and clearing treatments are identified). Soil chemical attributes include Na_2O, CaO, P_2O_5 and Al_2O_3. Eigen values for the 1st and 2nd axes were 0.411 and 0.244 respectively, explaining 65.6 % cumulative variance of species data. 44

Figure 3.4 Centered and standardized PCA of soil physical attributes for low altitude study sites using Euclidian distance measure with two identified groupings of Low invasion cleared sites (Blue) and low invasion uncleared sites (Red). Soil physical attributes include sand, gravel, silt (2 - 20 μm), silt (20 - 50 μm), clay, aspect and soil pH. Eigen values for the 1st and 2nd axes were 0.388 & 0.221 respectively, representing 60.9 % cumulative variance of species data... 45

Figure 3.5 Centered and standardized PCA of soil physical attributes for high altitude study sites using Euclidian distance measure illustrating no clear groupings or separation of sites. Soil physical attributes including sand, gravel, silt (2 - 20 μm), clay, yearly rainfall and slope had no discernable groupings. Eigen values for the 1st and 2nd axes were 0.312 and 0.245 respectively, representing 55.7 % cumulative variance of species data. 46

Figure 3.6 Centered and standardized PCA representation of low altitude study site relationships in ordinal space based on "biological" transient variables illustrating three mixed groupings based generally on site invasion category (Uncleared – Red; High Invasion Cleared – Black; Low Invasion – Blue). Eigen values for 1st and 2nd axes are 0.338 and 0.207 respectively, representing 54.5% of the cumulative variance of species data. 48

Figure 3.7 Centered and standardized PCA representation of high altitude plot relationships in ordinal space based on "biological" transient variables illustrating two groupings based on clearing status (Cleared – Red grouping; Uncleared – Blue grouping). Eigenvalues for 1st

and 2nd axes are 0.481 & 0.197 respectively, representing 67.8% of the cumulative variance of species data… 49

Figure 3.8 The relationship of percentage litter cover on the soil surface with increasing invasion intensity (% exotic cover of alien plants as calculated in section 4.4.2 of the Vegetation Chapter) on sites; (A) uncleared and (B) cleared of exotic plant species along the Sabie River, South Africa. The two regression slopes were not significantly different between cleared and uncleared plots (P > 0.05). The regression relationship (A) is $Y = 2.853003 + (0.4147964 * X)$ (r^2=0.39; P<0.05) and for (B) $Y = 4.205003 + (0.2004332 * X)$ (r^2=0.30; P<0.05). 52

Figure 3.9 The relationship of litter depth (cm) on the soil surface with increasing invasion intensity (% aerial cover of exotic plants as calculated in section 4.4.2 of the Vegetation Chapter) on sites; (A) uncleared & (B) cleared of exotic plant species along the Sabie River, South Africa. ⊡ indicates outliers not included in regression calculation. The regression relationship (A) was not significant ($r^2 = 0.23$; P > 0.05); & (B) was significant with $Y = 0.701062 + (0.0303288 * X)$ ($r^2 = 0.31$; P< 0.05).
.....53

Figure 3.10 Regression of percentage soil organic matter for (A) uncleared and (B) cleared plots with increasing invasion intensity in the soil A horizon. Cleared (linearized) and uncleared regressions were significant at $P < 0.05$. The two regression slopes were not significant at $P < 0.05$. Regression relationships were as follows: (A) $Y = 0.4855938 + (0.00932027 * X)$ ($r^2 = 0.49$; P < 0.05) and (B) $Y = 0.9119732 * EXP (0.007023803 * X)$ ($r^2 = 0.45$; P < 0.05).
.....59

Figure 4.1 Three models of the mechanisms producing the sequence of species succession. The dashed lines represent interruptions of the process, in decreasing frequency of order *w, x, y* and *z*. From Souza (1984). 69

Figure 4.2 Layout of how overstorey aerial cover was determined within 20 x 50 m plots using line transects. 70

Figure 4.3 Regressions of diameter at breast height (DBH) verses basal diameter (DB) with 95% standard error lines for *A. mearnsii* (A) ($Y = 0.833 * (X)$) ($r^2 = 0.904$), *E. grandis* (B) ($Y = 0.732 * (X) + 6.94 * 10^3$; $r^2 = 0.92$) and *P. patula* (C) ($Y = 0.853 * (X) – 3.2 * 10^{-3}$; $r^2 = 0.993$), used to determine biomass of felled individuals in cleared sites.

..... 77

Figure 4.4 Centered and standardized PCA representation of low altitude study site relationships in ordinal space based on "biological" transient variables. Three groupings discernable are (A) Blue – Low Invasion Cleared Sites, (B) Red – Uncleared Sites (mainly Low Invasion), and (C) Black – High Invasion Cleared Sites. Eigen values for 1st and 2nd axes are 0.338 and 0.207 respectively, representing 54.5% of the cumulative variance of species data. KEY: GRASBIOM – Grass Biomass; invasion – Invasion intensity (%), % Soilex – Percentage soil surface exposed; % Litter – Percentage Litter cover; WOODBIOM – Wood Biomass (Ton); Carbona – Carbon content of A-soil horizon (mg)..... 79

Figure 4.5 Centered and standardized PCA representation of high altitude site relationships in ordinal space based on "biological" transient variables. Two groupings were identified (A) Red – Cleared Plots, and (B) Blue – Uncleared Plots. Eigenvalues for 1st and 2nd axes are 0.481 and 0.197 respectively, representing 67.8 % of the cumulative variance of species data. KEY: GRASBIOM – Grass Biomass; invasion – Invasion intensity (%), % Soilex – Percentage soil surface exposed; % Litter – Percentage Litter cover; WOODBIOM – Wood Biomass (Ton); Carbona – Carbon content of A-soil horizon (mg)..... 80

Figure 4.6 Mean aerial cover of indigenous and exotic species for each altitude, invasion intensity and management category showing high exotic species aerial cover in uncleared study sites and extent of vegetation aerial cover loss in cleared study sites. Different letters within categories denote statistical differences between treatments (P<0.05). 84

Figure 4.7 Mean percentage aerial cover of exotic species in three observed height classes and total aerial cover for altitude, invasion intensity and management experimental categories. Different letters within categories denote statistical differences between treatments (P<0.05). Statistical differences for total aerial cover are depicted by the boxed letters. 85

Figure 4.8 Mean percentage aerial cover of indigenous vegetation in three observed height classes for altitude, invasion intensity and management categories. Similar letters within categories depict statistical similarity. Statistical differences for total aerial cover are depicted by the boxed letters..... 86

Figure 5.1 Soil seed banks of total indigenous and total exotic propagules (excluding *E. grandis* capsules) for each experimental category. 108

Figure 5.2 The relationship of *Clutia monticola* seed density in the soil with increasing invasion intensity (% aerial cover of exotic plants as calculated in section 4.4.2 of the Vegetation

Chapter) on sites; (A) uncleared ($r^2 = 0.25$; $P > 0.05$) and (B) cleared of exotic plant species ($r^2 = 0.17$; $p > 0.05$) along the Sabie River, South Africa. 110

Figure 5.3 The relationship of *Ipomoea* spp. seed density in the soil with increasing invasion intensity (% aerial cover of exotic plants as calculated in section 4.4.2 of the Vegetation Chapter) on sites; (A) uncleared ($r^2 = 0.03$; $P > 0.05$) and (B) cleared of exotic plant species ($r^2 = 0.21$; $P < 0.05$) along the Sabie River, South Africa. ⊡ indicates outliers not included in regression analyses. Regression relationship (B) $Y = 14.130863^{(-0.006050041 * X)}$ 111

Figure 5.4 The relationship of *S. mauritianum* seed density in the soil with increasing invasion intensity (% aerial cover of exotic plants as calculated in section 4.4.2 of the Vegetation Chapter) on sites; (A) uncleared ($r^2 = 0.16$; $P > 0.05$) and (B) cleared of exotic plant species ($r^2 = 0.31$; $P < 0.05$) along the Sabie River, South Africa. ▣ indicates outliers not included in regression calculation. The regression relationship (B) is $Y = 49.94468^{(0.03681499 * X).}$ 112

Figure 5.5 The relationship of *E. grandis* seed density in the soil with increasing invasion intensity (% aerial cover of exotic plants as calculated in section 4.4.2 of the Vegetation Chapter) on sites; (A) uncleared ($r^2 = 0.32$; $P < 0.05$) and (B) cleared of exotic plant species ($r^2 = 0.30$; $P < 0.05$) along the Sabie River, South Africa. The regression relationship (A) is $Y = (11.28 * X) - 55.3$ and (B) is $Y = 83.4 * X^{0.56}$ ….....113

Figure 5.6 Percentage viable *S. mauritianum* seeds remaining through time for different depth layers under field conditions of high (unshaded) and low (shaded) light conditions. . ..115

Figure 5.7 Percentage viable *A. mearnsii* seeds remaining through time for different depth layers under field conditions of high (unshaded) and low (shaded) light conditions. 115

Figure 5.8 Viable seed persistence through time and with burial (Litter & 0-2 cm) under greenhouse water and light trials for *S. mauritianum* and *A. mearnsii*. HL - high light; LL - low light; HW - high water; LW - low water. 116

Figure 5.9 Regression relationships of viable seeds and inflorescences of *S. mauritianum* with measured height of the adult plant. 121

Figure 6.1 Species richness as a function of plot sizes (log scale) 1 m^2 (200 plots at each altitude), 10 m^2 (40 plots at each altitude), 100 m^2 (20 plots at each altitude) and 1000 m^2 (20 plots at each altitude) (mean ± S.E.) for both high and low altitudes.....132

Figure 6.2 The relationship between plant species richness and invasion intensity (% exotic aerial cover) at the low altitude sites for (A) uncleared ($r^2 = 0.06$; $P < 0.05$) and (B) cleared plots

($r^2 = 0.25$; $P < 0.05$) at the 10 m^2 quadrat scale. 136

Figure 6.3 The relationship between plant species richness and invasion intensity (% exotic aerial cover) at the high altitude sites for (A) uncleared ($r^2 = 0.31$; $P < 0.05$) and (B) cleared plots ($r^2 = 0.24$; $P > 0.05$) at the 100 m^2 quadrat scale. Regression relationship for uncleared plots is as follows: $Y = (1679.908 + (-0.6045157 * X))/100)$ 137

Figure 6.4 The relationship between plant species alpha diversity and invasion intensity (% exotic aerial cover) for (A) cleared ($r^2 = 0.04$; $P < 0.10$) and (B) uncleared plots ($r^2 = 0.15$; $P > 0.05$) at the 10 m^2 quadrat scale. Regression relationship for uncleared plots is as follows: $Y = 0.2294527 + 0.00569029 * LOG(X)$. ▣ indicates outliers not included in regression calculation. 147

Figure 6.5 The relationship between woody plant species alpha diversity and invasion intensity (% exotic aerial cover) for (A) cleared ($r^2 = 0.12$; $P > 0.05$) & (B) uncleared plots ($r^2 = 0.31$; $P < 0.05$) at the 100 m^2 quadrat scale. Regression relationship for cleared plots is as follows: $Y = 0.1992874+(0.006228929*X)$. ▣ indicates outliers not included in regression calculation. Outlier in uncleared regression (A) is the same site as outlier in Figure 6.4. ..148

Figure 6.6 Constrained Canonical Analyses (CCA) of low altitude plots using symmetric scaling. Species were separated into exotic and indigenous based on the Mpumalanga Working for Water list of unwanted exotic species (Table 1.1.). Black arrows point to predominant exotic species in relation to site categories. The brown line depicts a indigenous/exotic species division. The four experimental groupings: Red – Low Invasion Uncleared Sites; Black – High Invasion Cleared Sites; Blue – Low Invasion Cleared Sites; and Green – High Invasion Uncleared Sites (Refer to Appendix 17. for species label codes). 149

Figure 6.7 Constrained Canonical Analyses (CCA) of high altitude plots using symmetric scaling. Species were separated into exotic and indigenous based on the Mpumalanga Working for Water list of unwanted exotic species (Table 1.1.). Black arrows point to predominant exotic species. The four experimental categories highlighted as groupings: Red – Low Invasion Uncleared Sites; Blue – Low Invasion Cleared Sites; and Green – High Invasion Uncleared Sites (Refer to Appendix 17. for species label codes). 150

LIST OF TABLES

Table 1.1 List of invasive exotic species targeted for clearing in the riverine areas of Mpumalanga Province (A. Poulter 1996[1]). Stars (*) indicate the weed category number of the species (Appendix 1.) 15

Table 1.2 Dimensions of plots and subplots in various nested vegetation sampling designs. A comparison of the original Whittaker nested plot with the modified-Whittaker nested plot. 17

Table 2.1 Principal problem exotic plant species of the Zululand region state forests, KwaZulu-Natal Province. These species are also present in the Mpumalanga silvicultural zone as problem plants. (MacDonald & Jarman 1985) 29

Table 3.1 Mean and standard error for percentage ground cover estimates of soil, litter, grass, herbaceous vegetation, rock and depth of litter. Values with the same superscript letter within rows are not significantly different using Ryan's Q post-hoc test ($p < 0.05$). 51

Table 3.2 Soil organic matter, pH and physical soil attributes (mean ± S.E.) found under different altitudes, management (Cleared versus Uncleared) treatments and invasion intensities for A (0 -10 cm) and B (10 - 20 cm) horizons. Values with the same superscript letter within row are not significantly different ($P < 0.05$, Ryan's Q). 56

Table 3.3 Soil elements (as oxides, XRF data) significance values for three-way ANOVA's of altitude (ALT), invasion intensity (INV) and management (MAN) for soil depths 0 - 10 cm (A) and 10 - 20 (B). *d.f.* = 1,32 for all main effects and interaction terms. Bold text indicates $P > 0.05$. 57

Table 3.4 Soil element mean ± S.E. under different altitude, invasion intensity & management treatment (Cleared versus Uncleared) for the A (0 -10 cm) and B (10 - 20 cm) soil horizons. Means with the same superscript letter within row are not significantly different ($P < 0.05$, Ryan's Q). 58

Table 4.1 Mean and S.E. for uncleared, pre- and post-clearing percentage aerial cover of total exotic vegetation (invasion intensity). Values with the same superscript letter within rows are not significantly different using Ryan's Q post-hoc test ($p < 0.05$). 76

Table 4.2 Probability values pre- and post-clearing aerial cover from the three way ANOVA's for total exotic vegetation, *E. grandis* and *S. mauritianum*, in relation to invasion (INV), altitude (ALT) and management / clearing treatment (MAN). *d.f.* = 1,32 for all main effects and

interaction terms. 79

Table 4.3 Probability values of the three way ANOVA's of the percentage aerial cover for exotic vegetation, *E. grandis, S. mauritianum* and indigenous vegetation at three height classes (> 5 m; 2 - 5 m; < 2 m) for each site with relation to invasion (INV), altitude (ALT) and management / clearing treatment (MAN). *d.f.* = 1,32 for all main effects and interaction terms. 81

Table 4.4 *t*-tests and mean ± S.E. for *S. mauritianum* and indigenous vegetation height in both cleared and uncleared plots. 83

Table 4.5 Standing timber volumes (m^3/ha) (mean ± S.E.) for the species *E. grandis, P. patula* and *A. mearnsii* and total timber for each altitude, invasion intensity and management/treatment. 87

Table 4.6 Woody vegetation density with invasion and clearing of exotic vegetation. Data used from the 1 m^2 plots. Significance using *t*-tests, *d.f.* = 40. 88

Table 4.7 List of plant growth forms (grass, herbaceous, shrub and tree) found in riverine habitats along the Sabie River. Grass, herbaceous, shrub, tree and total species number per category and proportional composition for each experimental category is given. 89

Table 5.1 Soil seed banks (mean seeds/m^2 ± S.E.) for species with seeds > 1 mm in diameter recovered from litter and 0 - 4 cm depth of burial in the soil. Values with the same superscript letter in each row were not significantly different (Ryan's Q multiple comparison test, $P < 0.05$). 106

Table 5.2 Species richness of the soil seed banks for both total and depth categories for each experimental category. 107

Table 5.3 Probability values for soil seed banks (litter plus 0 - 4 cm depth) of *E. grandis* (capsules), *S. mauritianum*, *C. monticola* and *Ipomoea* spp. Results from a three way ANOVA analyses of invasion (INV), altitude (ALT) and management / clearing treatment (MAN). *d.f.* = 1,32 for all main effects and interaction terms. 107

Table 5.4 Probability values for soil seed banks for *E. grandis* (capsules), *S. mauritianum*, *C. monticola* and *Ipomoea* spp. for three way ANOVA's of seeds recovered for each depth class in the soil in relation to invasion (INV), altitude (ALT) and management / clearing treatment (MAN). *d.f.* = 1,32 for all main effects and interaction terms. 117

Table 5.5 Probability values of the three way ANOVA's with repeated measures (depth) for soil seed banks for four species in relation to invasion (INV), altitude (ALT) and management /

clearing treatment (MAN). *d.f.* = 1,32 for all main effects and interaction terms. 118

Table 5.6 Seed half-life for seeds of *A. mearnsii* and *S. mauritianum* for different light, water and depths of burial from greenhouse and field trials. Regression equations used in the calculation of the seed half-life are to be found in Appendix 14. 120

Table 5.7 Proportion coppicing exotic individuals (mean ± S.E.), and proportion exotic vegetation "missed" or germinated after clearing operations for *E. grandis, P. patula* and *S. mauritianum*. 120

Table 6.1 Plant species richness significance values for three-way ANOVA's of altitude (ALT), invasion intensity (INV) and management / clearing treatment (MAN) for quadrat sizes 1 m^2, 10 m^2, 100 m^2 and 1000 m^2. *d.f.* = 1,32 for all main effects and interaction terms. Bold text indicates $P < 0.05$. 133

Table 6.2 Mean and standard error for plant species richness. Values with the same superscript letter within rows are not significantly different using Ryan's Q multiple comparison test ($P < 0.05$). 134

Table 6.3 Mean and standard error for plant species alpha diversity. Values with the same superscript letter within rows are not significantly different using Ryan's Q post-hoc multiple comparison test ($P < 0.05$). 134

Table 6.4 Total plant species alpha diversity significance values for three-way ANOVA's of altitude (ALT), invasion intensity (INV) and management / clearing treatment (MAN) for quadrat sizes 1 m^2, 10 m^2, 100 m^2 and 1000 m^2. *d.f.* = 1,32 for all main effects and interaction terms. Bold text indicates $P < 0.05$. 135

Table 6.5 Woody plant species alpha diversity (Simpsons Index) significance values for three-way ANOVA's of altitude (ALT), invasion intensity (INV) and management / clearing treatment (MAN) for quadrat sizes 1 m^2, 10 m^2, 100 m^2 and 1000 m^2. *d.f.* = 1,32 for all main effects and interaction terms. Bold text indicates $P < 0.05$. 136

Table 6.6 List of plant species with naming authorities and taxonomic family for grass, herbaceous, shrub and tree growth forms found in riverine habitats along the Sabie River. Presence (1) and absence of species for each different experimental categories is given (invasion (INV), altitude (ALT) and management/clearing treatment (MAN). * denotes Category 1 weed species; ** denotes Category 2 weed species and *** denotes Category 3 weed species as per the National Water Act of 1998. 138

Table 6.7 Matrix of Sorenson's coefficient of community for sites in each experimental category at

the 100 m^2 quadrat scale. Red – Low community similarity (< 0.30); Green – High community similarity (> 0.50). 146

APPENDICES

Appendix 1. Category 1 – 3 Declared Weed and Alien Invader Plants in South Africa in terms of the Regulations pertaining to the Conservation of Agricultural Resources Act 43 of 1983 as amended.

Appendix 2. Study site co-ordinates.

Appendix 3. Probability values for percentage ground cover estimates of soil, litter, grass, herbaceous vegetation, rock and depth of litter for the three way ANOVA's on invasion (INV), altitude (ALT) and management (MAN). *d.f.* = 1,32 for all main effects and interaction terms.

Appendix 4. Differences in soil physical characteristics tested by three-way ANOVA's with repeated measures (depth) for altitude (ALT), invasion intensity (INV) and clearing (MAN). *d.f.* = 1,32 for all main effects and interaction terms. Bold text indicates $P > 0.05$.

Appendix 5. Soil elements as oxides, (mean ± S.E.) found under different altitudes, invasion intensities and management treatments for both A (0 -10 cm) and B (10 - 20 cm) horizons. Means with the same superscript letter within row are not significantly different ($P < 0.05$, Ryan's Q).

Appendix 6. Probability values for soil chemical elements (XRF data) from three way ANOVA's with repeated measures (depth) for altitude (ALT), invasion intensity (INV) and management / clearing treatments (MAN). *d.f.* = 1,32 for all main effects and interaction terms. Bold text indicates $P > 0.05$.

Appendix 7. Probability values for soil trace elements (XRF data) from three-way ANOVA's of altitude (ALT), invasion (INV) and management (MAN) for soil depths 0 - 10 cm (A) and 10 - 20 (B). *d.f.* = 1,32 for all main effects and interaction terms. Bold text indicates $P > 0.05$.

Appendix 8. Soil organic matter, pH and soil physical characteristics tested for significant differences using three-way ANOVA's for altitude (ALT), invasion (INV) and management (MAN) for soil horizons, 0 - 10 cm (A) and 10 - 20 (B). *d.f.* = 1,32 for all main effects and interaction terms. Bold text indicates $P > 0.05$.

Appendix 9. Regression relationships of invasive species basal cover and density with aerial cover

used to determine pre-clearing invasion intensity in plots cleared of exotic species. -, indicates no data available, #, indicates regression relationship used.

Appendix 10. Mean and S.E. for pre- and post-clearing aerial cover of total exotic vegetation and two exotic weed species, *E. grandis* and *S. mauritianum*. Values with the same superscript letter are not significantly different using Ryan's Q post-hoc test ($p < 0.05$).

Appendix 11. Means and S.E. for percentage aerial cover of total, indigenous, exotic vegetation and various common species from plots under different experimental categories. -, not present. Values with same superscript letters indicate no significant differences using Ryan's Q post-hoc test.

Appendix 12. Letter from the Directorate: Plant and Quality Control, National Department of Agriculture on seed identification.

Appendix 13. Species list, presence/absence and richness per experimental category for all seeds and capsules greater than 1 mm in diameter found in the litter and soil, down to 4 cm depth of burial.

Appendix 14. Mean and S.E. for all species of seed and capsules found in the soil seed bank for litter, 0 - 2 cm and 2 - 4 cm depth of burial for each treatment category in the experimental design. Values with the same superscript letter are not significantly different using a one way ANOVA and Ryan's Q post hoc test ($p < 0.05$).

Appendix 15. Regression equations of seed half life for seeds of *A. mearnsii* and *S. mauritianum* under greenhouse and field trials for varying light, water and depths of burial. * indicates $P < 0.05$.

Appendix 16. Key species codes for Constrained Canonical Analyses (CCA) Plots.

Appendix 17. Mean and standard error for woody plant species alpha diversity. Values with the same superscript letter within rows are not significantly different using Ryan's Q post-hoc multiple comparison test ($P < 0.05$).