Chapter 4

Results

4.1 Land use

4.1.1 Vegetation cover and avian communities

The vegetation cover of the four land use types included in the current study is presented in the following sections. The summer and winter bird communities inhabiting the four land use types included in the study are also presented, as well as the birds recorded in each land use type.

4.1.2 Moderate Land Management

4.1.2.1 Vegetation

The vegetation of the Moderate Land Management (MLM) was categorised as having the following vegetation cover (Figures 4.1 & 4.2)(Table 4.1).

Table 4.1 Vegetation categories for MLM

Bare ground accounted for 22% of total cover.

Height Category	% of tree cover
10–20 m	10%
5–10 m	9%
2–5 m	10%

Height Category	% of shrub cover
1–2 m	7%
0.5–1 m	11%
<0.5 m	8%

Height Category	% of grass cover
1–2 m	6%
0.5–1 m	9%
<0.5 m	8%

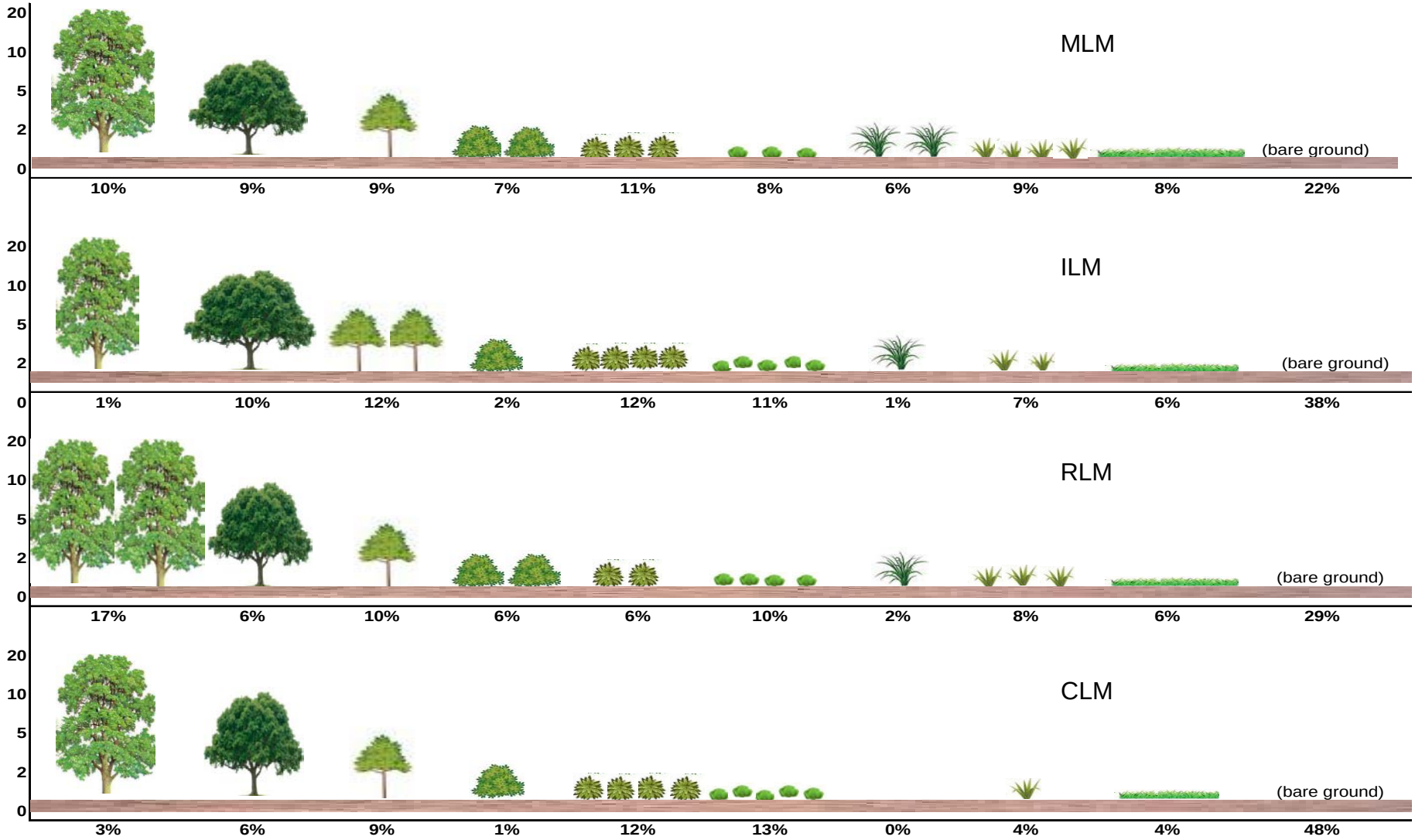

Figure 4.1 General structure of the vegetation of the four land use types of the study area

Figure 4.2 MLM vegetation during summer (left) & winter (right)

4.1.2.2 Birds

4.1.2.2.1 Bird species and numbers recorded for the MLM during summer

Fifty-four species and 481 birds were recorded during the summer surveys (Table 4.2). In summer, nine species were recorded in the MLM that were not recorded in the same season in the other three land use types (Table 4.3).

Table 4.2 Bird species and numbers recorded in the MLM during summer

Robert's N°	Common name	Biological name	Points								Total
			1	2	5	6	9	10	13	14	
361	African Green-Pigeon	*Treron calvus*						3			3
457	African Grey Hornbill	*Tockus nasutus*	1				3	1	2	4	11
710	African Paradise-Flycatcher	*Terpsiphone viridis*	1		4			1			6
560	Arrow-marked Babbler	*Turdoides jardineii*			5	8					13
518	Barn Swallow	*Hirundo rustica*	2		1	3	1				7
487	Bearded Woodpecker	*Dendropicos namaquus*		1				1			2
538	Black Cuckooshrike	*Campephaga flava*			1			1	1		3
740	Black-backed Puffback	*Dryoscopus cubla*		1	2	4		1			8
464	Black-collared Barbet	*Lybius torquatus*						2			2
545	Black-headed Oriole	*Oriolus larvatus*	1	2	2	1	1	1	1	1	10
844	Blue Waxbill	*Uraeginthus angolensis*	4						3		7
610	Boulder Chat	*Pinarornis plumosus*		2			2	2			6
743	Brown-crowned Tchagra	*Tchagra australis*						2	2	2	6
764	Cape Glossy Starling	*Lamprotornis nitens*					5	9	2		16
354	Cape Turtle-Dove	*Streptopelia capicola*	3	2	7	5	7	3	14	6	47
701	Chinspot Batis	*Batis molitor*	2		4		1	3	3	3	16
454	Common Scimitarbill	*Rhinopomastus cyanomelas*		3			1		1	1	6
473	Crested Barbet	*Trachyphonus vaillantii*	3			1	1	1			6
189	Crested Francolin	*Dendroperdix sephaena*	1					1			2
568	Dark-capped Bulbul	*Pycnonotus tricolor*	8	3	1	2	2		9	2	27

Continuation of Table 4.2

Robert's N°	Common name	Biological name	Points								Total
			1	2	5	6	9	10	13	14	
386	Diderick Cuckoo	*Chrysococcyx caprius*								1	1
358	Emerald-spotted Wood-Dove	*Turtur chalcospilos*	2	2	1	1	2	3	3	5	19
438	European Bee-eater	*Merops apiaster*	20	6	13	5	8	4			56
589	Familiar Chat	*Cercomela familiaris*	2								2
541	Fork-tailed Drongo	*Dicrurus adsimilis*	2	1	1		2	4	3	4	17
884	Golden-breasted Bunting	*Emberiza flaviventris*					1				1
452	Green Wood-Hoopoe	*Phoeniculus purpureus*			5		9				14
373	Grey Go-away-bird	*Corythaixoides concolor*			2	3	1	2		2	10
62	Grey Heron	*Ardea cinerea*				1					1
203	Helmeted Guineafowl	*Numida meleagris*				2					2
382	Jacobin Cuckoo	*Clamator jacobinus*							2		2
615	Kalahari Scrub-Robin	*Cercotrichas paena*						1			1
385	Klaas's Cuckoo	*Chrysococcyx klaas*		1		1		1			3
355	Laughing Dove	*Streptopelia senegalensis*			3		1			5	9
381	Levaillant's Cuckoo	*Clamator levaillantii*				1					1
444	Little Bee-eater	*Merops pusillus*						2			2
651	Long-billed Crombec	*Sylvietta rufescens*			1	2	1			2	6
364	Meyer's Parrot	*Poicephalus meyeri*		3			3	3	3	4	16
196	Natal Spurfowl	*Pternistis natalensis*	1	1	2		3		3		10
733	Red-backed Shrike	*Lanius collurio*							1		1
458	Red-billed Hornbill	*Tockus erythrorhynchus*		1		4				1	6
377	Red-chested Cuckoo	*Cuculus solitarius*		1	3	1			1	1	7
237	Red-crested Korhaan	*Lophotis ruficrista*								1	1
426	Red-faced Mousebird	*Urocolius indicus*						8			8
819	Red-headed Weaver	*Anaplectes melanotis*		2				1			3
769	Red-winged Starling	*Onychognathus morio*							1		1
754	Retz's Helmet-Shrike	*Prionops retzii*			7						11
554	Southern Black Tit	*Parus niger*		5	2	9		4			20
756	Southern White-crowned Shrike	*Eurocephalus anguitimens*					1	1			2
459	Southern Yellow-billed Hornbill	*Tockus leucomelas*	1	2	2	6	2	1	2	6	23
787	White-bellied Sunbird	*Cinnyris talatala*	2	2	3	5	1		1	1	15
799	White-browed Scrub-Robin	*Cercotrichas leucophrys*							1	1	2
643	Willow Warbler	*Phylloscopus trochilus*	2								2
470	Yellow-fronted Tinkerbird	*Pogoniulus chrysoconus*				2					2
	Total species richness		18	19	22	21	22	28	21	20	54
	Total bird numbers		58	41	72	67	59	67	59	53	481

Table 4.3 Bird species, numbers, feeding & nesting guilds observed only in the MLM during summer

Common name	Feeding guild	Nesting guild	Numbers
Arrow-marked Babbler	Insectivore	Shrub	13
Black Cuckooshrike	Insectivore	Tree	3
Familiar Chat	Insectivore	Ground	2
Grey Heron	Carnivore	Tree	1
Kalahari Scrub-Robin	Insectivore	Shrub	1
Meyer's Parrot	Frugivore	Cavity	16
Red-backed Shrike	Carnivore	Extralimital	1
Retz's Helmet-Shrike	Insectivore	Tree	7
Red-winged Starlng	Omnivore	Structure	1

4.1.2.2.2 Bird species and numbers recorded for the MLM during winter

Sixty species and 685 birds were recorded in the MLM in the winter (Table 4.4). In the winter, nine species were recorded in the MLM that were not recorded, in the same season, in the other three land use types (Table 4.5).

Table 4.4 Bird species & numbers recorded in the MLM during winter

Robert's number	Common name	Biological name	Points								Total
			1	2	5	6	9	10	13	14	
544	African Golden Oriole	*Oriolus auratus*			1						1
457	African Grey Hornbill	*Tockus nasutus*	7	7	1		6	3	2	1	19
560	Arrow-marked Babbler	*Turdoides jardineii*			6		7			5	18
487	Bearded Woodpecker	*Dendropicos namaquus*		2	1						3
538	Black Cuckooshrike	*Campephaga flava*								1	1
464	Black-collared Barbet	*Lybius torquatus*			2	2		4		6	14
545	Black-headed 0riole	*Oriolus larvatus*	2	1	1	2	1	1	3	3	14
844	Blue Waxbill	*Uraeginthus angolensis*		5	2	8	3	4		12	34
610	Boulder Chat	*Pinarornis plumosus*		6					4	4	14
743	Brown-crowned Tchagra	*Tchagra australis*								1	1
741	Brubru	*Nilaus afer*			2	1		2		2	7
764	Cape Glossy Starling	*Lamprotornis nitens*	18	8	8	9	9				52
354	Cape Turtle-Dove	*Streptopelia capicola*	3	7	8	7	6	7	3	3	52
486	Cardinal Woodpecker	*Dendropicos fuscescens*	2				1		1	1	5
701	Chinspot Batis	*Batis molitor*	1	1	3	1		1			7
886	Cinnamon-breasted Bunting	*Emberiza tahapisi*	1	1	1	2					5
454	Common Scimitarbill	*Rhinopomastus cyanomelas*	2	1	1					1	5
473	Crested Barbet	*Trachyphonus vaillantii*	1	2	2	1	4		1		12
189	Crested Francolin	*Dendroperdix sephaena*	4		2	4	1	1	4	1	22
739	Crimson-breasted Shrike	*Laniarius atrococcineus*								2	2
568	Dark-capped Bulbul	*Pycnonotus tricolor*		3			9	10	6	6	34
358	Emerald-spotted Wood-dove	*Turtur chalcospilos*	7	3	7	3	6	4	4		34
438	European Bee-eater	*Merops apiaster*				6					6

Continuation of Table 4.4

Robert's number	Common name	Biological name	Points								Total
			1	2	5	6	9	10	13	14	
541	Fork-Tailed Drongo	*Dicrurus adsimilis*			1		5	6		2	14
884	Golden-breasted Bunting	*Emberiza flaviventris*		1							1
483	Golden-tailed Woodpecker	*Campethera abingoni*							1		1
452	Green Wood-hoopoe	*Phoeniculus purpureus*	7		5				6	4	22
373	Grey Go-away-bird	*Corythaixoides concolor*			1	5		4			12
751	Grey-headed Bush-Shrike	*Malaconotus blanchoti*	2	1	1	1		1			6
580	Groundscraper Thrush	*Psophocichla litsitsirupa*		2							2
801	House Sparrow	*Passer domesticus*		1							1
382	Jacobin Cuckoo	*Clamator jacobinus*								1	1
615	Kalahari Scrub-Robin	*Cercotrichas paena*			1		2				3
385	Klaas's Cuckoo	*Chrysococcyx klaas*		2							2
355	Laughing Dove	*Streptopelia senegalensis*		1	1	2	6	3	1	2	16
381	Levaillant's Cuckoo	*Clamator levaillantii*				1					1
447	Lilac-breasted Roller	*Coracias caudatus*						1			1
444	Little bee-eater	*Merops pusillus*						2			2
651	Long-billed Crombec	*Sylvietta rufescens*			1	2	2	3	1	2	11
862	Long-tailed Paradise-Whydah	*Vidua paradisaea*				2					2
735	Magpie Shrike	*Corvinella melanoleuca*	2								2
364	Meyer's Parrot	*Poicephalus meyeri*		3	2		4		3	2	14
356	Namaqua Dove	*Oena capensis*		2		2	1	2			7
196	Natal Spurfowl	*Pternistis natalensis*	3		2	2		3			10
398	Pearl-spotted Owlet	*Glaucidium perlatum*							1	1	2
449	Purple Roller	*Coracias naevius*						1		1	2
733	Red-backed Shrike	*Lanius collurio*								2	2
458	Red-billed Hornbill	*Tockus erythrorhynchus*	3	1	1	2		3			10
821	Red-billed Quelea	*Quelea quelea*							9		9
426	Red-faced MouseBird	*Urocolius indicus*					5	8	6		19
791	Scarlet-chested Sunbird	*Chalcomitra senegalensis*				1					1
554	Southern Black Tit	*Parus niger*	4	3	3				5	2	14
563	Southern Pied Babbler	*Turdoides bicolor*								6	6
756	Southern White-Crowned Shrike	*Eurocephalus anguitimens*	4	7					5		16
459	Southern Yellow-billed Hornbill	*Tockus leucomelas*	4	2	6	6	4	6	7	8	37
761	Violet-backed Starling	*Cinnyricinclus leucogaster*	5	5						4	14
787	White-bellied Sunbird	*Cinnyris talatala*		1	1					1	7
613	White-browed Scrub-Robin	*Cercotrichas leucophrys*	2	2	1	2	3	1	4	5	14
753	White-crested Helmet-Shrike	*Prionops plumatus*		25		6			7		38
574	Yellow-bellied Greenbul	*Chlorocichla flaviventris*	1								1
	Total species richness		22	29	30	25	20	24	22	30	60
	Total birds		85	106	75	80	85	81	84	92	685

Table 4.5 Bird species, numbers, feeding & nesting guilds observed only in the MLM during winter

Common name	Feeding guild	Nesting guild	Numbers
African Golden Oriol	Insectivore	Tree	1
Black Cuckooshrike	Insectivore	Tree	1
Golden-tailed Woodpecker	Insectivore	Cavity	1
Groundscrapper Trush	Insectivore	Tree	1
Klaas's Cuckoo	Insectivore	Parasitic	1
Levaillant's Cuckoo	Insectivore	Parasitic	1
Magpie Shrike	Insectivore	Tree	3
Red-billed Quelea	Granivore	Tree	7
Scarlet-chested Sunbird	Nectarivore	Tree	1

4.1.3 Intensive Land Management

4.1.3.1 Vegetation

The vegetation of the Intensive Land Management (ILM) was categorised as having the following vegetation cover (Figures 4.1 & 4.3)(Table 4.6).

Table 4.6 Vegetation categories for ILM

Bare ground accounted for 38% of total cover (Figure 4.1)

Height Category	% of tree cover
10–20 m	1%
5–10 m	10%
2–5 m	12%

Height Category	% of shrub cover
1–2 m	2%
0.5–1 m	12%
<0.5 m	11%

Height Category	% of grass cover
1–2 m	1%
0.5–1 m	7%
<0.5 m	6%

Figure 4.3 ILM vegetation during summer (left) & winter (right)

4.1.3.2 Birds

4.1.3.2.1 Bird species and numbers recorded for the ILM during summer

Fifty five species and 409 birds were recorded during the summer surveys (Table 4.7). In summer, seven species were recorded in the ILM that were not recorded in the same season in the other three land use types (Table 4.8)

Table 4.7 Bird species & numbers recorded in the ILM during summer

Robert's number	Common name	Biological name	Points								Total
			3	4	7	8	11	12	15	16	
465	Acacia Pied Barbet	*Tricholaema leucomelas*	1		1						2
457	African Grey Hornbill	*Tockus nasutus*	3	3	1		2	1			7
451	African Hoopoe	*Upupa africana*				2					2
518	Barn Swallow	*Hirundo rustica*	2	2	2				5		11
487	Bearded Woodpecker	*Dendropicos namaquus*	1								1
740	Black-backed Puffback	*Dryoscopus cubla*				2					2
143	Black-chested Snake-Eagle	*Circaetus pectoralis*						1			1
545	Black-headed Oriole	*Oriolus larvatus*	3	2	2	1		1			9
844	Blue Waxbill	*Uraeginthus angolensis*	4	8	3	6			2		23
743	Brown-crowned Tchagra	*Tchagra australis*	1	1		1				3	5
741	Brubru	*Nilaus afer*			2	2	2			2	8
764	Cape Glossy Starling	*Lamprotornis nitens*		2	6		4	13	5	8	33
354	Cape Turtle-Dove	*Streptopelia capicola*	4	3	6	8	4	4	8	3	40
697	Chat Flycatcher	*Bradornis infuscatus*				1					1
701	Chinspot Batis	*Batis molitor*	2	1			2	1			6
886	Cinnamon-breasted Bunting	*Emberiza tahapisi*		2		1		1	1	1	6
473	Crested Barbet	*Trachyphonus vaillantii*				1					1
189	Crested Francolin	*Dendroperdix sephaena*				3		2			5

Continuation of Table 4.7

Robert's number	Common name	Biological name	Points								Total
			3	4	7	8	11	12	15	16	
739	Crimson-breasted Shrike	*Laniarius atrococcineus*					2	2			4
568	Dark-capped Bulbul	*Pycnonotus tricolor*		1	2						3
358	Emerald-spotted Wood-Dove	*Turtur chalcospilos*	2	1	5	1	3	3	1	2	18
438	European Bee-eater	*Merops apiaster*	1		6	4	6	6			23
541	Fork-tailed Drongo	*Dicrurus adsimilis*		1			2	1	3		7
884	Golden-breasted Bunting	*Emberiza flaviventris*				3	1			2	6
452	Green Wood-Hoopoe	*Phoeniculus purpureus*						4			4
834	Green-winged Pytilia	*Pytilia melba*							3		3
373	Grey Go-away-bird	*Corythaixoides concolor*		1	2		3	3	5	1	15
580	Groundscraper Thrush	*Psophocichla litsitsirupa*	1								1
201	Harlequin Quail	*Coturnix delegorguei*	2	1			1			2	6
203	Helmeted Guineafowl	*Numida meleagris*	1								1
382	Jacobin Cuckoo	*Clamator jacobinus*						1			1
385	Klaas's Cuckoo	*Chrysococcyx klaas*				1					1
355	Laughing Dove	*Streptopelia senegalensis*	2	3	2	2	12	6	1	2	30
444	Little Bee-eater	*Merops pusillus*				3					3
651	Long-billed Crombec	*Sylvietta rufescens*	1		1	1	3		2	1	9
862	Long-tailed Paradise-Whydah	*Vidua paradisaea*					2				2
356	Namaqua Dove	*Oena capensis*		3							3
196	Natal Spurfowl	*Pternistis natalensis*	3	2							5
798	Red-billed Buffalo-Weaver	*Bubalornis niger*							5		5
458	Red-billed Hornbill	*Tockus erythrorhynchus*			4	1				1	6
377	Red-chested Cuckoo	*Cuculus solitarius*								1	1
237	Red-crested Korhaan	*Lophotis ruficrista*			1	1	1				3
791	Scarlet-chested Sunbird	*Chalcomitra senegalensis*		1							1
861	Shafttailed Wydha	*Vidua regia*					2				2
554	Southern Black Tit	*Parus niger*			6		5	1			12
756	Southern White-crowned Shrike	*Eurocephalus anguitimens*				2		3			5
459	Southern Yellow-billed Hornbill	*Tockus leucomelas*	2	4	2	1	6	1	5	6	27
659	Stierling's Wren-Warbler	*Calamonastes stierlingi*	1					1			2
437	Striped Kingfisher	*Halcyon chelicuti*	2								2
761	Violet-backed Starling	*Cinnyricinclus leucogaster*								4	4
787	White-bellied Sunbird	*Cinnyris talatala*	3	1	2	1		2	3	1	13
613	White-browed Scrub-Robin	*Cercotrichas leucophrys*							1		1
753	White-crested Helmet-Shrike	*Prionops plumatus*			8	6					14
753	Yellow-fronted Canary	*Crithagra mozambicus*	2								2
470	Yellow-fronted Tinkerbird	*Pogoniulus chrysoconus*			1						1
	Total species richness		*22*	20	21	24	18	21	15	16	55
	Total bird numbers		44	43	65	55	63	58	50	40	409

Table 4.8 Bird species & numbers only recorded in the ILM during summer

Common name	Feeding guild	Nesting guild	Numbers
Black-chested Snake-Eagle	Carnivore	Tree	1
Brubru	Insectivore	Tree	8
Chat Flycatcher	Insectivore	Shrub	1
Groundscraper Trush	Insectivore	Tree	1
Halequin Quail	Granivore	Ground	6
Red-billed Buffalo-Weaver	Insectivore	Tree	5
Yellow-fronted Canary	Granivore	Shrub	2

4.1.3.2.2 Bird species and numbers recorded for the ILM during winter

Fifty-six species and 600 birds were recorded in the ILM in the winter (Table 4.9). In the winter, nine species were recorded in the ILM that were not recorded in the same season in the other three land use types (Table 4.10)

Table 4.9 Bird species & numbers recorded in ILM during winter

Robert's	Common name	Biological name	Points								Total
number			3	4	7	8	11	12	15	16	
465	Acacia Pied Barbet	*Tricholaema leucomelas*							1		2
457	African Grey Hornbill	*Tockus nasutus*	4	1		2	1	5	3	3	19
560	Arrow-marked Babbler	*Turdoides jardineii*	7			5				4	16
487	Bearded Woodpecker	*Dendropicos namaquus*						1			3
740	Black-backed Puffback	*Dryoscopus cubla*				4					4
545	Black-headed Oriole	*Oriolus larvatus*			2	1	2		3	1	9
844	Blue Waxbill	*Uraeginthus angolensis*	7	3	3	10	4	4		4	35
743	Brown-crowned Tchagra	*Tchagra australis*	1		2	2		4	1	2	12
741	Brubru	*Nilaus afer*			2	2	1	1		2	8
764	Cape Glossy Starling	*Lamprotornis nitens*	10	5	4	5					24
354	Cape Turtle-Dove	*Streptopelia capicola*	8	6	5	3	7	4	7	5	57
701	Chinspot Batis	*Batis molitor*	3	2	5		1		1		12
886	Cinnamon-breasted Bunting	*Emberiza tahapisi*		2	1	1			1	2	7
200	Common Quail	*Coturnix coturnix*	1	1							2
454	Common Scimitarbill	*Rhinopomastus cyanomelas*			1					1	2
846	Common Waxbill	*Estrilda astrild*					4				4
473	Crested Barbet	*Trachyphonus vaillantii*		1	1	2			1	1	6
189	Crested Francolin	*Dendroperdix sephaena*	1		2					2	14
739	Crimson-breasted Shrike	*Laniarius atrococcineus*						2	2	1	3
568	Dark-capped Bulbul	*Pycnonotus tricolor*	3	3			1		1	2	10
347	Double-banded Sandgrouse	*Pterocles bicinctus*			2						2
358	Emerald-Spotted Wood-Dove	*Turtur chalcospilos*	4	6	7	2	1	2	1	4	27
541	Fork-tailed Drongo	*Dicrurus adsimilis*		2	4	3	2	6	1		18
884	Golden-breasted Bunting	*Emberiza flaviventris*				1					1
452	Green Wood-hoopoe	*Phoeniculus purpureus*		4	11	5			4	6	28
834	Green-winged Pytilia	*Pytilia melba*	2				1				5
373	Grey Go-away-bird	*Corythaixoides concolor*			2	4	3	3	3	2	17
751	Grey-headed Bush-Shrike	*Malaconotus blanchoti*							1		5

Continuation of Table 4.9

Robert's	Common name	Biological name	Points								Total
number			3	4	7	8	11	12	15	16	
201	Harlequin Quail	*Coturnix delegorguei*	2		1						3
203	Helmeted GuineaFowl	*Numida meleagris*				2					3
841	Jameson's Firefinch	*Lagonosticta rhodopareia*							2		2
615	Kalahari Scrub-Robin	*Cercotrichas paena*			2						2
355	Laughing Dove	*Streptopelia senegalensis*	4		4	3	10	7	2	2	32
444	Little Bee-eater	*Merops pusillus*					2				2
651	Long-Billed Crombec	*Sylvietta rufescens*		2	1	1	1	1	3	1	10
862	Long-tailed Paradise-Whydah	*Vidua paradisaea*								1	1
364	Meyer's Parrot	*Poicephalus meyeri*							3		3
356	Namaqua Dove	*Oena capensis*			2		2		2	3	9
196	Natal Spurfowl	*Pternistis natalensis*		2	3	2	2	4			13
398	Pearl-spotted Owlet	*Glaucidium perlatum*			1						1
548	Pied Crow	*Corvus albus*	3								3
733	Red-backed Shrike	*Lanius collurio*							1		1
458	Red-billed Hornbill	*Tockus erythrorhynchus*		1			5	3			9
237	Red-crested Korhaan	*Lophotis ruficrista*				1			2	1	4
426	Red-faced MouseBird	*Urocolius indicus*	6	6	17		6				35
806	Scaley-Feathered Finch	*Sporopipes squamifrons*							12		12
554	Southern Black Tit	*Parus niger*	5	5		4	2	6			22
459	Southern Yellow-billed Hornbill	*Tockus leucomelas*	4	8	4	6	6	6	4	6	44
659	Stierling's Wren-Warbler	*Calamonastes stierlingi*	1			1	2	1			5
437	Striped Kingfisher	*Halcyon chelicuti*			2						2
199	Swainson's Spurfowl	*Pternistis swainsonii*		1			1		1	1	4
761	Violet-backed Starling	*Cinnyricinclus leucogaster*								1	1
787	White-bellied Sunbird	*Cinnyris talatala*	2		1						3
613	White-browed Scrub-Robin	*Cercotrichas leucophrys*	2	3	2		5	2	2	1	17
753	White-crested Helmet-Shrike	*Prionops plumatus*			4						4
574	Yellow-bellied Greenbul	*Chlorocichla flaviventris*		1							1
	Total species richness		19	21	29	24	24	18	26	26	56
	Total birds		80	65	98	72	72	62	65	59	600

Table 4.10 Bird species & numbers only recorded in the ILM during winter

Common name	Feeding guild	Nesting guild	Numbers
Common Quail	Omnivore	Ground	2
Common Waxbill	Granivore	Shrub	4
Double-banded Sandgrouse	Granivore	Ground	2
Harlequin Quail	Granivore	Ground	2
Helmeted Guineafowl	Granivore	Ground	3
Striped Kingfisher	Insectivore	Cavity	2
Swainson's Francolin	Granivore	Ground	4

4.1.4 Riparian Land Management

4.1.4.1 Vegetation

The vegetation of the Riparian Land Management (RLM) was categorised as having the following vegetation cover (Figures 4.1 & 4.4)(Table 4.11).

Table 4.11 Vegetation categories for RLM

Bare ground accounted for 29% of the total cover (Figure 4.1)

Height Category	% of tree cover
10–20 m	17%
5–10 m	6%
2–5 m	10%

Height Category	% of shrub cover
1–2 m	6%
0.5–1 m	6%
<0.5 m	1%

Height Category	% of grass cover
1–2 m	2%
0.5–1 m	8%
<0.5 m	6%

Figure 4.4 RLM vegetation during summer (left) & winter (right)

4.1.4.2 Birds

4.1.4.2.1 Bird species and numbers recorded for the RLM during summer

Thirty-nine species and 312 birds were recorded during the summer (Table 4.12). In summer, nine species were recorded in the RLM that were not recorded in the same season in the other three land use types (Table 4.13)

Table 4.12 Bird species & numbers recorded in the RLM during summer

Robert's number	Common name	Biological name	Points				Total
			17	18	19	20	
465	Acacia Pied Barbet	*Tricholaema leucomelas*			2		2
361	African Green-Pigeon	*Treron calvus*		5	4	3	12
457	African Grey Hornbill	*Tockus nasutus*				3	3
710	African Paradise-Flycatcher	*Terpsiphone viridis*	1	2	3	3	9
518	Barn Swallow	*Hirundo rustica*					38
487	Bearded Woodpecker	*Dendropicos namaquus*			1		1
378	Black Cuckoo	*Cuculus clamosus*			1		1
740	Black-backed Puffback	*Dryoscopus cubla*			1	3	4
464	Black-collared Barbet	*Lybius torquatus*	4				4
545	Black-headed Oriole	*Oriolus larvatus*		1		2	3
844	Blue Waxbill	*Uraeginthus angolensis*			6		6
435	Brown-hooded Kingfisher	*Halcyon albiventris*		2	2	1	5
764	Cape Glossy Starling	*Lamprotornis nitens*	10	2		4	16
354	Cape Turtle-Dove	*Streptopelia capicola*	11	9	6	6	32
886	Cinnamon-breasted Bunting	*Emberiza tahapisi*		1			1
473	Crested Barbet	*Trachyphonus vaillantii*	4				4
568	Dark-capped Bulbul	*Pycnonotus tricolor*	8	10	1		19
358	Emerald-spotted Wood-Dove	*Turtur chalcospilos*	1	1	3	1	6
438	European Bee-eater	*Merops apiaster*		3			38
541	Fork-tailed Drongo	*Dicrurus adsimilis*	1				1
373	Grey Go-away-bird	*Corythaixoides concolor*	2				2
801	House Sparrow	*Passer domesticus*	6				3
625	Icterine Warbler	*Hippolais icterina*		2			2
382	Jacobin Cuckoo	*Clamator jacobinus*			4		4
841	Jameson's Firefinch	*Lagonosticta rhodopareia*		3			3
355	Laughing Dove	*Streptopelia senegalensis*	6	4		2	14
651	Long-billed Crombec	*Sylvietta rufescens*	1		1		2
196	Natal Spurfowl	*Pternistis natalensis*	1				1
748	Orange-breasted Bush-Shrike	*Telophorus sulfureopectus*		2	3	4	5
458	Red-billed Hornbill	*Tockus erythrorhynchus*		1			1
377	Red-chested Cuckoo	*Cuculus solitarius*	5	2	1	1	9
554	Southern Black Tit	*Parus niger*	5	1	2		8
814	Southern Masked-Weaver	*Ploceus velatus*		1			1
459	Southern Yellow-billed Hornbill	*Tockus leucomelas*	6		3	5	14
249	Three-banded Plover	*Charadrius tricollaris*				2	2
737	Tropical Boubou	*Laniarius aethiopicus*		4	4	2	10
787	White-bellied Sunbird	*Cinnyris talatala*	2		1	2	5
799	White-browed Sparrow-Weaver	*Plocepasser mahali*	16				16
574	Yellow-bellied Greenbul	*Chlorocichla flaviventris*	2	3			5
	Total species richness		19	20	19	16	39
	Total bird numbers		*92*	59	49	44	312

Table 4.13 Bird species & numbers only recorded in the RLM during summer

Common name	Feeding guild	Nesting guild	Numbers
Black Cuckoo	Insectivore	Parasitic	1
House Sparrow	Granivore	House	6
Icterine Warbler	Insectivore	Extralimital	2
Orange-breasted Bush-Shrike	Insectivore	Tree	9
Southern Masked-Weaver	Insectivore	Tree	1
Three-banded Plover	Insectivore	Ground	2
Tropical Boubou	Insectivore	Tree	10
White-browed Sparrow-Weaver	Insectivore	Tree	16
Yellowbellied Greenbul	Frugivore	Tree	19

4.1.4.2.2 Bird species and numbers recorded for the RLM during winter

Forty-one species and 330 birds were recorded during the winter (Table 4.14). In the winter, nine species were recorded in the RLM that were not recorded in the same season in the other three land use types (Table 4.15).

Table 4.14 Bird species & numbers recorded in the RLM during winter

Robert's number	Common name	Biological name	Points				Total
			17	18	19	20	
361	African Green-Pigeon	*Treron calvus*		2			2
710	African Paradise-Flycatcher	*Terpsiphone viridis*		1		2	3
378	Black Cuckoo	*Cuculus clamosus*		1			1
740	Black-backed Puffback	*Dryoscopus cubla*		3			3
464	Black-collared Barbet	*Lybius torquatus*	4				4
545	Black-headed Oriole	*Oriolus larvatus*			4	3	4
844	Blue Waxbill	*Uraeginthus angolensis*	11	3			14
435	Brown-hooded Kingfisher	*Halcyon albiventris*		1	3	4	8
764	Cape Glossy Starling	*Lamprotornis nitens*	11	8	7	3	29
354	Cape Turtle-dove	*Streptopelia capicola*	4	8	9	4	25
486	Cardinal Woodpecker	*Dendropicos fuscescens*	1				1
701	Chinspot Batis	*Batis molitor*	2				2
886	Cinnamon-breasted Bunting	*Emberiza tahapisi*	1	1			2
473	Crested Barbet	*Trachyphonus vaillantii*	2		2	1	5
189	Crested Francolin	*Dendroperdix sephaena*		1	1		2
739	Crimson-breasted Shrike	*Laniarius atrococcineus*		2			2
568	Dark-capped Bulbul	*Pycnonotus tricolor*	7	5	6	1	19
358	Emerald-spotted Wood-Dove	*Turtur chalcospilos*		5	1	1	7
373	Grey Go-away-bird	*Corythaixoides concolor*		8	3		11
94	Hadeda Ibis	*Bostrychia hagedash*		2	2		4
801	House Sparrow	*Passer domesticus*	7				7
625	Icterine Warbler	*Hippolais icterina*		1			1
382	Jacobin Cuckoo	*Clamator jacobinus*			1		1
841	Jameson's Firefinch	*Lagonosticta rhodopareia*		3		4	7
355	Laughing Dove	*Streptopelia senegalensis*	8	1	2	4	15
447	Lilac-breasted Roller	*Coracias caudatus*	2				2
364	Meyer's Parrot	*Poicephalus meyeri*	4		10	2	16
196	Natal Spurfowl	*Pternistis natalensis*	2	2			4
748	Orange-breasted Bush-Shrike	*Telophorus sulfureopectus*		4	1	4	9
398	Pearl-spotted Owlet	*Glaucidium perlatum*			1		1
449	Purple Roller	*Coracias naevius*	1				1
458	Red-billed Hornbill	*Tockus erythrorhynchus*	3		2		5
426	Red-faced Mousebird	*Urocolius indicus*	12	17			29
861	Shafttailed Wydha	*Vidua regia*	2				2
554	Southern Black Tit	*Parus niger*	3				3
756	Southern White-crowned Shrike	*Eurocephalus anguitimens*			4		4
459	Southern Yellow-billed Hornbill	*Tockus leucomelas*	6		3	5	14
249	Three-banded Plover	*Charadrius tricollaris*		4	3	7	14
613	White-browed Scrub-Robin	*Cercotrichas leucophrys*		1	4	1	6
799	White-browed Sparrow-Weaver	*Plocepasser mahali*	36				36
574	Yellow-bellied Greenbul	*Chlorocichla flaviventris*		3	2		5
	Total species richness		21	24	21	15	41
	Total birds		129	87	71	46	330

Table 4.15 Bird species & numbers only recorded in the RLM during winter

Common name	Feeding guild	Nesting guild	Numbers
African Green-Pigeon	Frugivore	Tree	2
African Paradise-Flycatcher	Insectivore	Tree	3
Black Cuckoo	Insectivore	Parasitic	1
Hadeda Ibis	Insectivore	Tree	4
Icterine Warbler	Insectivore	Extralimital	1
Orange-breasted Bush-Shrike	Insectivore	Tree	9
Shaft-tailed Whydha	Granivore	Parasitic	2
Three-banded Plover	Insectivore	Ground	4
White-browed Sparrow-Weaver	Insectivore	Tree	36

4.1.5 Communal Land Management

4.1.5.1 Vegetation

The vegetation of the Communal Land Management (CLM) was categorised as having the following vegetation cover (Figures 4.1 & 4.4) (Table 4.16).

Table 4.16 Vegetation categories for CLM

Bare ground accounted for 48% of the total cover (Figure 4.1).

Height Category	% of tree cover
10–20 m	3%
5–10 m	6%
2–5 m	9%

Height Category	% of shrub cover
1–2 m	1%
0.5–1 m	12%
<0.5 m	13%

Height Category	% of grass cover
1–2 m	0%
0.5–1 m	4%
<0.5 m	4%

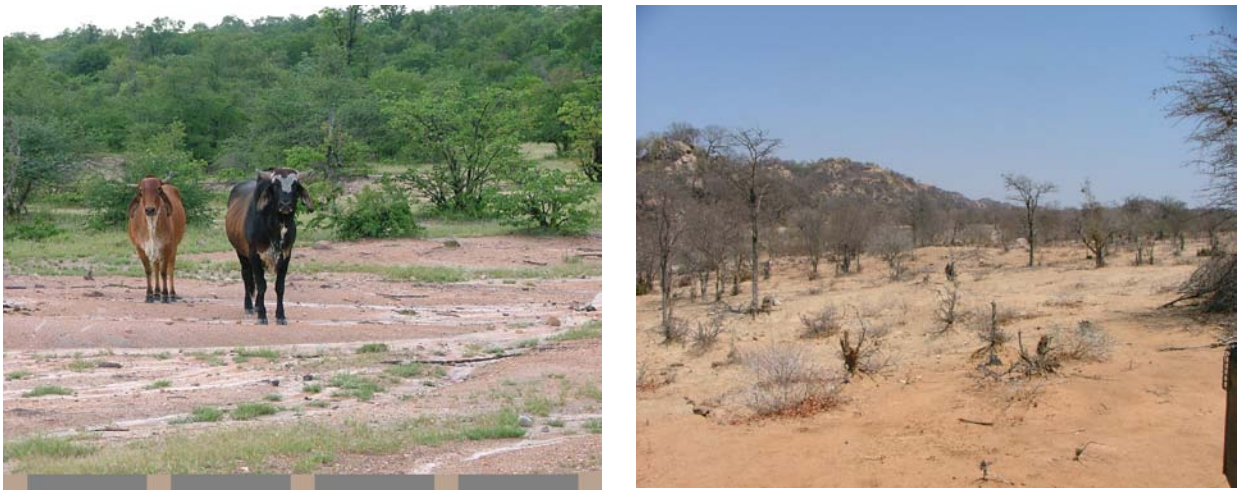

Figure 4.5 CLM vegetation during summer (left) & winter (right)

4.1.5.2 Birds

4.1.5.2.1 Bird species and numbers recorded for the CLM during summer

Fifty-four species and 364 birds were recorded during the summer surveys (Table 4.13). In summer, five species were recorded in CLM that were not recorded in the same season in the other three land use types (Table 4.14).

Table 4.17 Bird species & numbers recorded in the CLM during summer

Robert's number	Common name	Biological name	Points								Total
			21	22	23	24	25	26	27	28	
361	African Green-Pigeon	*Treron calvus*				2					2
457	African Grey Hornbill	*Tockus nasutus*	2	1		2	1				6
451	African Hoopoe	*Upupa africana*				1		1			2
710	African Paradise-Flycatcher	*Terpsiphone viridis*	1								1
518	Barn Swallow	*Hirundo rustica*			8		4				12
487	Bearded Woodpecker	*Dendropicos namaquus*					1				1
740	Black-backed Puffback	*Dryoscopus cubla*					4				4
464	Black-collared Barbet	*Lybius torquatus*					2				2
545	Black-headed Oriole	*Oriolus larvatus*				1					1
844	Blue Waxbill	*Uraeginthus angolensis*			3		2	5		6	16
610	Boulder Chat	*Pinarornis plumosus*	2				1				3
354	Cape Turtle-Dove	*Streptopelia capicola*	4	6	3	6	7	5	5	3	39
486	Cardinal Woodpecker	*Dendropicos fuscescens*					2				2
701	Chinspot Batis	*Batis molitor*		3	1	3		6		4	17
886	Cinnamon-breasted Bunting	*Emberiza tahapisi*		3	1					1	5
454	Common Scimitarbill	*Rhinopomastus cyanomelas*				1					1

Continuation of Table 4.17

Robert's number	Common name	Biological name	Points								Total
			21	22	23	24	25	26	27	28	
473	Crested Barbet	*Trachyphonus vaillantii*				4	1				5
739	Crimson-breasted Shrike	*Laniarius atrococcineus*							2		2
568	Dark-capped Bulbul	*Pycnonotus tricolor*							4	5	9
386	Diderick Cuckoo	*Chrysococcyx caprius*	1			1	1				3
358	Emerald-spotted Wood-Dove	*Turtur chalcospilos*	2	2	5		5	3		2	19
438	European Bee-eater	*Merops apiaster*	4				6		10		20
541	Fork-tailed Drongo	*Dicrurus adsimilis*		4	3	2		3			12
884	Golden-breasted Bunting	*Emberiza flaviventris*		1					3	1	5
483	Goldentailed Woodpecker	*Campethera abingoni*	1				2				3
452	Green Wood-Hoopoe	*Phoeniculus purpureus*						5			5
834	Green-winged Pytilia	*Pytilia melba*							1		1
373	Grey Go-away-bird	*Corythaixoides concolor*			1	1		4	3	2	11
355	Laughing Dove	*Streptopelia senegalensis*	4	2	2		5	3	3		19
381	Levaillant's Cuckoo	*Clamator levaillantii*				1					1
444	Little Bee-eater	*Merops pusillus*			1		3				4
447	Lilac-breasted Roller	*Coracias caudatus*		1		1				2	4
651	Long-billed Crombec	*Sylvietta rufescens*		2			1	1	3	3	10
862	Long-tailed Paradise-Whydah	*Vidua paradisaea*		2					3	1	6
356	Namaqua Dove	*Oena capensis*	4							3	7
196	Natal Spurfowl	*Pternistis natalensis*					2				2
449	Purple Roller	*Coracias naevius*	1	2					1		4
458	Red-billed Hornbill	*Tockus erythrorhynchus*			3					7	10
772	Red-billed Oxpecker	*Buphagus erythrorhynchus*			3						3
507	Red-capped Lark	*Calandrella cinerea*	1	1	1	1					4
377	Red-chested Cuckoo	*Cuculus solitarius*	4		1		2	1			8
237	Red-crested Korhaan	*Lophotis ruficrista*			2				1		3
426	Red-faced Mousebird	*Urocolius indicus*					5				5
819	Red-headed Weaver	*Anaplectes melanotis*		2							2
791	Scarlet-chested Sunbird	*Chalcomitra senegalensis*					1				1
861	Shafttailed Wydha	*Vidua regia*	2	2	2				3	1	10
554	Southern Black Tit	*Parus niger*							5		5
563	Southern Pied Babbler	*Turdoides bicolor*	4	9	4					5	22
459	Southern Yellow-billed Hornbill	*Tockus leucomelas*				1	4	4			9
689	Spotted Flycatcher	*Muscicapa striata*				1					1
659	Stierling's Wren-Warbler	*Calamonastes stierlingi*						1			1
761	Violet-backed Starling	*Cinnyricinclus leucogaster*	2					2			4
787	White-bellied Sunbird	*Cinnyris talatala*			1	1	2				4
613	White-browed Scrub-Robin	*Cercotrichas leucophrys*				1					1
753	White-crested Helmet-Shrike	*Prionops plumatus*				1		7			8
	Total species richness		16	15	17	17	15	15	13	14	54
	Total bird numbers		39	43	45	31	64	51	47	46	367

Table 4.18 Bird species & numbers only recorded in the CLM during summer

Common name	Feeding guild	Nesting guild	Numbers
Purple Roller	Insectivore	Cavity	1
Southern Pied Babbler	Insectivore	Tree	5
Red-billed Oxpecker	Acarivore	Cavity	3
Red-capped Lark	Granivore	Ground	1
Spotted Flycatcher	Insectivore	Extralimital	1

4.1.5.2.2 Bird species and numbers recorded for the CLM during winter

Forty-four species and 434 birds were recorded in the CLM in the winter (Table 4.15). In the winter the African Hoopoe was only recorded in the CLM and not in the other three land use types.

Table 4.19 Bird species & numbers recorded in the CLM during winter

Robert's number	Common name	Biological name	Points								Total
			21	22	23	24	25	26	27	28	
465	Acacia Pied Barbet	*Tricholaema leucomelas*			1						1
457	African Grey Hornbill	*Tockus nasutus*	2	2	4	4		3	1		16
451	African Hoopoe	*Upupa africana*				1		2			3
487	Bearded Woodpecker	*Dendropicos namaquus*					1				1
740	Black-backed Puffback	*Dryoscopus cubla*					2				2
464	Black-collared Barbet	*Lybius torquatus*	5				4				9
844	Blue Waxbill	*Uraeginthus angolensis*		3		7		4	3	1	18
610	Boulder Chat	*Pinarornis plumosus*	8				6				14
764	Cape Glossy Starling	*Lamprotornis nitens*	9	4	3	3					19
354	Cape Turtle-Dove	*Streptopelia capicola*	6	4	8	4	7	5	5	6	45
486	Cardinal Woodpecker	*Dendropicos fuscescens*	1				2				3
701	Chinspot Batis	*Batis molitor*				1	1		3	2	7
886	Cinnamon-Breasted Bunting	*Emberiza tahapisi*	1	1	1			2	2	2	9
454	Common Scimitarbill	*Rhinopomastus cyanomelas*	1			1					2
473	Crested Barbet	*Trachyphonus vaillantii*	2		1	1	1				5
189	Crested Francolin	*Dendroperdix sephaena*			1			3			4
739	Crimson-breasted shrike	*Laniarius atrococcineus*			2						2
568	Dark-capped Bulbul	*Pycnonotus tricolor*	5	5	5			2	7	6	30
358	Emerald-spotted Wood-dove	*Turtur chalcospilos*	1	5	4	2	1	1	1	3	18
541	Fork-tailed Drongo	*Dicrurus adsimilis*		9	3	5	2	7	3	1	30
884	Golden-breasted Bunting	*Emberiza flaviventris*							1		1
483	Goldentailed Woodpecker	*Campethera abingoni*	1								1
452	Green Wood-Hoopoe	*Phoeniculus purpureus*	13			5					18
834	Green-winged Pytilia	*Pytilia melba*			2						2
373	Grey Go-away-bird	*Corythaixoides concolor*	2	1		5	3	6	1	3	21
355	Laughing Dove	*Streptopelia senegalensis*	4	3	2	3	4	4	2		22
447	Lilac-Breasted Roller	*Coracias caudatus*		1		1					2
651	Long-billed Crombec	*Sylvietta rufescens*				3	2	2	2	2	11
862	Long-tailed Paradise-Whydah	*Vidua paradisaea*		1							1
356	Namaqua Dove	*Oena capensis*	4	2					8	4	18
196	Natal Spurfowl	*Pternistis natalensis*		2	2	1	4	2			11
548	Pied Crow	*Corvus albus*		2							2
449	Purple Roller	*Coracias naevius*			1				1		2
458	Red-billed Hornbill	*Tockus erythrorhynchus*	3		2				1	4	10
237	Red-crested Korhaan	*Lophotis ruficrista*			1				1		2
554	Southern Black Tit	*Parus niger*	6	2	4				3	4	19
563	Southern Pied Babbler	*Turdoides bicolor*				5					5
459	Southern Yellow-billed Hornbill	*Tockus leucomelas*	5	3	3	4		2	7	4	28
659	Stierling's Wren-Warbler	*Calamonastes stierlingi*					1		2		3
761	Violet-backed Starling	*Cinnyricinclus leucogaster*	6								6
787	White-bellied Sunbird	*Cinnyris talatala*					1				1
613	White-browed Scrub-Robin	*Cercotrichas leucophrys*					2				2
753	White-crested Helmet-Shrike	*Prionops plumatus*				5					5
574	Yellow-bellied Greenbul	*Chlorocichla flaviventris*					3				3
	Total species richness		20	17	19	19	18	15	19	13	44
	Total birds		85	187	50	61	47	45	81	42	434

4.1.5.2.3 Bird species and numbers only recorded in the CLM during winter

Only the African Hoopoe was recorded on the CLM on three occasions during the winter surveys.

4.2 Birds recorded in each of the four land use types

One hundred and five species of birds and 3,618 birds were recorded for the total survey (Table 4.16).

Table 4.20 Total bird species & numbers recorded for each land use type during summer & winter

Common Name	Scientific name	Summer				Winter			
		M	I	R	C	M	I	R	C
Acacia Pied Barbet	*Tricholaema leucomelas*		2	2			2		1
African Golden Oriole	*Oriolus auratus*					1			
African Green-Pigeon	*Treron calvus*	3		12	2			2	
African Grey Hornbill	*Tockus nasutus*	11	7	3	6	19	19		16
African Hoopoe	*Upupa africana*		2		2				3
African Paradise-Flycatcher	*Terpsiphone viridis*	6		9	1			3	
Arrow-marked Babbler	*Turdoides jardineii*	13				18	16		
Barn Swallow	*Hirundo rustica*	7	11	38	12				
Bearded Woodpecker	*Dendropicos namaquus*	2	1	1	1	3	3		1
Black Cuckoo	*Cuculus clamosus*			1				1	
Black Cuckooshrike	*Campephaga flava*	3				1			
Black-backed Puffback	*Dryoscopus cubla*	8	2	4	4		4	3	2
Black-chested Snake-Eagle	*Circaetus pectoralis*		1						
Black-collared Barbet	*Lybius torquatus*	2		4	2	14		4	9
Black-headed Oriole	*Oriolus larvatus*	10	9	3	1	14	9	4	
Blue Waxbill	*Uraeginthus angolensis*	7	23	6	16	34	35	14	18
Boulder Chat	*Pinarornis plumosus*	6			3	14			14
Brown-crowned Tchagra	*Tchagra australis*	6	5			1	12		
Brown-hooded Kingfisher	*Halcyon albiventris*			5				8	
Brubru	*Nilaus afer*		8			7	8		
Cape Glossy Starling	*Lamprotornis nitens*	16	33	16		52	24	29	19
Cape Turtle-Dove	*Streptopelia capicola*	47	40	32	39	52	57	25	45
Cardinal Woodpecker	*Dendropicos fuscescens*				2	5		1	3
Chat Flycatcher	*Bradornis infuscatus*		1						
Chinspot Batis	*Batis molitor*	16	6		17	7	12	2	7
Cinnamon-breasted Bunting	*Emberiza tahapisi*		6	1	5	5	7	2	9
Common Quail	*Coturnix coturnix*						2		
Common Scimitarbill	*Rhinopomastus cyanomelas*	6			1	5	2		2
Common Waxbill	*Estrilda astrild*						4		
Crested Barbet	*Trachyphonus vaillantii*	6	1	4	5	12	6	5	5
Crested Francolin	*Dendroperdix sephaena*	2	5			22	14	2	4
Crimson-breasted Shrike	*Laniarius atrococcineus*		4		2	2	3	2	2

Continuation of Table 4.20

Common Name	Scientific name	Summer				Winter			
		M	I	R	C	M	I	R	C
Dark-capped Bulbul	*Pycnonotus tricolor*	27	3	19	9	34	10	19	30
Diderick Cuckoo	*Chrysococcyx caprius*	1			3				
Double-banded Sandgrouse	*Pterocles bicinctus*						2		
Emerald-spotted Wood-Dove	*Turtur chalcospilos*	19	18	6	19	34	27	7	18
European Bee-eater	*Merops apiaster*	56	23	38	20	6			
Familiar Chat	*Cercomela familiaris*	2							
Fork-tailed Drongo	*Dicrurus adsimilis*	17	7	1	12	14	18		30
Golden-breasted Bunting	*Emberiza flaviventris*	1	6		5	1	1		1
Golden-tailed Woodpecker	*Campethera abingoni*				3	1			1
Green Wood-Hoopoe	*Phoeniculus purpureus*	14	4		5	22	28		18
Green-winged Pytilia	*Pytilia melba*		3		1		5		2
Grey Go-away-bird	*Corythaixoides concolor*	10	15	2	11	12	17	11	21
Grey Heron	*Ardea cinerea*	1							
Grey-headed Bush-Shrike	*Malaconotus blanchoti*					6	5		
Groundscraper Thrush	*Psophocichla litsitsirupa*		1			2			
Hadeda Ibis	*Bostrychia hagedash*							4	
Harlequin Quail	*Coturnix delegorguei*		6				3		
Helmeted Guineafowl	*Numida meleagris*	2	1				3		
House Sparrow	*Passer domesticus*			3		1		7	
Icterine Warbler	*Hippolais icterina*			2				1	
Jacobin Cuckoo	*Clamator jacobinus*	2	1	4		1		1	
Jameson's Firefinch	*Lagonosticta rhodopareia*			3			2	7	
Kalahari Robin	*Erythropygia paena*	1				3	2		
Klaas's Cuckoo	*Chrysococcyx klaas*	3	1			2			
Laughing Dove	*Streptopelia senegalensis*	9	30	14	19	16	32	15	22
Levaillant's Cuckoo	*Clamator levaillantii*	1			1	1			
Lilac-breasted Roller	*Coracias caudatus*				4	1		2	2
Little Bee-eater	*Merops pusillus*	2	3		4	2	2		
Long-billed Crombec	*Sylvietta rufescens*	6	9	2	10	11	10		11
Long-tailed Paradise-Whydah	*Vidua paradisaea*		2		6	2	1		1
Magpie Shrike	*Corvinella melanoleuca*					2			
Meyer's Parrot	*Poicephalus meyeri*	16				14	3	16	
Namaqua Dove	*Oena capensis*		3		7	7	9		18
Natal Spurfowl	*Pternistis natalensis*	10	5	1	2	10	13	4	11
Orange-breasted Bush-Shrike	*Telophorus sulfureopectus*			5				9	
Pearl-spotted Owlet	*Glaucidium perlatum*					2	1	1	
Pied Crow	*Corvus albus*						3		2
Purple Roller	*Coracias naevius*				4	2		1	2
Red-backed Shrike	*Lanius collurio*	1				2	1		
Red-billed Buffalo-Weaver	*Bubalornis niger*		5						
Red-billed Hornbill	*Tockus erythrorhynchus*	6	6	1	10	10	9	5	10
Red-billed Oxpecker	*Buphagus erythrorhynchus*				3				
Red-billed Quelea	*Quelea quelea*					9			
Red-capped Lark	*Calandrella cinerea*				4				
Red-chested Cuckoo	*Cuculus solitarius*	7	1	9	8				
Red-crested Korhaan	*Lophotis ruficrista*	1	3		3		4		2
Red-faced Mousebird	*Urocolius indicus*	8			5	19	35	29	
Red-headed Weaver	*Anaplectes melanotis*	3			2				
Red-winged Starling	*Onychognathus morio*	1							
Retz's Helmet-Shrike	*Prionops retzii*	11							

Continuation of Table 4.20

Common Name	Scientific name	Summer				Winter			
		M	I	R	C	M	I	R	C
Scarlet-chested Sunbird	*Chalcomitra senegalensis*		1		1	1			
Shafttailed Whydha	*Vidua regia*		2		10			2	
Southern Black Tit	*Parus niger*	20	12	8	5	14	22	3	19
Southern Masked-Weaver	*Ploceus velatus*			1					
Southern Pied Babbler	*Turdoides bicolor*				22	6			5
Southern White-crowned Shrike	*Eurocephalus anguitimens*	2	5			16		4	
Southern Yellow-billed Hornbill	*Tockus leucomelas*	23	27	14	9	37	44	14	28
Spotted Flycatcher	*Muscicapa striata*				1				
Stierling's Wren-Warbler	*Calamonastes stierlingi*		2		1		5		3
Striped Kingfisher	*Halcyon chelicuti*		2				2		
Swainson's Spurfowl	*Pternistis swainsonii*						4		
Three-banded Plover	*Charadrius tricollaris*			2				14	
Tropical Boubou	*Laniarius aethiopicus*			10					
Violet-backed Starling	*Cinnyricinclus leucogaster*		4		4	14	1		6
White-bellied Sunbird	*Cinnyris talatala*	15	13	5	4	7	3		1
White-browed Scrub-Robin	*Cercotrichas leucophrys*	2	1		1	14	17	6	2
White-browed Sparrow-Weaver	*Plocepasser mahali*			16				36	
White-crested Helmet-Shrike	*Prionops plumatus*		14		8	38	4		5
Willow Warbler	*Phylloscopus trochilus*	2							
Yellow-bellied Greenbul	*Chlorocichla flaviventris*			5		1	1	5	3
Yellow-fronted Canary	*Crithagra mozambicus*		2						
Yellow-fronted Tinkerbird	*Pogoniulus chrysoconus*	2	1						
Total Species richness		54	55	39	55	60	56	41	44
Total number of birds		481	409	312	367	685	600	330	434

4.2.1 Bird species and numbers common to all land use types during summer

Twenty bird species were common to all land use types during the summer (Table 4.21).

Table 4.21 Bird species & numbers common to all land use types during summer

Common Name	MLM	ILM	RLM	CLM	Total
African Grey Hornbill	13	10	3	6	32
Barn Swallow	7	11	38	12	68
Bearded Woodpecker	2	1	1	1	5
Black-backed Puffback	7	2	4	4	17
Black-headed Oriole	11	9	3	1	24
Blue Waxbill	7	23	6	16	52
Cape Turtle-Dove	47	40	32	39	158
Crested Barbet	8	1	4	5	18
Dark-capped Bulbul	27	3	19	7	56
Emerald-spotted Wood-Dove	19	18	6	19	62
European Bee-ater	56	23	38	20	137
Fork-tailed Drongo	17	7	1	11	36

Continuation of Table 4.21

Common Name	MLMM	ILM	RLM	CLM	Total
Laughing Dove	9	30	16	19	74
Long-billed Crombec	6	9	2	10	27
Natal Spurfowl	12	5	1	6	24
Redbilled Hornbill	6	6	1	10	23
Redcheasted Cuckoo	7	1	9	10	27
Southern Black Tit	20	12	8	11	51
Whitebellied Sunbird	15	13	5	4	37
Total	**310**	**239**	**199**	**220**	

4.2.2 Bird species and numbers common to all land use types during winter

Fourteen bird species were common to all land use types during the winter (Table 4.22).

Table 4.22 Bird species & numbers common to all land use types during winter

Common name	MLM	ILM	RLM	CLM	Totals
Blue Waxbill	34	35	14	18	101
Cape Glossy Starling	26	15	16	10	67
Cape Turtle-Dove	53	57	37	39	186
Chinspot Batis	7	12	2	7	28
Cinnamon-breasted Bunting	5	7	2	10	24
Crested Barbet	11	6	5	3	25
Crested Francolin	23	12	2	4	41
Emerald-spotted Wood-Dove	34	27	7	14	82
Natal Spurfowl	9	16	6	11	42
Red-billed Hornbill	16	9	5	7	37
Southern Black Tit	14	22	3	13	52
Southern Yellow-billed Hornbill	39	54	14	23	130
White-browed Scrub-Robin	23	17	6	2	48
Yellow-bellied Greenbul	4	1	5	3	13
Total	**298**	**290**	**124**	**164**	

4.2.3 Bird species and numbers common to all land use types during both seasons

Eleven bird species were common to the all land use types during the summer and winter surveys (Table 4.23).

Table 4.23 Bird species & numbers common to all land use types during both seasons

Robert's number	Common Name	Scientific name	Summer				Winter			
			MLM	ILM	RLM	CLM	MLM	ILM	RLM	CLM
844	Blue Waxbill	*Uraeginthus angolensis*	7	23	6	16	34	35	14	18
354	Cape Turtle-Dove	*Streptopelia capicola*	47	40	32	39	52	57	25	45
473	Crested Barbet	*Trachyphonus vaillantii*	6	1	4	5	12	6	5	5
568	Dark-capped Bulbul	*Pycnonotus tricolor*	27	3	19	9	34	10	19	30
358	Emerald-spotted Wood-Dove	*Turtur chalcospilos*	19	18	6	19	34	27	7	18
373	Grey Go-away-bird	*Corythaixoides concolor*	10	15	2	11	12	17	11	21
355	Laughing Dove	*Streptopelia senegalensis*	9	30	14	19	16	32	15	22
196	Natal Spurfowl	*Pternistis natalensis*	10	5	1	2	10	13	4	11
458	Red-billed Hornbill	*Tockus erythrorhynchus*	6	6	1	10	10	9	5	10
554	Southern Black Tit	*Parus niger*	20	12	8	5	14	22	3	19
459	Southern Yellow-billed Hornbill	*Tockus leucomelas*	23	27	14	9	37	44	14	28

4.2.4 Indicator species analysis

Seventeen bird species were statistically recorded as indicator species (Table 4.24) Observed indicator value (OIV), standard deviation (SD) and probability (P) value are indicated.

Table 4.24 Indicator bird species for the complete census

Common name	Nesting guild	Feeding guild	OIV	SD	P
African Green-Pigeon	Tree	Frugivore	56.1	10.21	0.018
African Grey Hornbill	Cavity	Omnivore	33.3	3.16	0.013
African Paradise-Flycatcher	Tree	Insectivore	66.7	8.55	0.007
Black-headed Oriole	Tree	Frugivore	48.3	7	0.024
Brubru	Tree	Insectivore	50	8.91	0.015
Brown-hooded Kingfisher	Ground	Insectivore	75	8.98	0.002
Common Scimitarbill	Cavity	Insectivore	45	8.22	0.023
Grey-headed Bush-Shrike	Shrub	Carnivore	52.1	9.18	0.003
Hadeda Ibis	Tree	Insectivore	50	8.82	0.016
Harlequin quail	Ground	Granivore	62.5	9.81	0.002
Jameson's Firefinch	Shrub	Granivore	40	8.96	0.046
Orange-breasted Bush-Shrike	Tree	Insectivore	75	8.98	0.002
Red-chested Cuckoo	Parasitic	Insectivore	47.1	8.28	0.045
Swainson's Spurfowl	Ground	Granivore	50	8.79	0.014
Three-banded Plover	Ground	Insectivore	50	8.91	0.015
Tropical Boubou	Tree	Insectivore	75	8.98	0.002
Yellow-bellied Greenbul	Tree	Frugivore	56.2	9.77	0.015

4.3. Geo-statistical analysis

4.3.1 Species richness

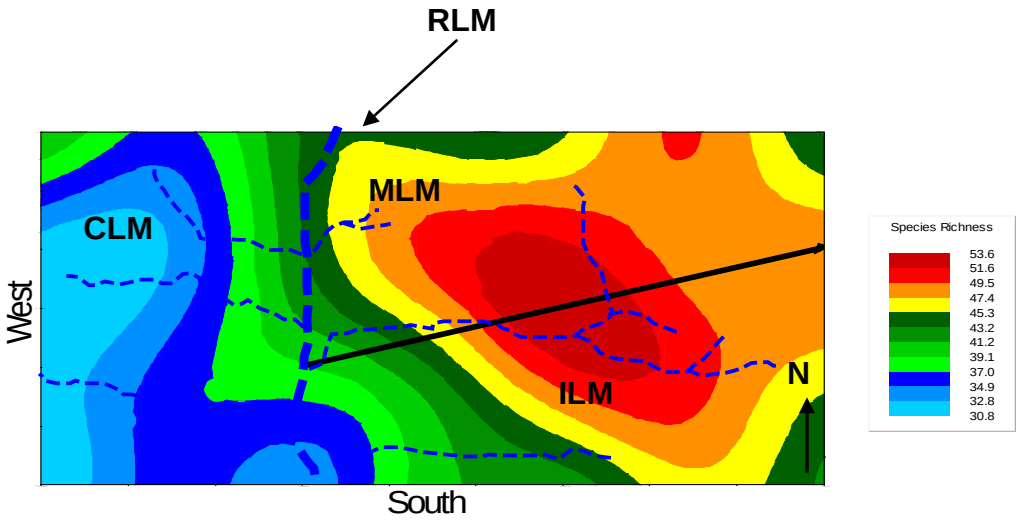

Figure 4.6 Distribution pattern of species richness

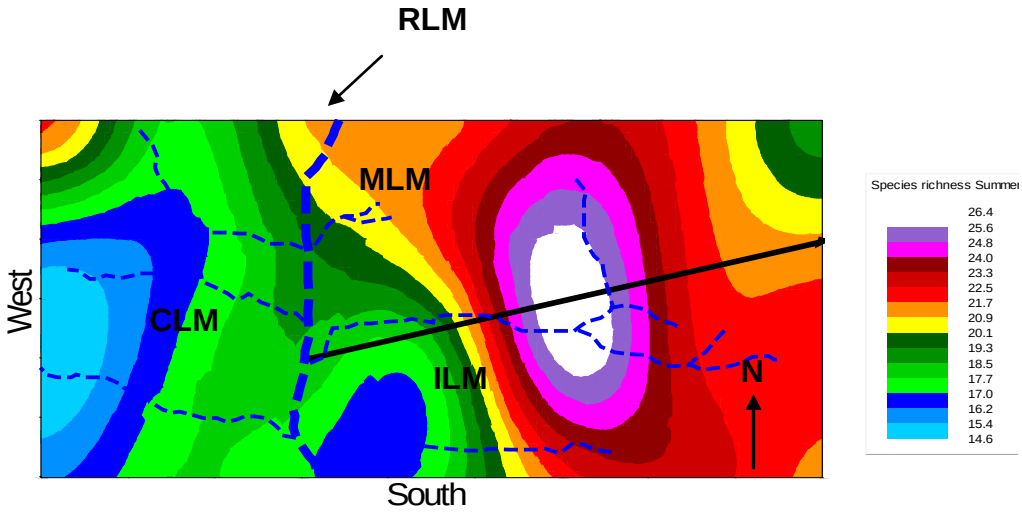

Figure 4.7 Species richness distribution pattern in summer

The maps from Figures 4.6–4.45 all have the same orientation and layout. Each map is accompanied by a description on the opposite page. Prominent landscape features include high ground in the north-east, with numerous rocky hills particularly evident in MLM. The Tati River flows in a north to south direction, separating the MLM and ILM from the CLM. Two prominent rocky hills on the northern edge of the CLM are an important feature of this land use. The landscape feature between the rocky hills and the river is flat savannah, gradually sloping to the river.

4.3.1.1. Distribution of bird species richness

The distribution of bird species richness (Figure 4.6) followed a maximum richness in the north east decreasing gradually towards the south-west. The MLM had a richness of 41.2-53.6 species, decreasing to the west. The species richness of the ILM followed a similar distribution to the MLM, but with a range between 32.8-35 species. The RLM had the highest species richness in the north of 43.2, with the lowest in the south of 32.8. The CLM had the lowest species richness of the four land uses, with a highest value of 43.2 in the north east of the land use and a lowest value in the south-west of 30.8.

4.3.1.2 Distribution of bird species richness during summer

The distribution of bird species richness in the summer (Figure 4.7) was highest across the MLM and the ILM, with a high count of 26.4 in the central area spanning the MLM and the ILM, decreasing to 16.2 in the south-west of the ILM. The RLM had a species richness high count of 20 in the north, decreasing to 16.2 in the south. The CLM had the highest count in the north-west of 21.7, with most of the land use between 14.6-19.3.

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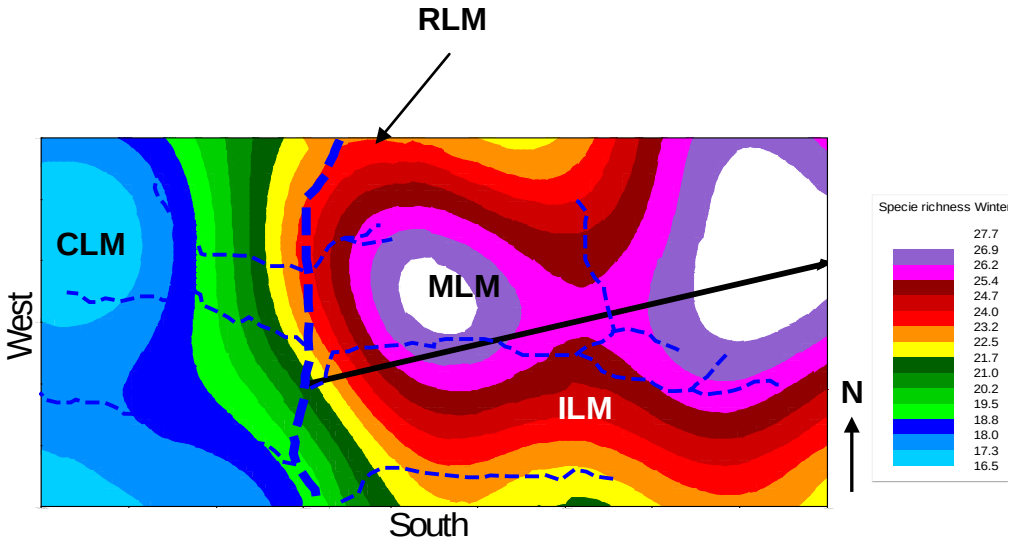

Figure 4.8 Distribution of species richness during winter

4.3.2 Distribution in the numbers of birds

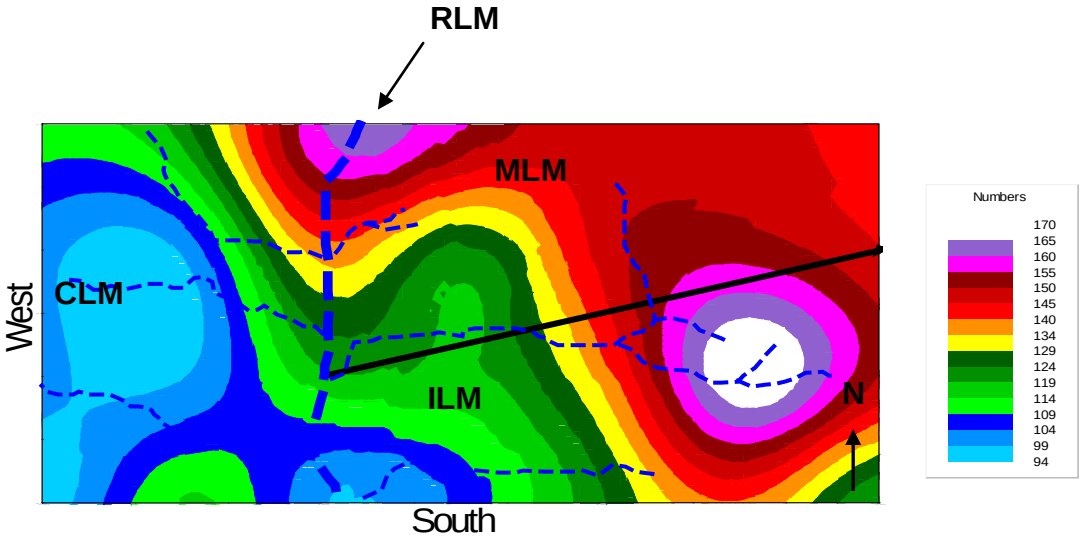

Figure 4.9 Distribution of numbers of birds

4.3.1.3 Distribution of bird species richness during winter

The distribution of bird species richness in the winter (Figure 4.8) was highest predominantly in the MLM, extending into the ILM. There were two peaks in the MLM with high counts of 27.7 species, dropping to 21.7. There was a high of 27.7 species in the north eastern section of the ILM, with the species richness declined southwards to 21.7 species. The RLM had a high of 24 species in the north, decreasing to 18.8 in the south. The CLM had a high of 21 species along the length of the river, decreasing towards the west to 16.5 species.

4.3.2.1 Distribution of numbers of birds

The distribution of the numbers of birds (Figure 4.9) was predominantly high in the MLM with two peaks in the ILM and RLM. The peak of 170 birds in the ILM was central to this management practice but decreased to 94 birds in the south-west of the ILM. Much of the MLM had a bird count between 145-165 birds, predominantly in the north east but decreasing to 109 birds in the south west of the MLM. The numbers of birds in the RLM declined from a high of 160 birds in the north to 94 in the south. The CLM had a high count in the north east of 140, decreasing southwards, with much of the CLM having a count of between 94-109 birds.

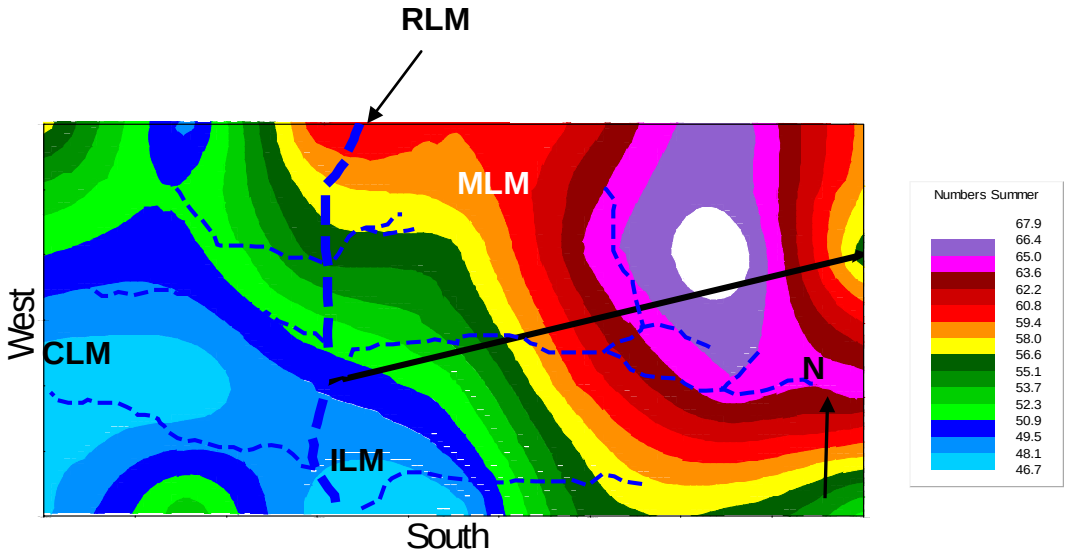

Figure 4.10 Distribution of the number of birds during summer

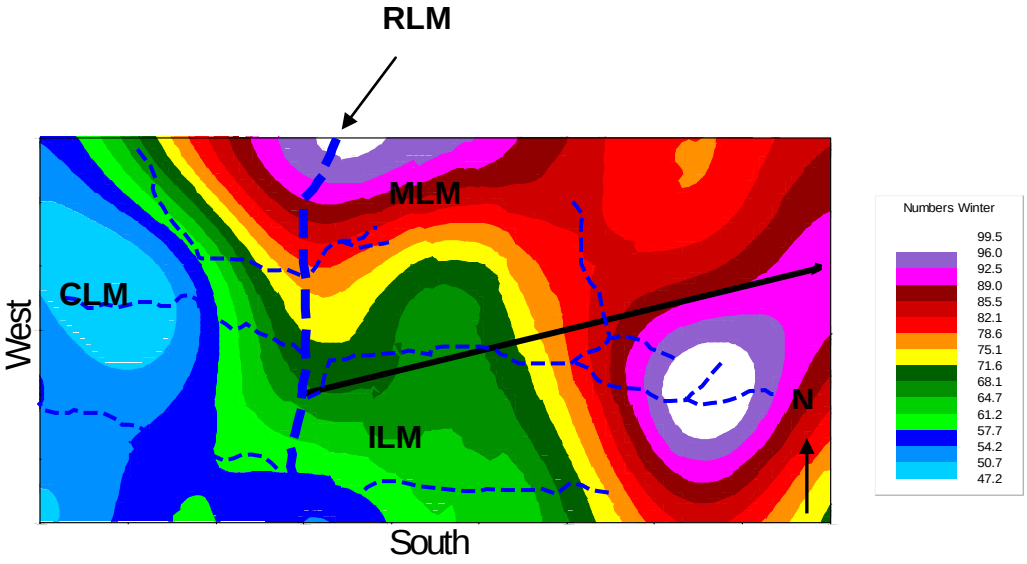

Figure 4.11 Distribution of the number of birds during winter

4.3.2.2 Distribution of numbers of birds during summer

The highest numbers of birds recorded in the summer (Figure 4.10) was in the eastern area of the study area. The MLM had a peak in the west of 67.9, stretching along the northern portion of the MLM, decreasing to 49.5 in the south western corner of this management practice. The numbers of birds followed a similar pattern in the ILM with a high of 66.4, decreasing to 46.7 in the south west.

The numbers of birds of the RLM had a high number of 59.4 in the north, decreasing to 46.9 in the south. The CLM had a low count of birds in the summer when compared to other land use types, with much of the area having a count of 50.9 birds, decreasing to 46.7 in the southern parts of this management practice.

4.3.2.3 Distribution of numbers of birds during winter

The numbers of birds in winter (Figure 4.11) had two peaks of 99.5 birds with one peak in the west of the ILM and the other in the RLM in the north. The MLM had a high number of birds in most of the area from 92.5 birds, decreasing to 64.7 birds in the south-west. The high of 99.5 in the ILM was found in the east, decreasing relatively quickly towards the west, with 54.2 birds being recorded. The RLM recorded a high of 99.5 birds in the north, with a steady decrease to 54.2 birds in the south. The CLM had a high count of 59.4 in the north-east, decreasing to a low of 46.7 in the central and southern portion of this area.

4.3.3 Biomass

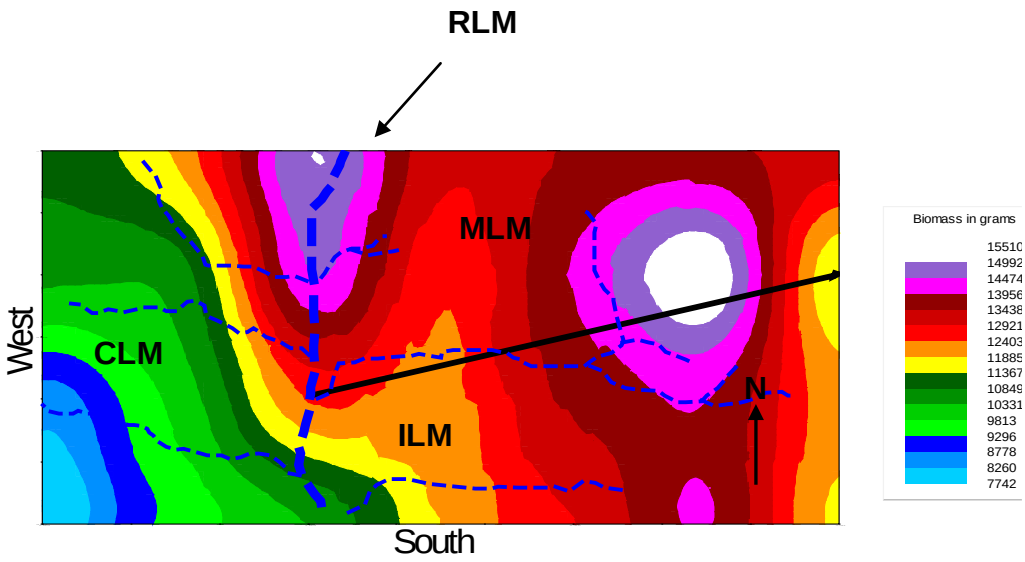

Figure 4.12 Distribution of the total biomass of birds

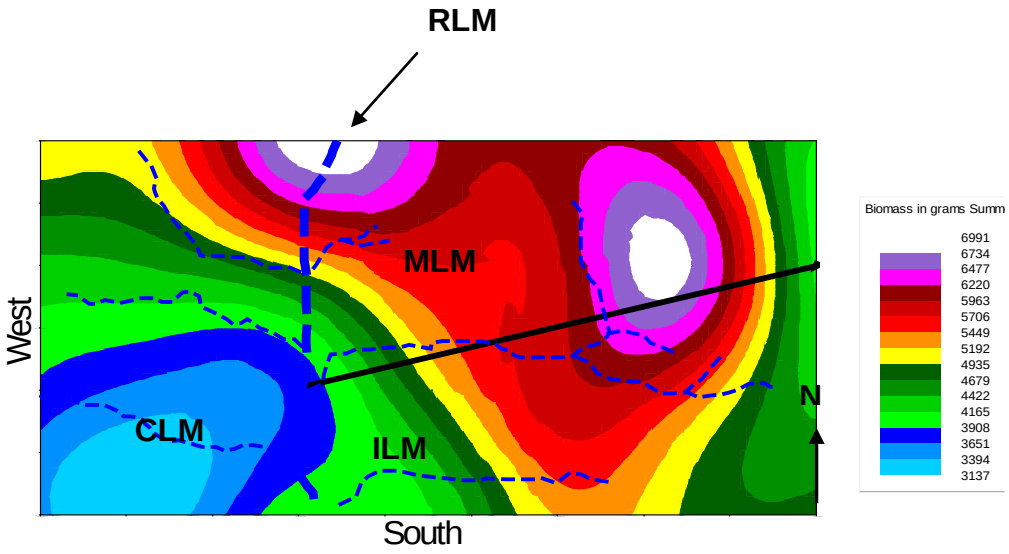

Figure 4.13 Distribution of the biomass of birds during summer

4.3.3.1 Biomass of birds for the complete census

The aggregated biomass for the complete count (Figure 4.12) had a trend similar to the distribution of the species richness and numbers of birds with a maximum in the north-east of the study area, decreasing gradually to the south west of the study area. The MLM had the highest biomass of birds when compared to the other land uses, with a central high of 15 610g, decreasing to the west to 12 403g. The ILM also had a high in the in the north east of land use of 15 610g, with a decreased biomass to the east and west of this high biomass. The biomass decreased in a westerly direction to 10 331g. The RLM has a high biomass in the north of 14 474g, decreasing gradually southwards to 10 849g. The CLM had the lowest biomass of the four land uses. The highest biomass was in the north east of the CLM of 14 474g, decreasing gradually to the south west to 7 741g.

4.3.3.2 Biomass during summer

The trends for the summer biomass counts (Figure 4.13) followed similar distribution patterns to the complete biomass count. The highest biomass recorded was in the MLM with a high recorded in the north east of 6 691g and north west of 6 991g. The biomass reduced to the east and west to 3 908g. The biomass for the ILM followed a similar trend as the total biomass, with a high of 6 477g in the north east of the land management, decreasing to the east and west to 3 908g. The RLM had a high in the north of 6 991g, decreasing to 3 651g in the south. The CLM had a high biomass of 6 991g in the north-east of this land use, decreasing southwards to 3 137g.

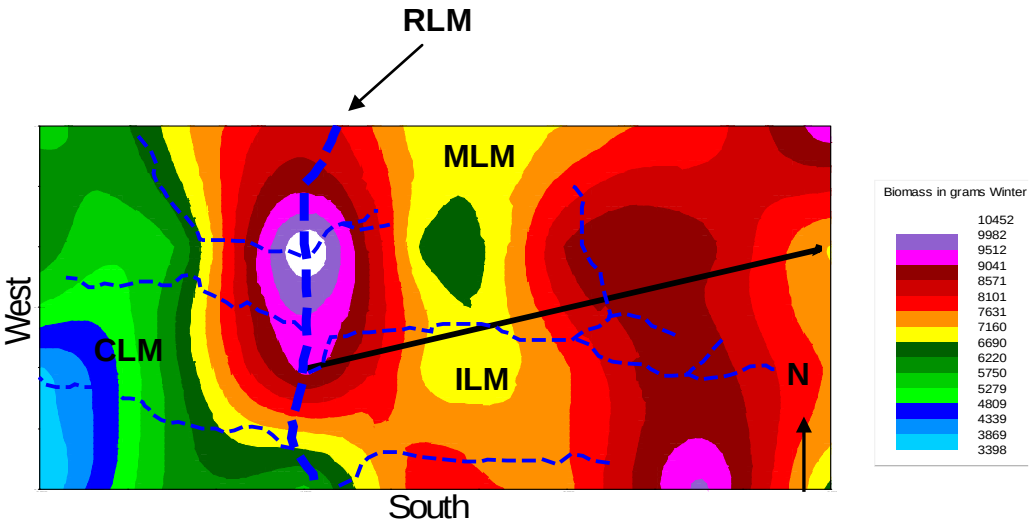

Figure 4.14 Distribution of the biomass patterns of birds during winter

4.3.4. Shannon Diversity Index

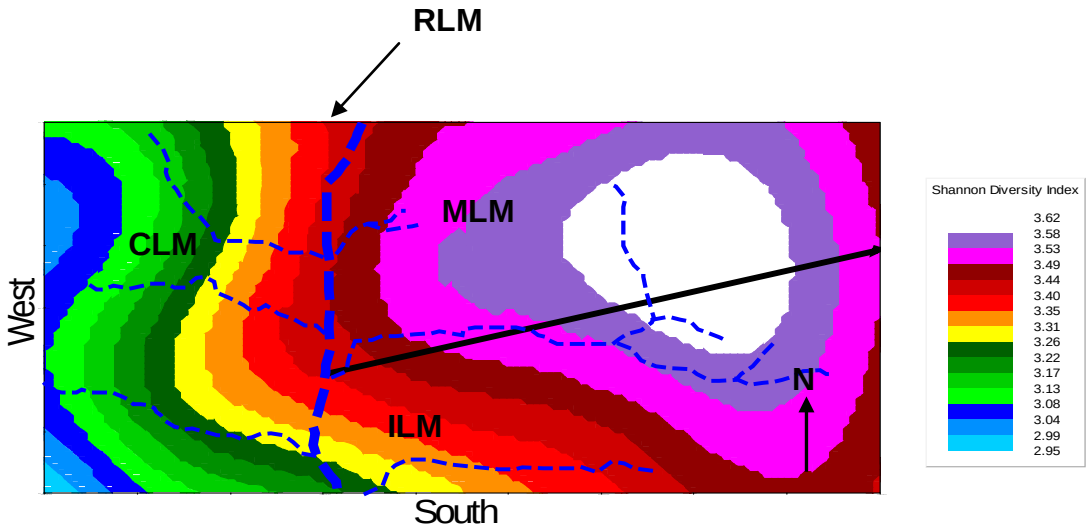

Figure 4.15 Distribution patters of the Shannon Diversity Index

4.3.3.3 Biomass during winter

There was a general increase in biomass throughout the study area during the winter (Figure 4.14). The MLM had a high in the north east of 9 041g, decreasing to the west to 6 220g. The winter biomass of ILM had a high of 9 512g in the south-east of this land use, decreasing to the east and west to 6 690g. The RLM had the highest biomass recorded in winter, with 10 452g in the central area of this land use. The CLM had the lowest biomass in the winter from 8 101g in the east of this land use, decreasing to the west and south to 3 398g.

4.3.4.1 Shannon Diversity Index

The Shannon Diversity Index (Figure 4.15) follows a similar pattern when compared to the species richness and the numbers of birds. There is a high diversity value of 3.62 in the MLM in the central and eastern part of the land use. The diversity decreased to the west and east to 3.44. The ILM has a similar high diversity in the central eastern area of this land use, decreasing to the south and west to 3.22. The diversity of the RLM was uniform, with much of this land use having a diversity of 3.40, decreasing in the south to 3.22. The CLM has the lowest diversity, with a high in the east of this land use being 3.35, decreasing to the west to 2.95.

4.3.5 Feeding guilds

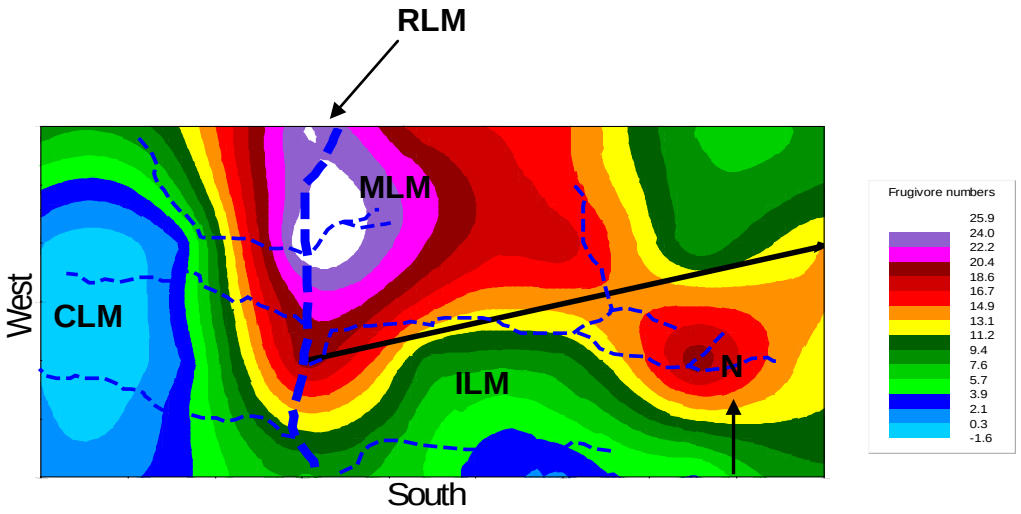

Figure 4.16 Distribution of the numbers of frugivores

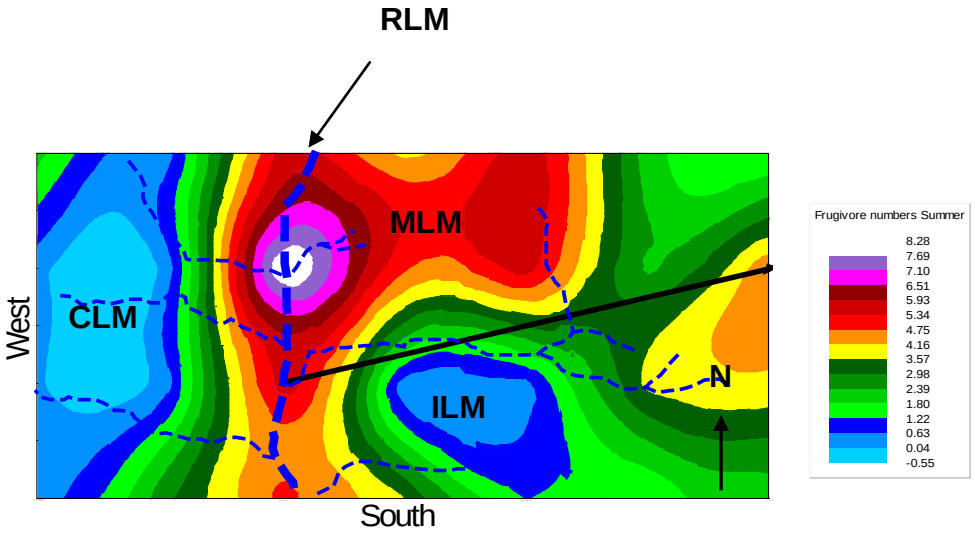

Figure 4.17 Distribution of the numbers of frugivores in summer

4.3.5.1 Distribution of frugivores

The distribution of numbers of the frugivorous birds (Figure 4.16) was centred predominantly over the RLM, with a high count of 25.9 birds. The distribution decreased into the MLM, where numbers decreases towards the east, with a low being recorded in the north east of the MLM. There was a high of 16.7 birds in the ILM, decreasing southwards to 2.1 birds. The CLM had a very low count of numbers of frugivores, with much of the land use having 2.1 birds.

4.3.5.2 Distribution of frugivores in summer

The distribution in the numbers of birds of the frugivore feeding guild during the summer counts (Figure 4.17) follows a similar pattern when compared with the trends with the total census (Figure 4.16). The distribution was highest in the RLM, with a high count of 8.28 birds, decreasing to 4.16 birds in this land use. The numbers of birds of the frugivore species feeding guild in the MLM has a high count of 4.75 birds, decreasing to 1.22 birds in the east of the MLM. The bird numbers drops in the ILM, with a high 4.16 in the east of this land use, decreasing towards the west to 0.63 birds. The bird numbers of this feeding guild reduced uniformly from 4.75 birds to less than one bird towards the west.

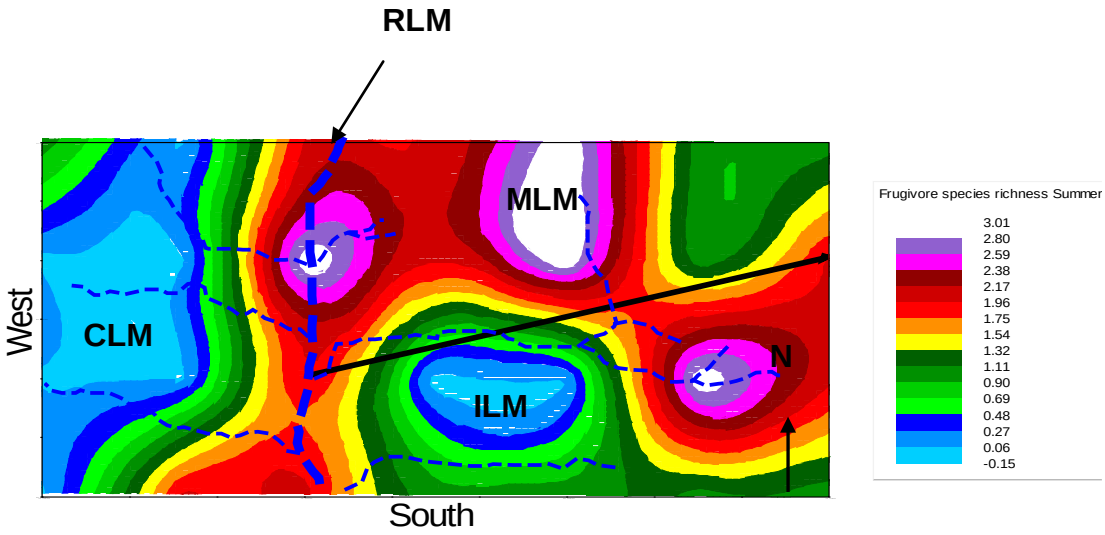

Figure 4.18 Distribution patterns of the species richness of frugivores in summer

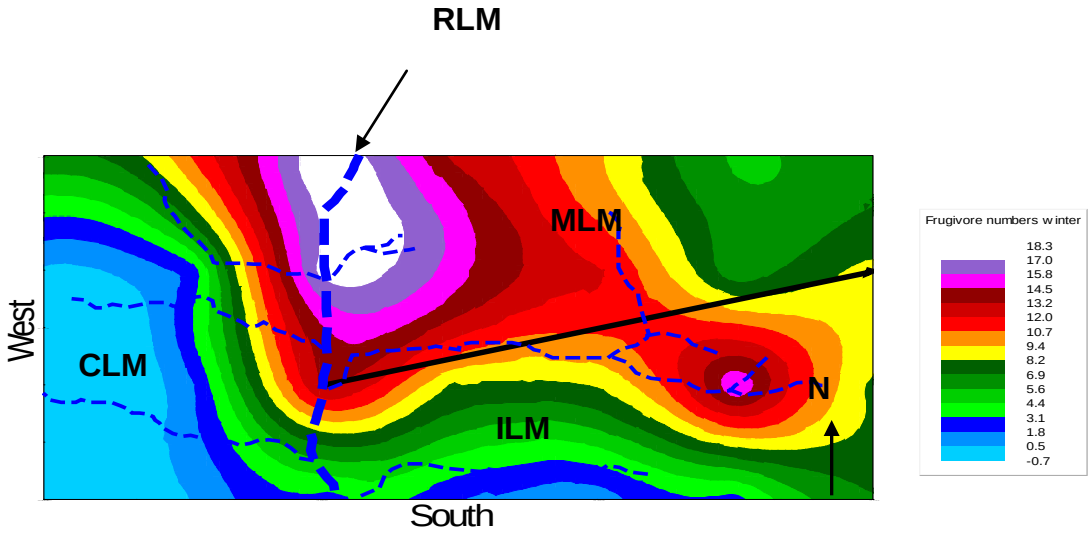

Figure 4.19 Distribution of frugivore numbers in winter

4.3.5.3. The distribution of the species richness of the frugivorous birds in summer

The distribution of the species richness of the frugivore feeding guild during the summer (Figure 4.18) had three maxima in the RLM, MLM and the ILM. The MLM had a high count of 3.01 species in the central area of this land use, decreasing to 1.11 species in the east. The ILM had a high of 3.01 in the east of this land management, decreasing to a low of less than species for most of the rest of the ILM. The species richness was fairly constant in the RLM, with a high of 3.01 species in the central area of the RLM, decreasing to 1.96 species north and south. The CLM had an overall count of one species and less, with the lowest count in the central and western area of the CLM.

4.3.5.4. The distribution of numbers of frugivorous birds in winter

The numbers of the frugivores in the winter (Figure 4.19) was highest in the RLM, stretching into the MLM and the ILM. The high of 18.3 in the RLM covered much of the northern area of this land use, decreasing southwards to 3.1 birds. In the western area of the MLM the numbers of frugivores was high, similar to the RLM, with 18.3 birds. The frugivore numbers decreased eastwards in this land use to 3.1 birds in the north east. There was a small peak in the ILM of 14.5 birds, decreasing to 1 bird in the southern area of the ILM. The CLM had a low of approximately one bird for most of this land use type.

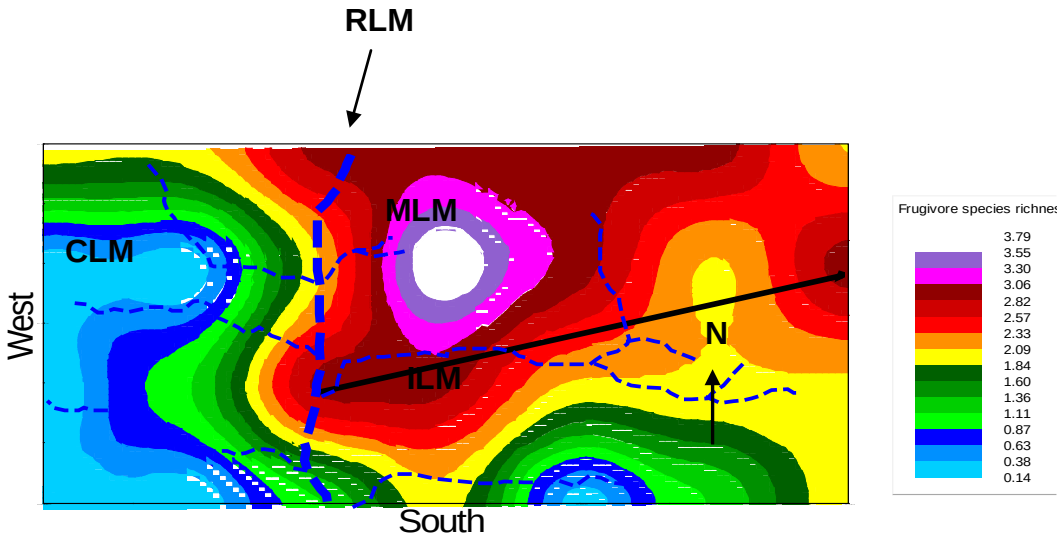

Figure 4.20 Distribution of frugivore species in the winter

4.3.6 Granivore feeding guild

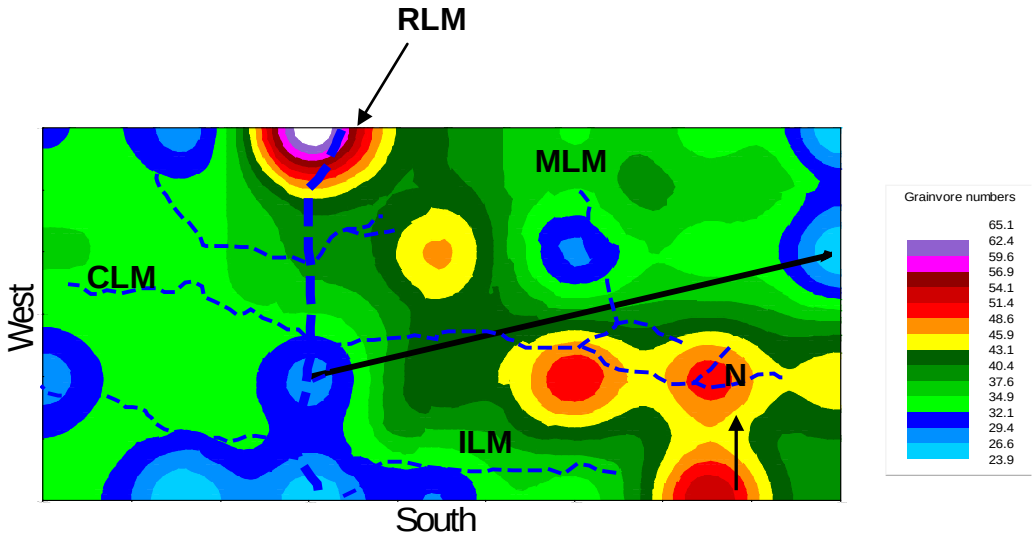

Figure 4.21 Distribution of granivore numbers

4.3.5.5 Distribution of the frugivore species richness in winter

The species richness for the frugivore feeding guild (Figure 4.20) was high almost exclusively in the MLM, with a high of 3.79 species in the central area of the land use, decreasing east and west of this area to 2.09 species. The ILM had a high count of species of the frugivore feeding guild in the north and east of this land use, decreasing from 2.3 species to less than one species in the south.

4.3.6.1 Distribution of the granivore numbers

The granivore feeding guild (Figure 4.21) indicates the numbers of birds during the entire census. The RLM had the highest number of birds with 65.1 in the north of this land use, decreasing to 23.9 birds in the south of the RLM. The ILM had a high 43.1-51.4 birds running through the centre of this land use, which reduced to 23.9 birds in the south west and north-east corners. The MLM had a small peak of 45.9 birds, decreasing to 23.9 birds in the east and south west. The CLM recorded 32.1 birds over much of the central area of this land use, decreasing to low counts of 23.9 birds in the south, west and north.

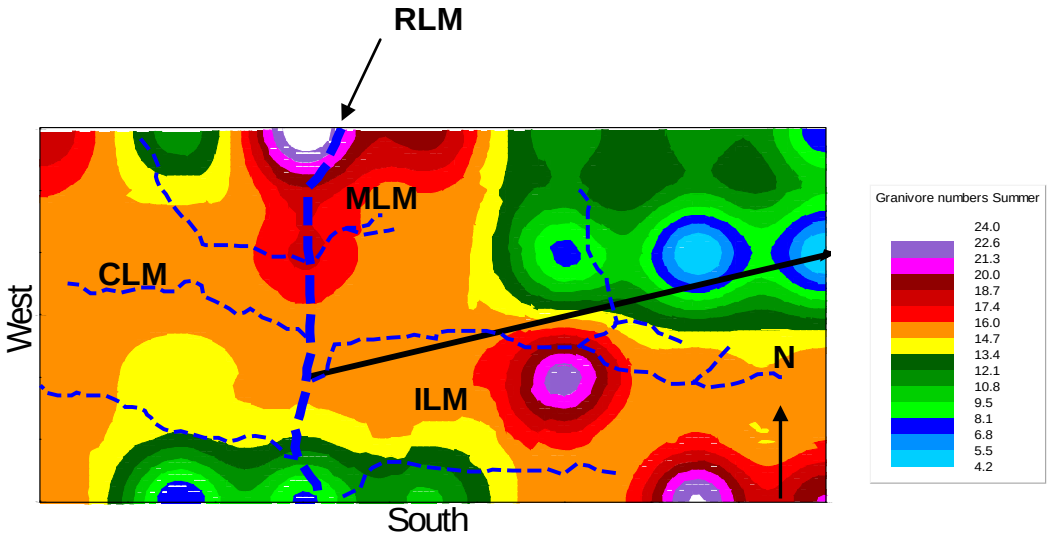

Figure 4.22 Distribution of granivore numbers in summer

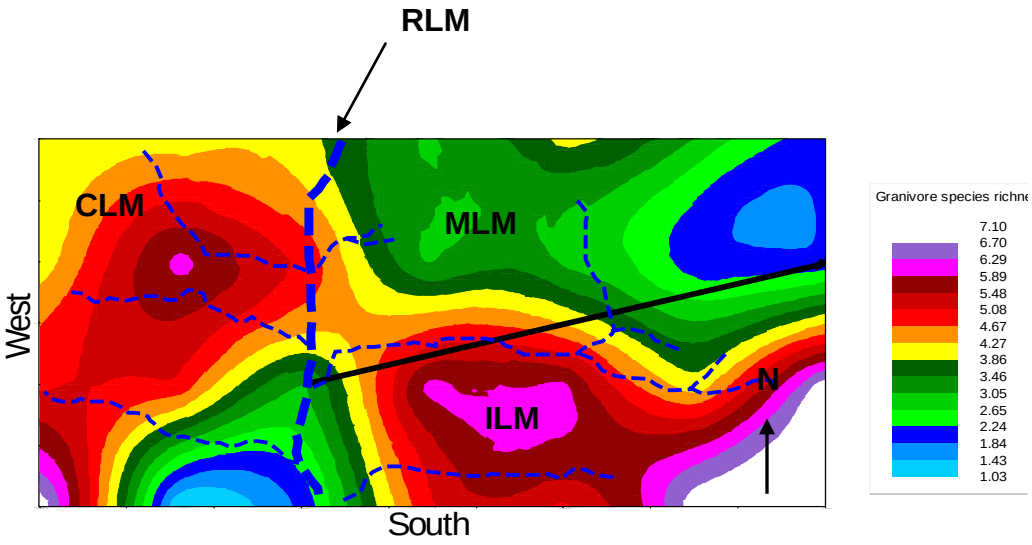

Figure 4.23 Distribution of granivore species richness in summer

4.3.6.2 Distribution of the granivores numbers in summer

The distribution of granivores in summer counts (Figure 4.22) indicates there was a high count in the north of the RLM of 24.0 birds, decreasing gradually to 4.2 birds in the south of this land use. The ILM had two high points in the south-east of this land use and a another high of 21.3 birds in the central area of this land use. The MLM had a general high of 14.4 birds in the west of this land use, increasing to 18.7 birds in the north west. The count in the CLM was fairly uniform, with much of the count at 14.7 birds, decreasing to the south to 4.2 birds. There was a high of 10.8 birds in the north-west of the CLM.

4.3.6.3 Distribution of granivore species richness in summer

The granivore feeding guild species richness (Figure 4.23) indicates there was a high of 7.10 species in the south-east of the ILM during summer. Much of the ILM had a high count of 5.89 species in the central area. The CLM had a generally high count between 5.89-3.85 species of the granivore feeding guild in the north and central areas. There was a reduction of species to 1.03 species in the south of this land use. The RLM had a high count of 3.85 species in the north and central areas, decreasing to 1.84 species in the south. The MLM had a high count of 4.27 species of the granivore feeding guild in the south west, decreasing to the east with a low of 1.03 in the east.

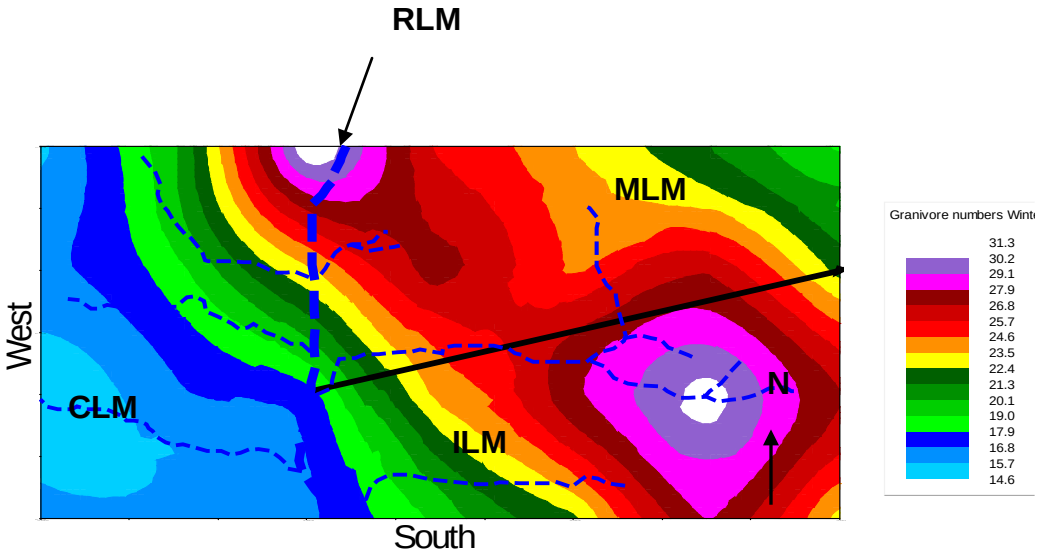

Figure 4.24 Distribution of granivore numbers in winter

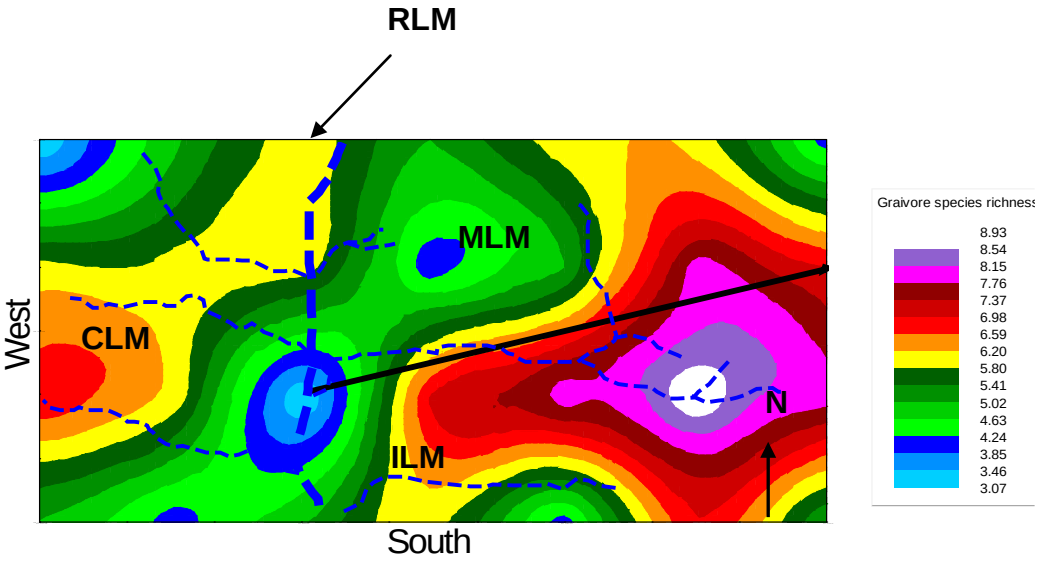

Figure 4.25 Distribution of granivore species richness in winter

4.3.6.4 Distribution of granivore numbers in winter

The distribution of numbers of granivores feeding guild for numbers of birds (Figure 4.24) for the winter indicates there was a central high in the ILM of 31.3 birds, decreasing gradually to the south-east of this land use. There was a further high of 31.3 birds in the RLM in the north, decreasing to 16.8 birds in the south of this land use. There was a general high count of this guild in the MLM with most of the area recording between 26.8 birds and 22.4 birds, decreasing to the north-east and south west to 20.1 birds. The CLM had a low count of between 22.4 and 17.9 birds, with an extensive area having between 15.7-14.6 birds.

4.3.6.5 Distribution of granivore species richness in winter

The granivore feeding guild for the species richness in the winter (Figure 4.25) indicated high richness in the ILM in the central area of 8.93 species, with much of the ILM having a count of between 5.8-8.15 species, decreasing to the south and west. The MLM had a similar number which reduced from a high in the central area of 7.76, extending northwards to 5.80 species. The western portion and the north-eastern corner of the MLM had a reduced species count of between 5.41 and 3.07 species. The species richness for the CLM had a high in the centre of this land use with a figure of 6.59 species, decreasing to the south and north to 4.24 species. The RLM had generally low counts of species richness, with a high count in the north of 5.8 species, decreasing southwards to a low of 3.07species.

4.3.7 Insectivore feeding guild

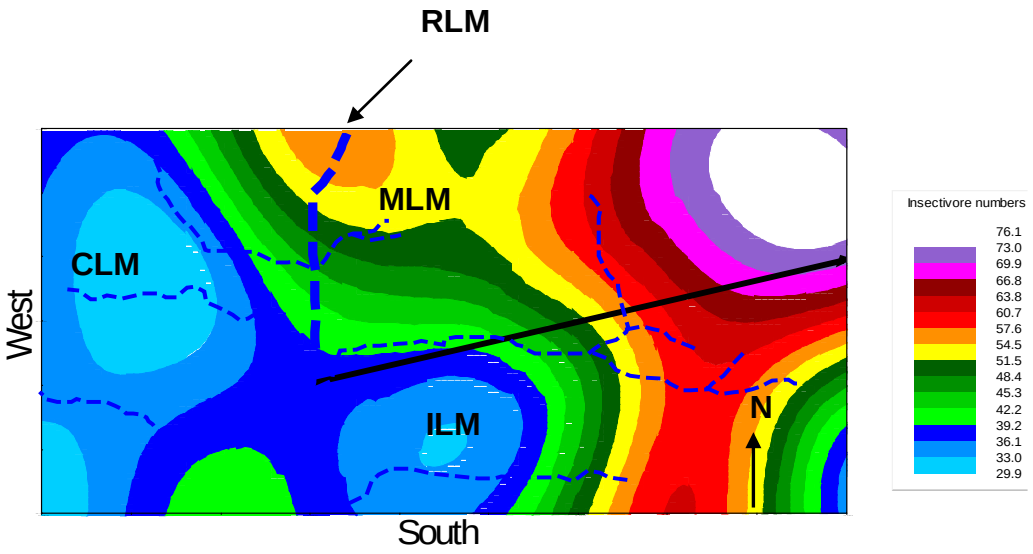

Figure 4.26 Distribution of insectivore numbers

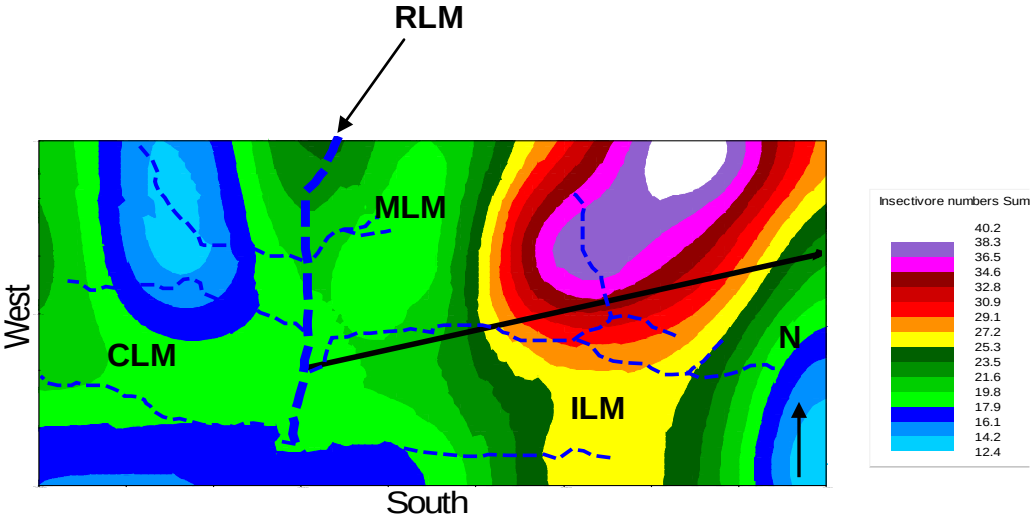

Figure 4.27 Distribution of insectivore numbers in summer

4.3.7.1 Distribution of insectivorous numbers

The numbers of insectivores (Figure 4.26) indicates a high in the north-east of the MLM, decreasing to 39.2 in the south-west of this land use. There is a high in the central ILM of 57.6 birds, decreasing to 29.9 in the south west and south east of the land use. The RLM has a high count of insectivore numbers in the north of 54.5, decreasing southwards to 36.1 birds recorded. Much of the CLM has a low count of between 36.1-29.9 birds, with a small high in the north and south of 39.2 birds.

4.3.7.2 Distribution of insectivore numbers in summer

The numbers of the insectivores in summer (Figure 4.27) indicates a high of 40.2 birds in the MLM, decreasing to the west, with a significant portion of this land use having a count of 17.9 birds. The number of insectivores in ILM had a high count of 30.9 birds in the central area, decreasing to the west and east to 16.1 and 12.4 birds respectively. The north of the RLM had a count of 23.5 birds, decreasing to 16.1 birds in the south. The count for the insectivore feeding guild for the CLM was low in comparison to the other land use types, with a high of 21.6 birds in the west, decreasing to 12.4 birds in the centre and 14.2 birds in the south.

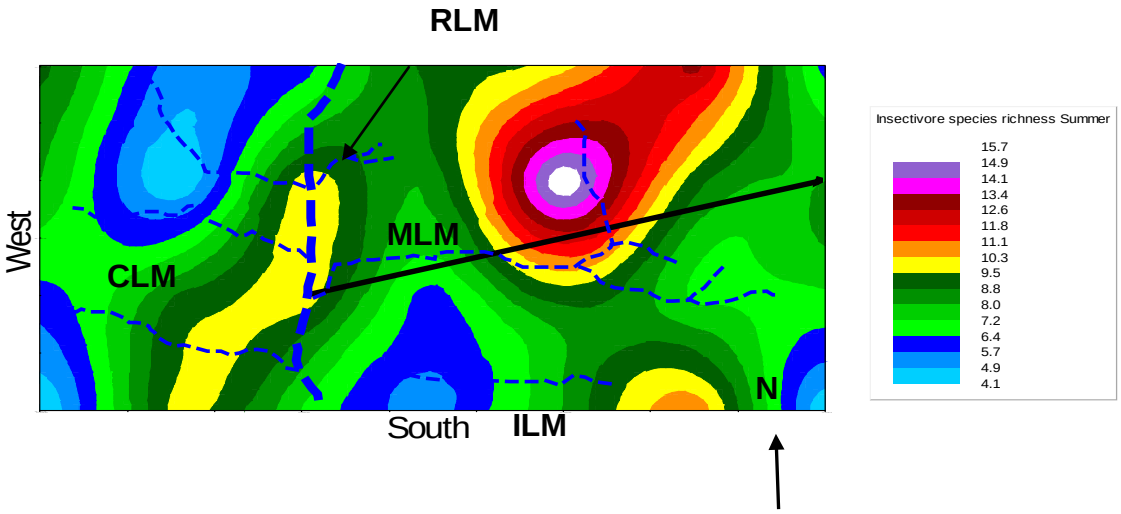

Figure 4.28 Distribution of insectivore species richness in summer

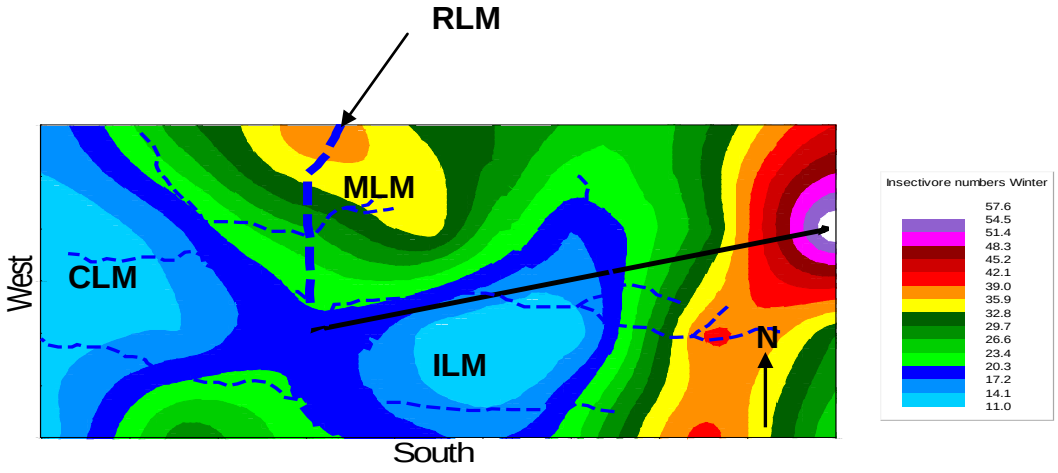

Figure 4.29 Distribution of insectivores in winter

4.3.7.3 Distribution of insectivorous species richness during summer

The species richness for the summer (Figure 4.28) indicates a high count in central MLM of 15.7 species, extending north-east, where 11.8 species. The area to the east and west of this high count in the MLM indicates a decrease in species to lows of 6.4 species and 7.2 species respectively. The ILM has a small peak in the south of 10.3 species, with the area to the east and west of this point decreasing to 4.1 species. The RLM had a count of 6.4 species in the north, increasing to 9.5 species in the centre, decreasing again to 7.2 species in the south. The CLM recorded a high in the south central area, with species numbers decreasing to 4.1 species in the south-west and north central parts.

4.3.7.4 Distribution of insectivore numbers in winter

The numbers of birds for the winter count of the insectivore feeding guild (Figure 4.29) indicates a high bordering the MLM and ILM of 57.6 birds. The count for the MLM drops to 14.1 species but increases to 35.9 species in the west. The drop in numbers of birds of the insectivore feeding guild in the ILM is significant, with a low of 11.0 species being recorded in a large part. The RLM had a high of 35.9 birds in the north, decreasing southwards to reach a low of 17.2. The numbers of this guild are low in the CLM, with a large central portion having a count between 17.2-11.00. There were two high counts in the CLM of 23.4 birds in the north and south.

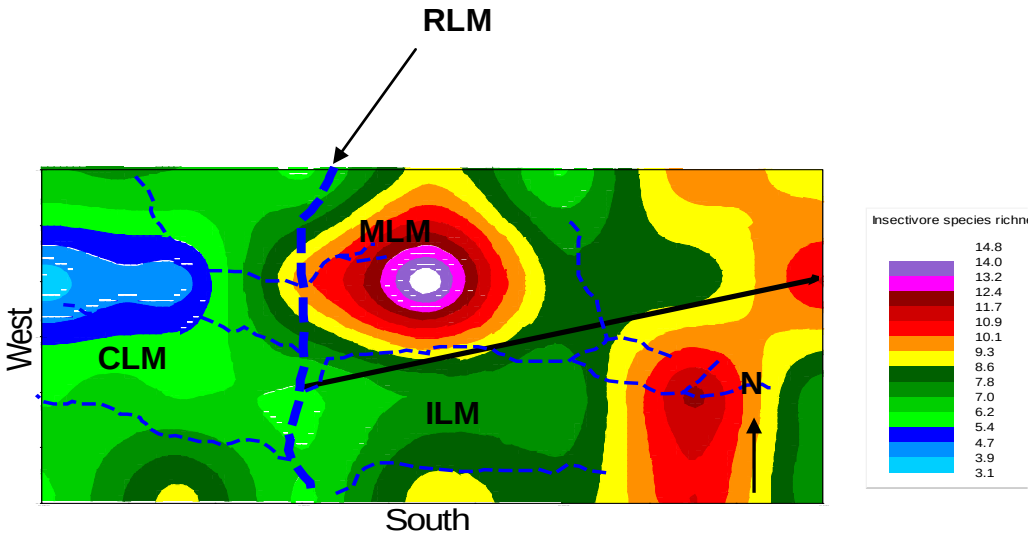

Figure 4.30 Distribution of insectivore species richness in winter

4.3.8 Omnivore feeding guild

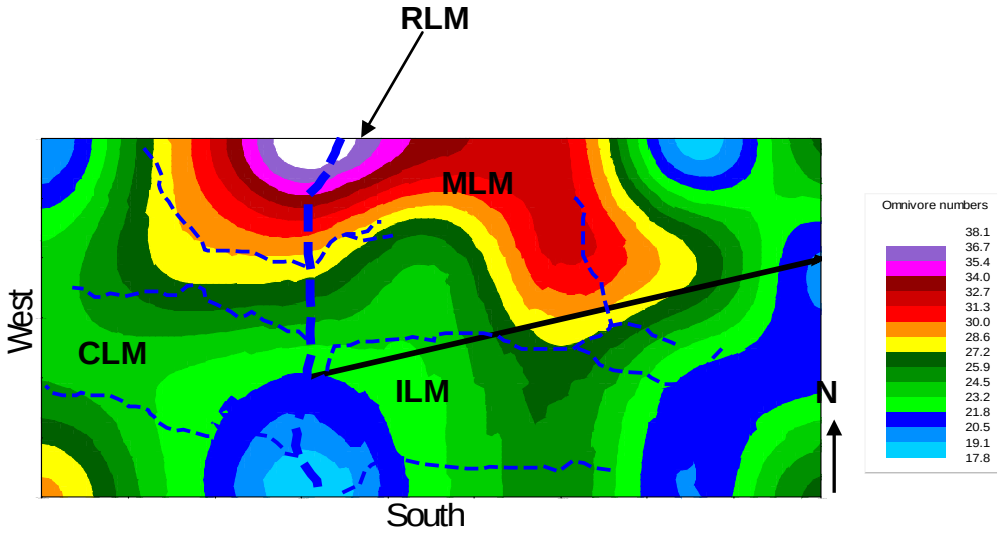

Figure 4.31 Distribution of omnivores numbers

4.3.7.5 Distribution of insectivore species richness in winter

The species richness for the winter counts of the insectivore feeding guild (Figure 4.30) indicates a high of 14.8 birds in the central area of the MLM, decreasing eastwards to 7.8 species and increasing again to 10.1 species in the east. The species count for the ILM was high in the east, dropping towards the west to a count of 5.4 species. The RLM had consistent low counts throughout the land use of between 5.4-6.2 species, with a high of 9.3 in the central area of this land use. The species counts for the CLM were low, ranging from 8.6 species in the south and dropping to 3.1 species in the west.

4.3.8.1 Distribution of numbers of the omnivorous birds

The numbers of birds of the omnivore feeding guild (Figure 4.31) indicate a high of 38.1 birds in the RLM, decreasing steadily to 17.8 birds in the south. The high of the RLM stretches into the MLM, with a high count of 34 birds, decreasing eastwards and southwards. The numbers of birds for the IML was high in the central area, decreasing westwards and eastwards to a low of 17.8 birds. The numbers of the omnivore feeding guild recorded in the CLM was high in the north-east of this land use, with a count of 32.7 birds. Numbers of this guild were low, with between 21.8-25.9 birds. There was a small increase in species of this guild to 28.6 birds in the south western corner CLM.

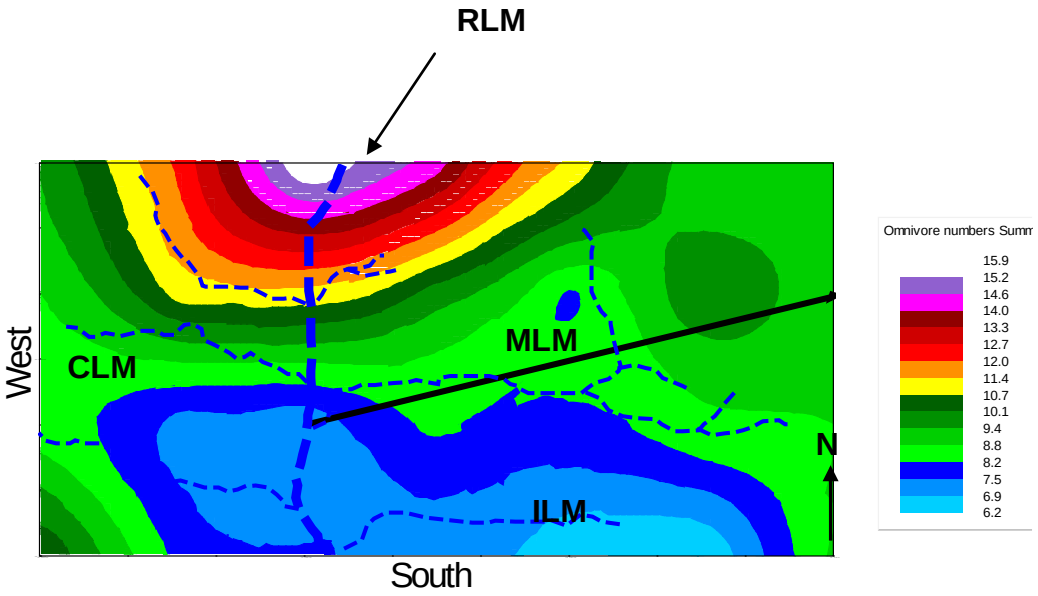

Figure 4.32 Distribution of omnivore numbers in summer

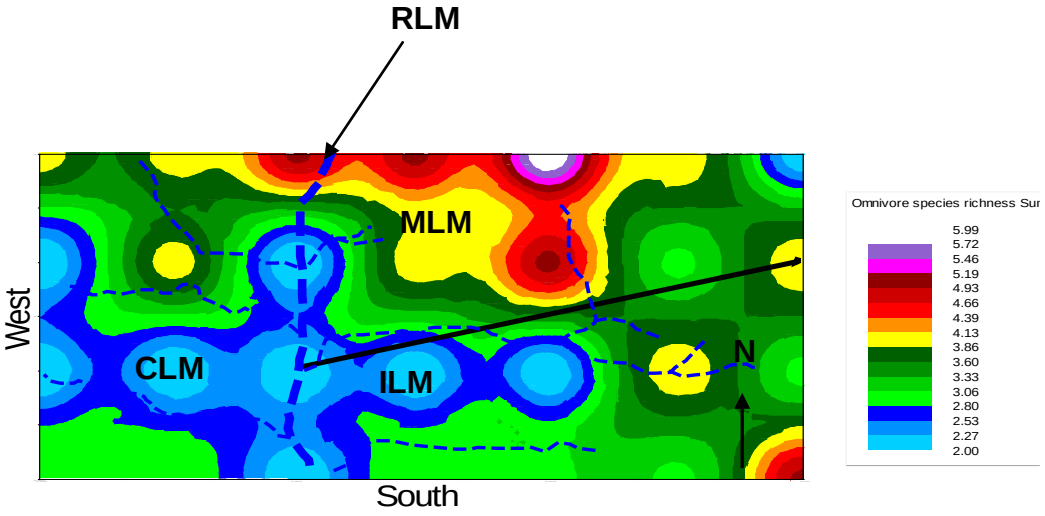

Figure 4.33 Distribution of omnivore species richness in summer

4.3.8.2 Distribution of omnivores in summer

The numbers of the omnivore feeding guild recorded in the summer (Figure 4.32) indicated a high of 15.9 birds in the north of the RLM. The distribution in the remaining land uses was constant, with a band of between 8.2-10.1 birds recorded throughout the study area, decreasing southwards to between 6.2-7.5 birds.

4.3.8.3 Distribution of omnivore species richness in summer

The species richness of the omnivore feeding guild indicates a high count of between 5.99-4.13 species in the north of the study area in the RLM and the MLM, decreasing to the south, with a high recording of 4.93 species in the south-east corner of the ILM. A large portion of all the land use types had a count between 2.80-3.60 species, with a significant portion of the CLM, RLM and ILM having a species richness 2.00-2.52 species.

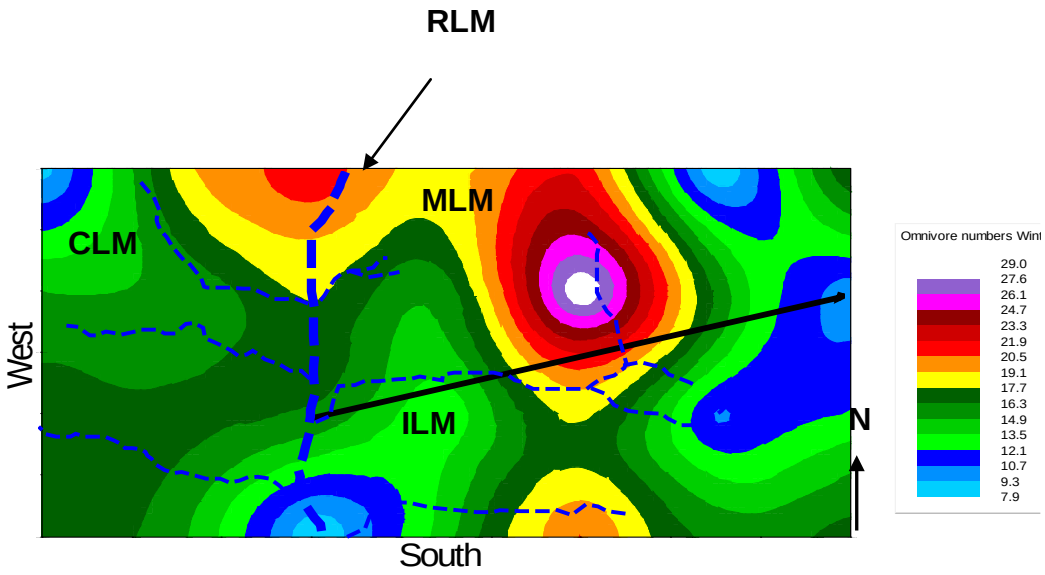

Figure 4.34 Distribution of omnivore numbers in winter

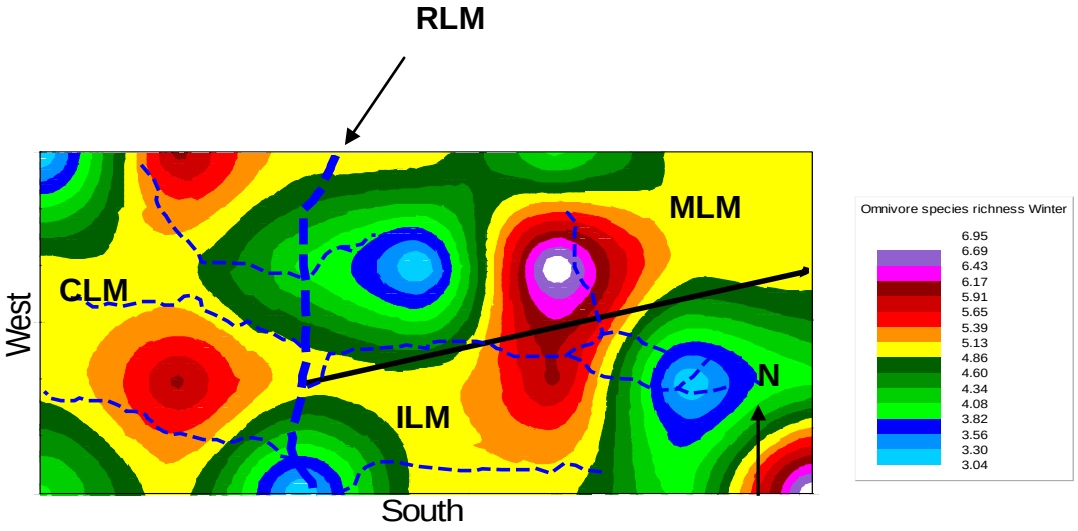

Figure 4.35 Distribution of omnivore species richness in winter

4.3.8.4 Distribution of omnivore numbers in winter

The numbers of birds of the omnivore feeding guild for the winter (Figure 4.34) indicates a high number of birds between 17-29 birds in the central area of the MLM. The numbers dropped east and west from the central high count of the MLM, to between 7.9-17.7 birds. The recorded numbers of birds of the omnivore feeding guild in the ILM, RLM and CLM had similar recordings between 7.9-16.3 birds. There were two high counts of between17.7-19.1birds in the north of the RLM and in the south of the ILM.

4.3.8.5 Distribution of omnivore species richness in winter

The species richness of the omnivore feeding guild (Figure 4.35) indicates a high richness of 6.95 species in the central area of the MLM, which reduced to 4.85 in the east and 3.04 in the west. The ILM had a high species richness in the south-east corner with a low species richness of 3.04 species between the high count of the MLM and the ILM. The central area of the ILM had a high species richness of 5.91, decreasing to 3.82 in the south-west. The species richness distribution in the RLM was fairly uniform with a high of 4.86 in the north and central area of this land use with a richness of 4.32 in the central area, decreasing to 3.04 in the south. The CLM had a species richness of 5.91 in the north and central area, with much of the area having a count of 4.86 species, with a low in the south west and north west of 3.82 and 3.04 respectively.

4.3.9 Distribution of nesting guilds

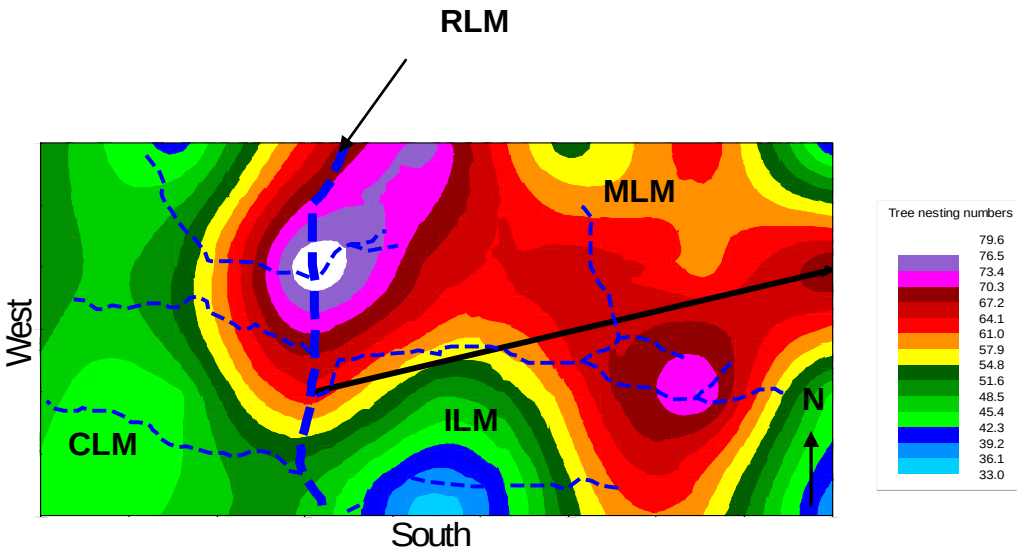

Figure 4.36 Distribution of the tree nesting guild

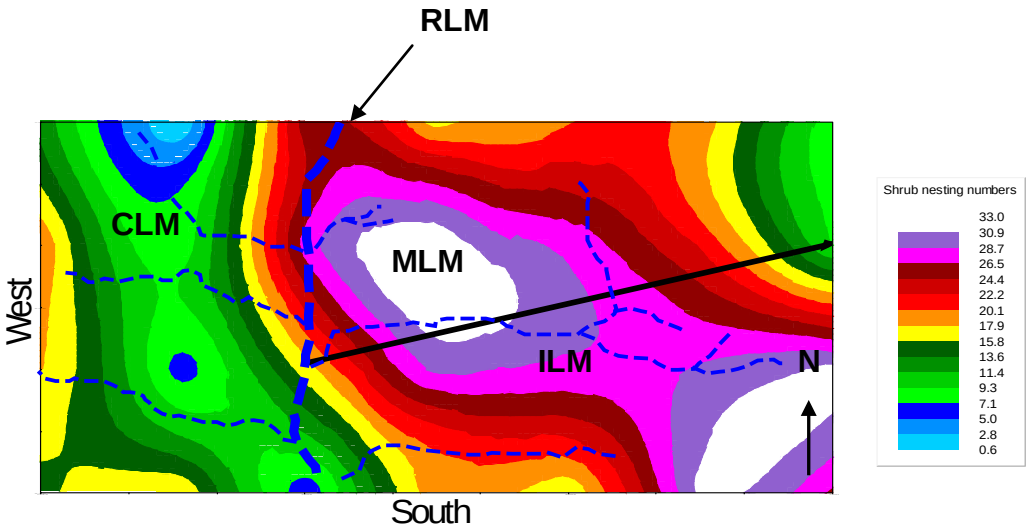

Figure 4.37 Distribution of the shrub nesting guild

4.3.9.1 Distribution numbers of the tree nesting guild

The numbers of tree nesters (Figure 4.36) indicates a high of 79.6 birds in the RLM, decreasing to 64.1 birds in the north. The numbers of tree nesters decreased to the south of the high recording in the RLM to 45.4 birds. There is a further peak in the ILM of 70.3 birds, which decreased to 33.0 birds in the south west and south east of this land use. The MLM has a high count of tree nesters throughout the land use, ranging from 61.0-73.4 birds with a low in the north east of 39.2 birds. The CLM has a low count of tree nesters, ranging from 42.3-51.6 birds.

4.3.9.2 Distribution numbers of the shrub nesting guild

The numbers of shrub nesters (Figure 4.37) indicated two high counts of 33 birds in the MLM and the ILM. The numbers decreased to the east of the MLM, with a low count of 7.1 birds. The numbers of shrub nesters in the ILM decreases to the west, with a low count of 7.1 in the south west of this land use. The RLM had a high count in the north of 24.4, decreasing to a count of 5.0 in the south. The CLM has a low count of 17.9 birds, decreasing to a count of 7.1 birds in the central area.

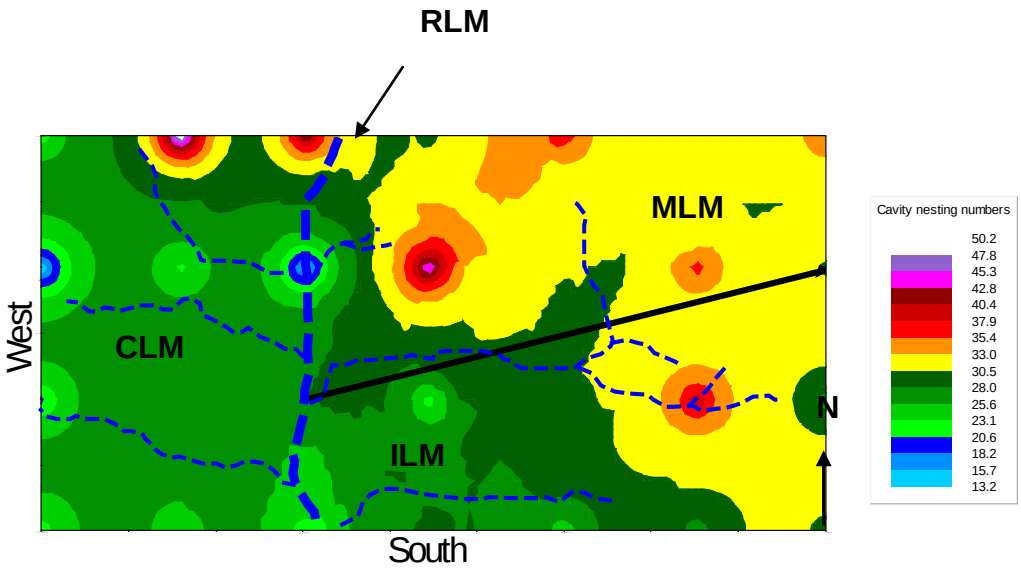

Figure 4.38 Distribution of the cavity nesting guild

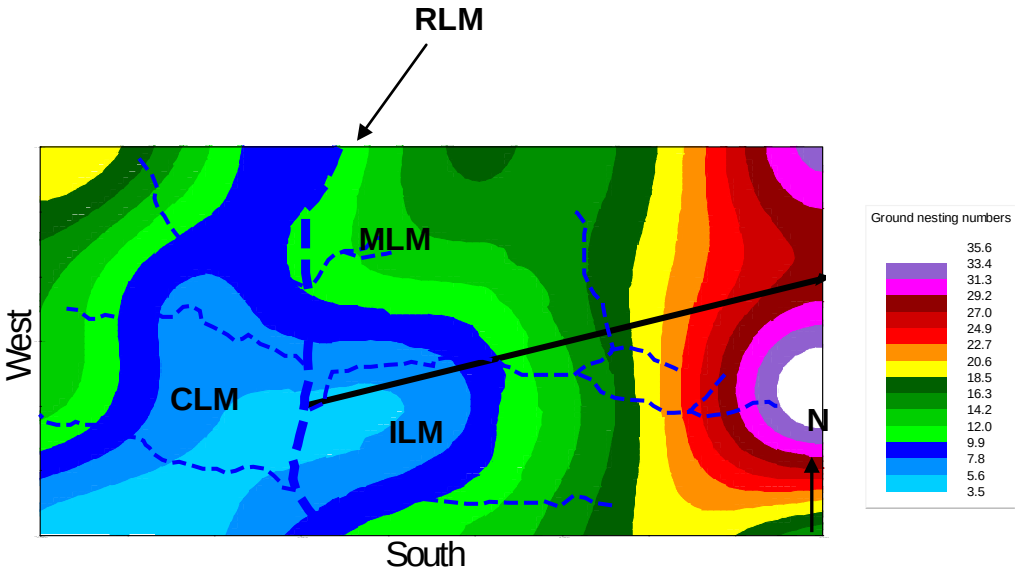

Figure 4.39 Distribution of the ground nesting guild

4.3.9.3 Distribution of numbers of the cavity nesting guild

The numbers of the cavity nesting guild (Figure 4.38) indicates a diagonal distribution across the study area. There were isolated peaks, with counts of 50.2 cavity nesters in the RLM, MLM and ILM, but the overall distribution was 30.5 birds in these land uses. The remaining area, which included the western portion of the ILM, most of the RLM excluding the north of the RLM and the bulk of the CLM had a lower count of cavity nesters within the range of 20.6-28 birds.

4.3.9.4 Distribution of numbers of the ground nesting guild

The numbers of birds of the ground nesting guild (Figure 4.38) indicates a high number of 35.6 birds in the east of the ILM and a high of 31.3 birds in the north-east of the CLM. The distribution decreased towards the west in the ILM to a number of 3.5 birds. The number of ground nesters also decreased to the west, but with a low count 5.6 birds in the south west. The RLM had a low count of 3.5 birds throughout. The CLM also had a low count of 3.5 birds for most of this land use, which increased towards the north-west to 18.5 birds.

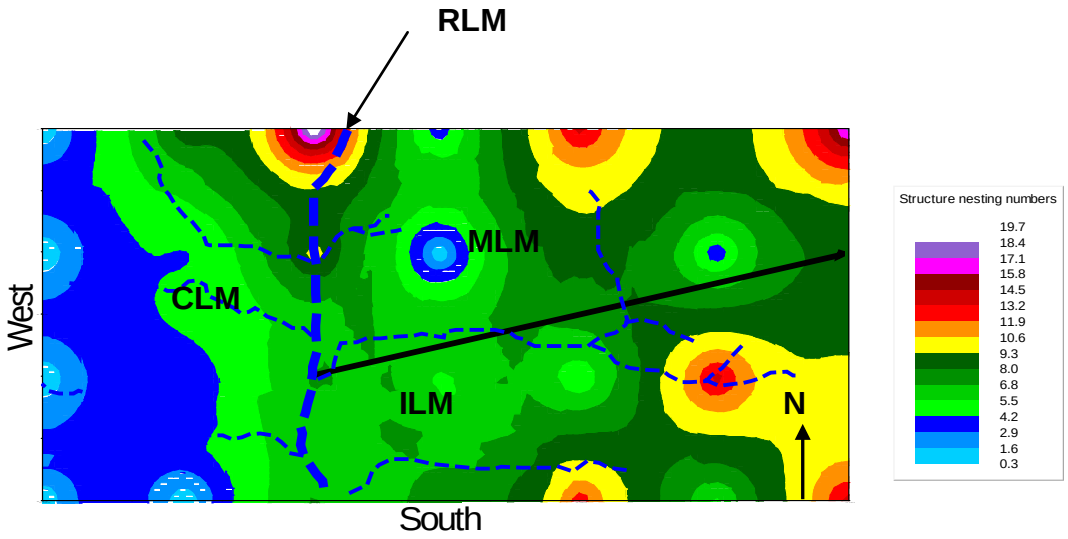

Figure 4.40 Distribution of the structure nesting guild

4.3.10. Distribution of cover provided by vegetation

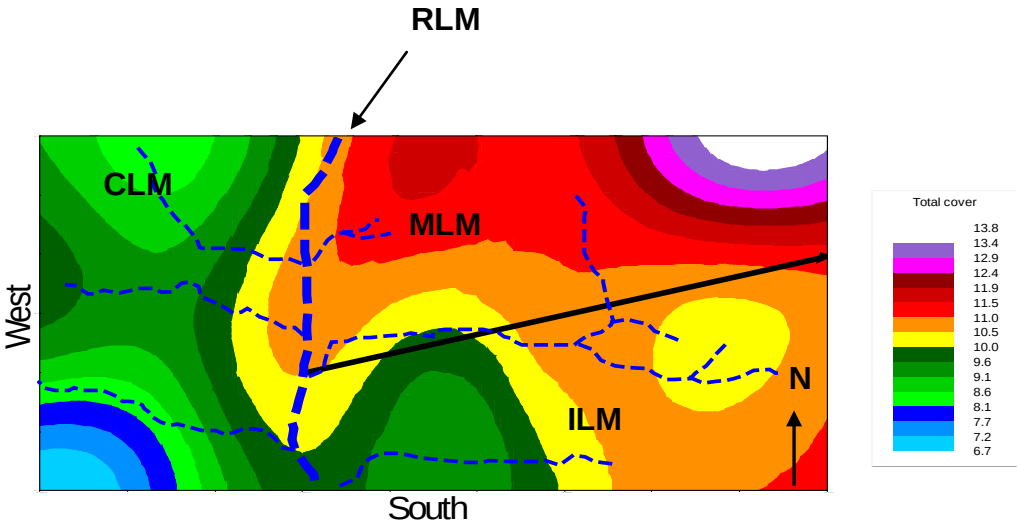

Figure 4.41 Distribution of cover provided by all classes of vegetation

4.3.9.5 Distribution of the structure nesting guild

The numbers of the structure nesting guild (Figure 4.40) indicates a high distribution in the RLM of 19.7 birds. There were similar high distributions in the north of the MLM and ILM, with numbers of 15.8 and 11.9 birds respectively. The remaining areas of the RLM, MLM and the ILM had counts of between 4.2-8.0 birds of the structure nesting guild. The CLM had a low count of structure nesters, with 8.0 birds recorded in the north-east, the bulk of the area recording between 0-6.8 birds.

4.3.10.1 Distribution of total cover provided by the vegetation

The total cover of the vegetation (Figure 4.41), which included cover provided by trees, shrubs and grasses, indicates the most cover in the north-east of the MLM, decreasing towards the west of this land use. The vegetation index value was 13.8 in the north east, decreased to 10.5 to the south and west. There was a reduced cover index of between 10-10.5 over the north-east of the ILM, which decreased towards the west, with an index value of 9.1. The cover provided by the vegetation in the RLM had an index value of 10 which decreased to 9.6 in the south. The CLM had a vegetation index value of between 8.1-10.0, which decreased further to 6.7 in the south-west.

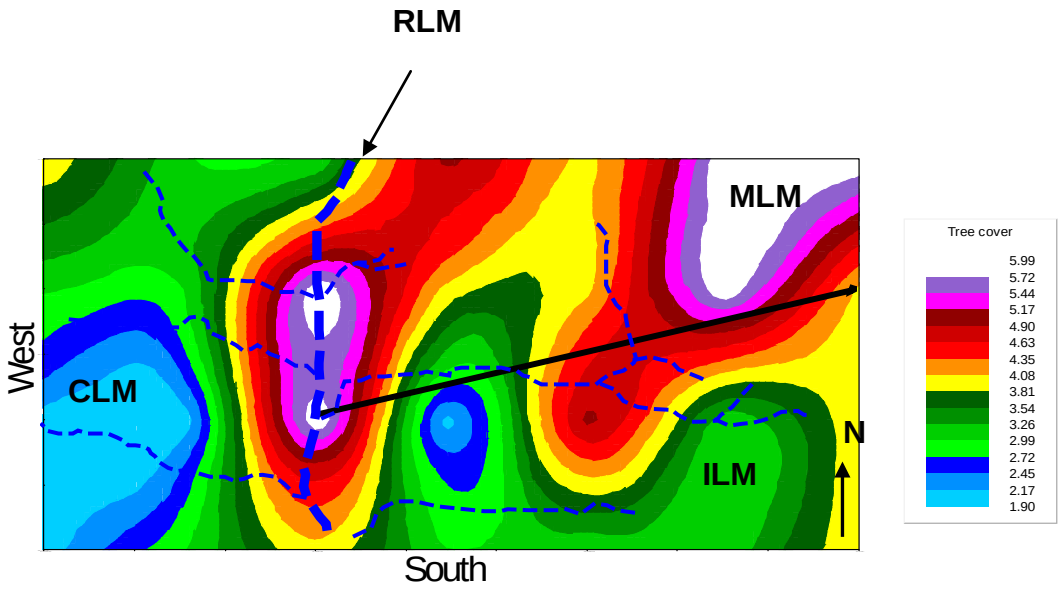

Figure 4.42 Distribution of total tree cover

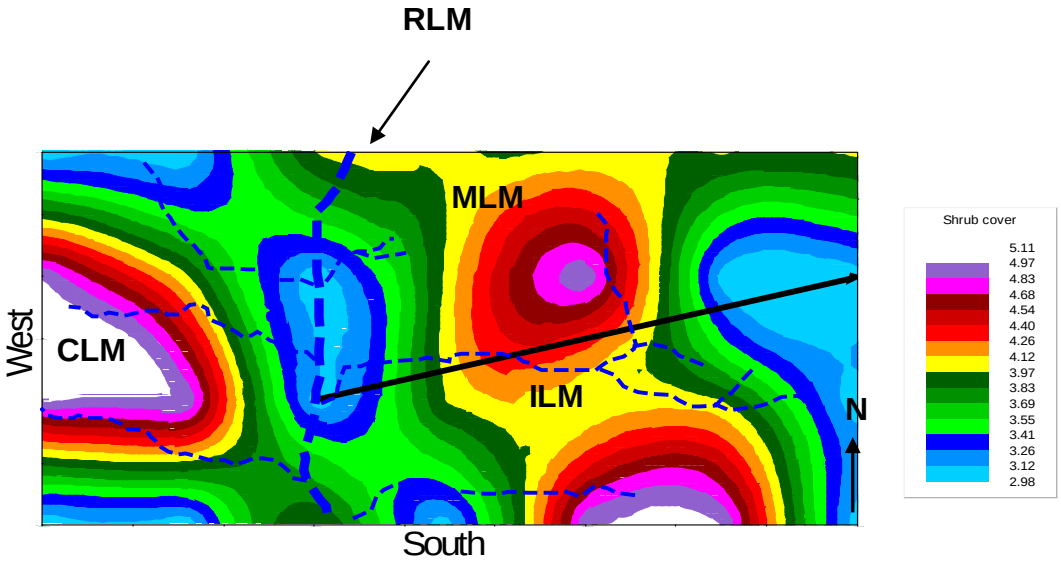

Figure 4.43 Distribution of total shrub cover

4.3.10.2 Distribution of the tree cover

The cover provided by trees (Figure 4.42) indicated two areas, with a high index of tree cover. Much of the north east of the MLM had a tree cover index value of 5.99, which reduced to 3.81 in the central area, but increased again to 4.63 in the west. The RLM had a similarly high tree cover index value of 5.99 which decreased to 3.81 in the south and 2.99 in the north. The ILM had a tree cover index value of 4.63 in the north-east, decreasing south and west to between 1.90-2.72. Much of the CLM had a tree cover index value of 4.63 in the east and 1.90 in the west.

4.3.10.3 Distribution of total shrub cover

The cover provided by shrubs (Figure 4.43) indicates a high cover index value of 5.11 in the central area of the CLM, which reduced north and south of this area to an index value of 2.98. There was a similar high shrub cover index value in the central area of the ILM, with an index of 5.11 which decreased to 3.97. The ILM shrub index value decreased to the east and west of the central high index value of 5.1-2.98. The MLM had a high shrub index value in the central area of 4.83 which decreased to the east and west to an index value of 2.98. The RLM had a low shrub index of 2.98 in the central area, increasing to 3.97 in the north and 3.83 in the south.

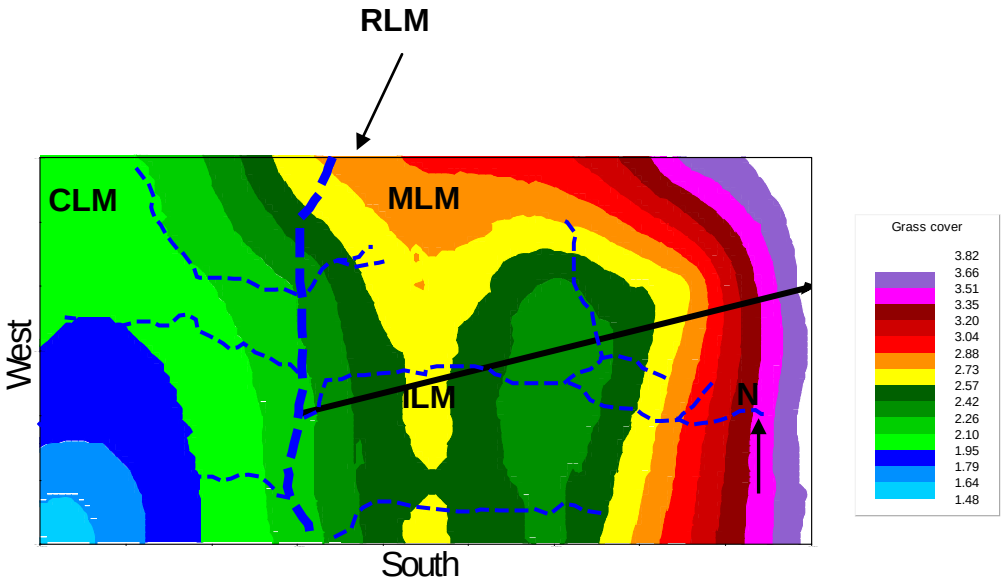

Figure 4.44 Distribution of total grass cover

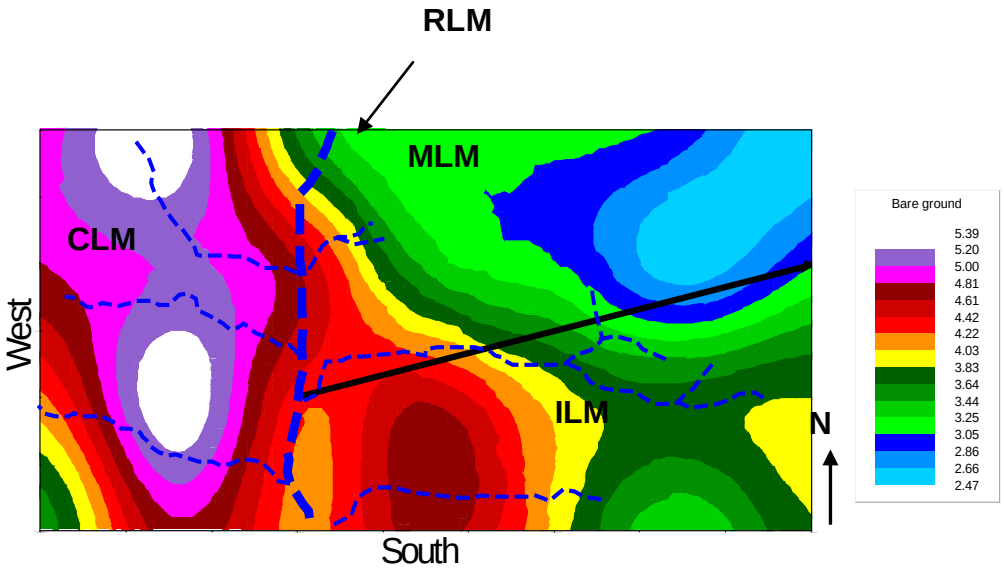

Figure 4.45 Distribution of bare ground

4.3.10.4 Distribution in grass cover

The cover provided by grasses (Figure 4.44) indicates that there was a band of grass cover, with an index value of 3.82 stretching along the eastern boundary of the study area in both the MLM and the ILM. Grass cover reduced to the west of the MLM, with most of this land use having an index value 2.28-3.20. The grass cover reduced westwards in the ILM, where the large central area had an index value 2.57-2.62. The grass cover index value for the RLM was 2.57 in the north of this land use, decreasing to 2.10 in the south. The grass cover index value for the CLM was between 1.48-2.26.

4.3.10.5 Distribution of bare ground

The bare ground (Figure 4.45) indicated that the CLM had the highest index value of 5.39 for a large portion of the CLM. The RLM had an index value of 4.61, decreasing to 3.64 in the north and 4.22 in the south. The ILM had an index value for bare ground of between 3.83-4.61 in the west decreasing to 3.05 in the east. The MLM had a large area of bare ground in the east with an index value of 2.47, with the remainder of the land use having a bare ground index of between 2.66-3.64. There was an increase in bare ground to the south west of the MLM between 3.83-4.42.

4.3.11 Indicator species

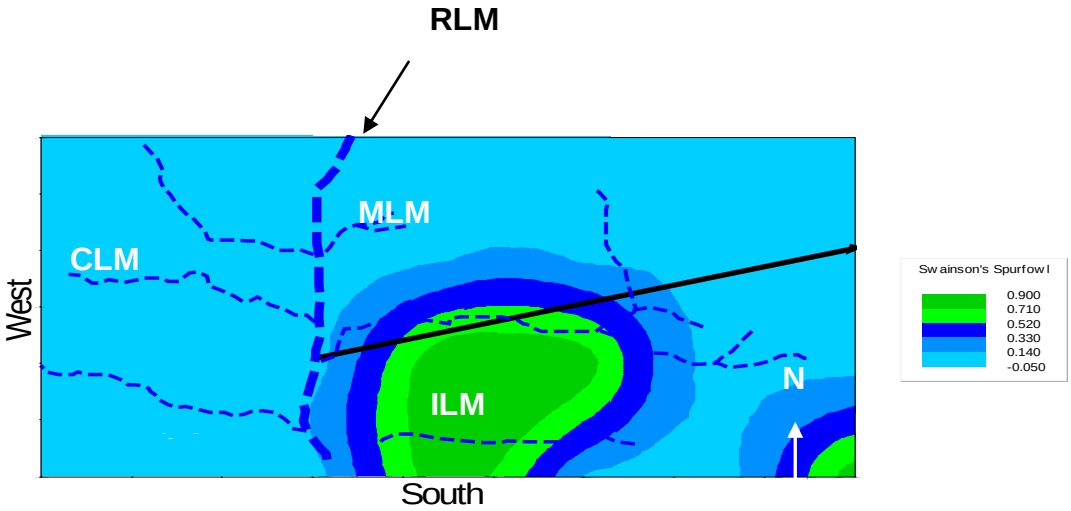

Figure 4.46 Distribution of the Swainson's Spurfowl

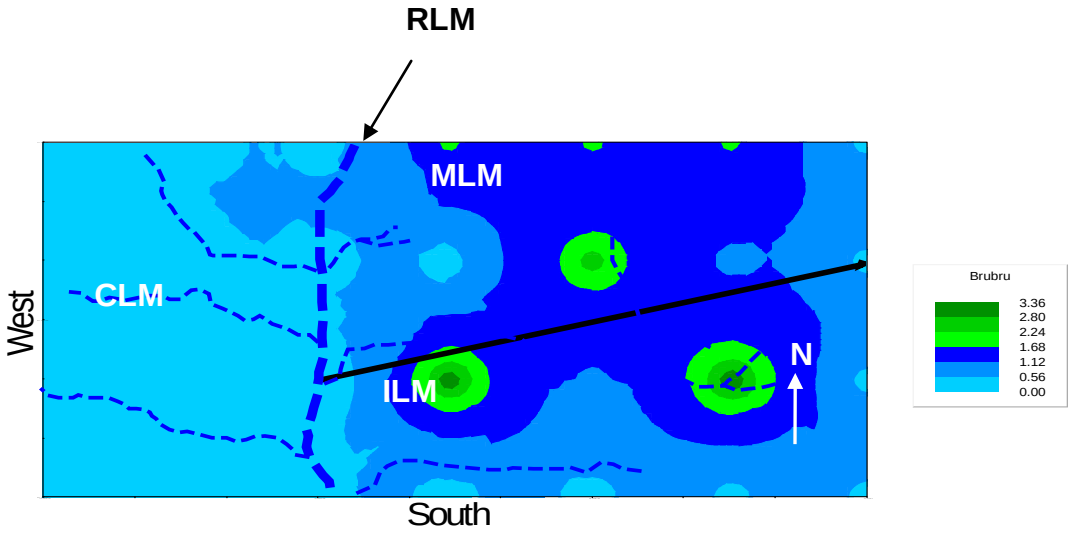

Figure 4.47 Distribution of the Brubru

The maps from Figures 4.46 – 4.63 have the same orientation and layout. Each map is accompanied by a description on the opposite page. Prominent landscape features include high ground in the north-east, with numerous rocky hills particularly evident in the MLM. The Tati River flows from the north to south separating the MLM and ILM from the CLM. Two prominent rocky hills on the northern edge of the CLM are an important feature here. The landscape feature between the rocky hill and the river is flat savannah, gradually reducing sloping towards the river.

4.3.11.1 Swainson's Spurfowl

The Swainson's Spurfowl was identified as an indicator species. Its distribution was recorded only in the ILM as indicated (Figure 4.46).

4.3.11.2 Brubru

The Brubru was identified as an indicator species. Its distribution was recorded only in the ILM and the MLM as indicated (Figure 4.47).

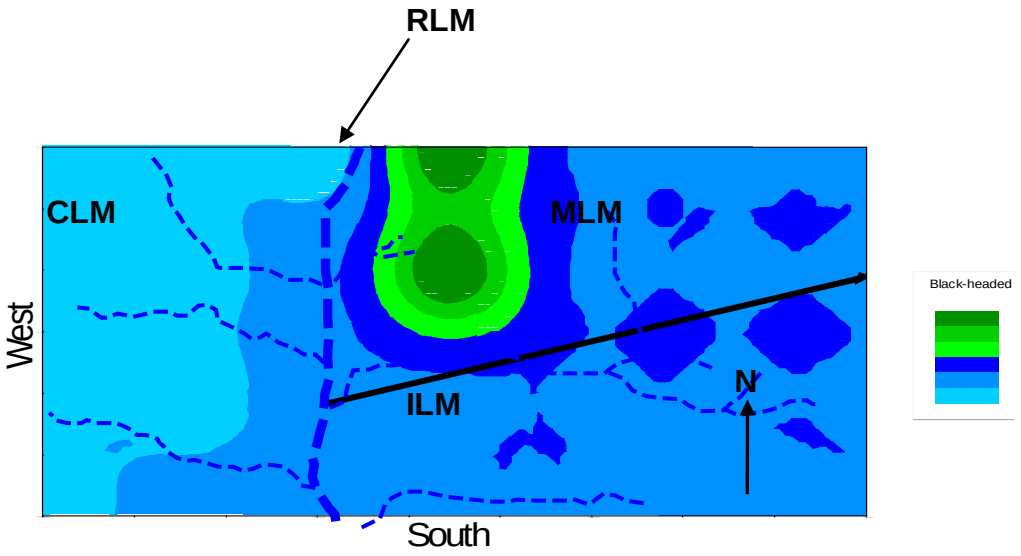

Figure 4.48 Distribution of the Black-headed Oriole

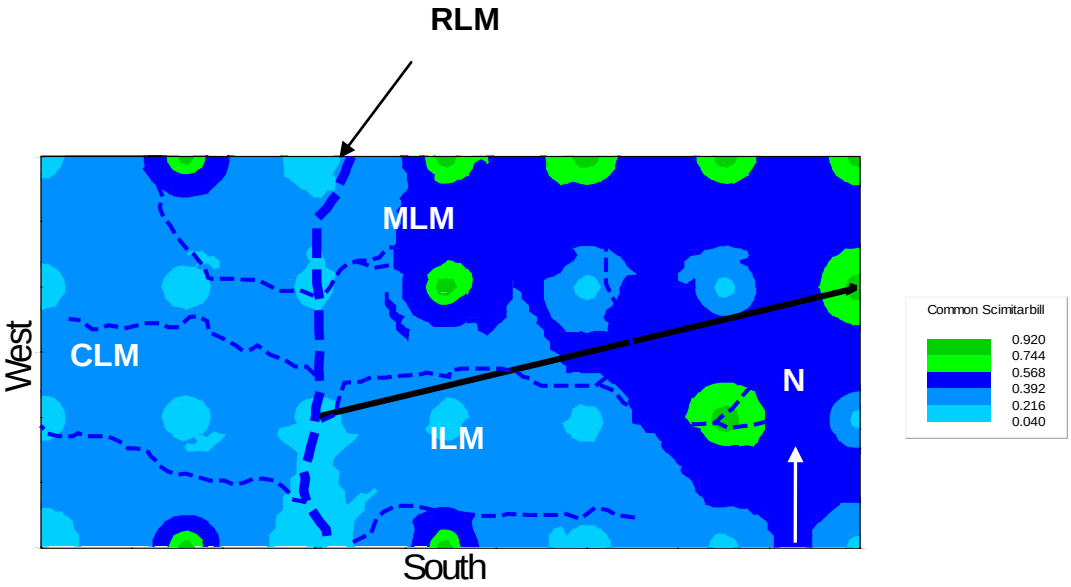

Figure 4.49 Distribution of the Common Scimitarbill

4.3.11.3 Black-headed Oriole

The Black-headed Oriole was identified as an indicator species. Its distribution was recorded only in the MLM as indicated (Figure 4.48).

4.3.11.4 Common Scimitarbill

The Common Scimitarbill was identified as an indicator species. The distribution was patchy only in the MLM and ILM as indicated (Figure 4.49).

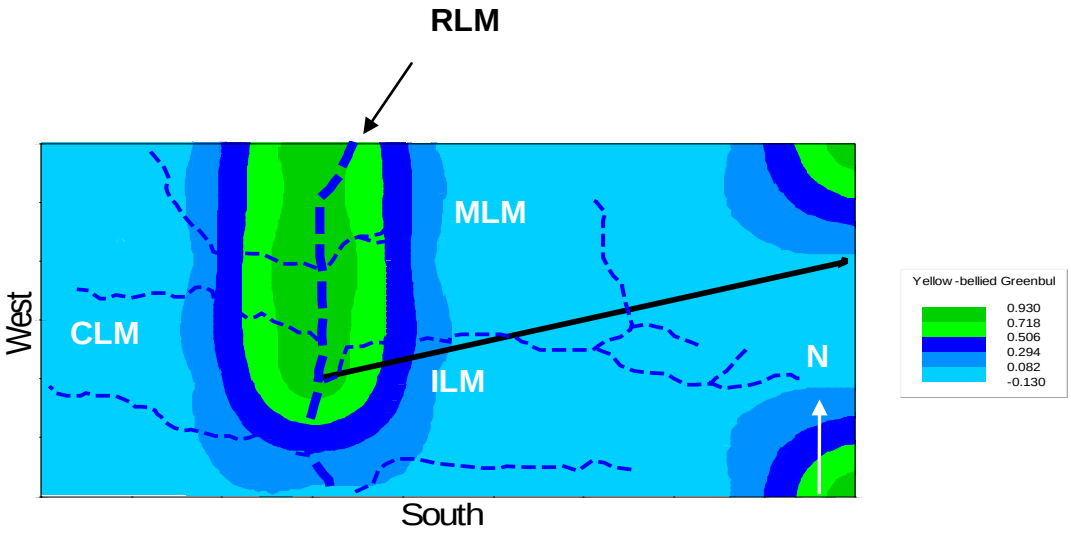

Figure 4.50 Distribution of the Yellow-bellied Greenbul

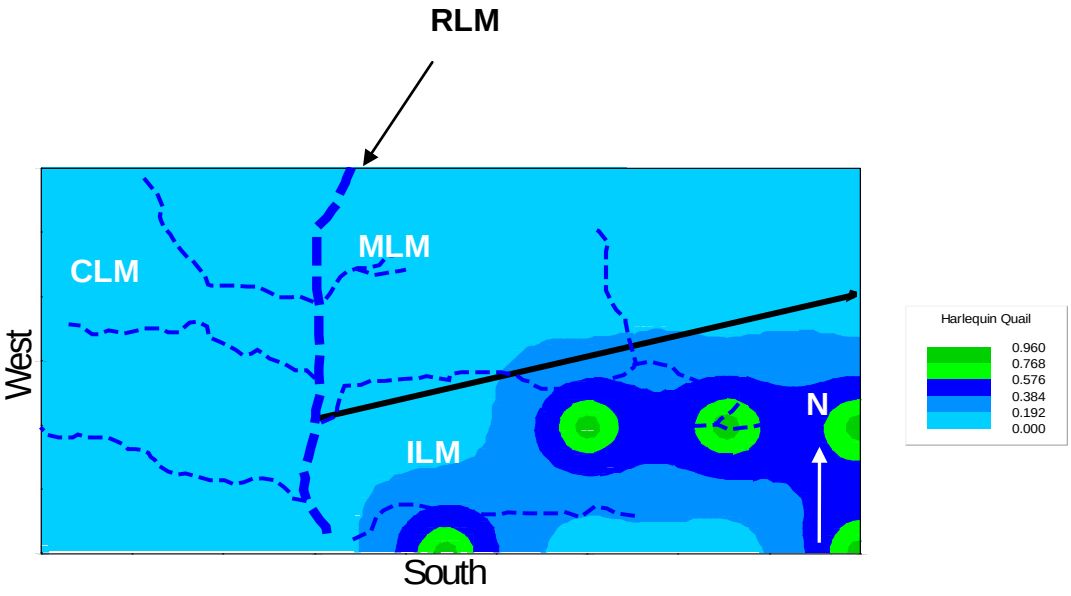

Figure 4.51 Distribution of the Harlequin Quail

4.3.11.5 Yellow-bellied Greenbul

The Yellow-bellied Greenbul was identified as an indicator species. Its distribution was recorded in the RLM and CLM as indicated (Figure 4.50).

4.3.11.6 Harlequin Quail

The Harlequin Quail was identified as an indicator species. Its distribution was patchy only in the ILM as indicated (Figure 4.51).

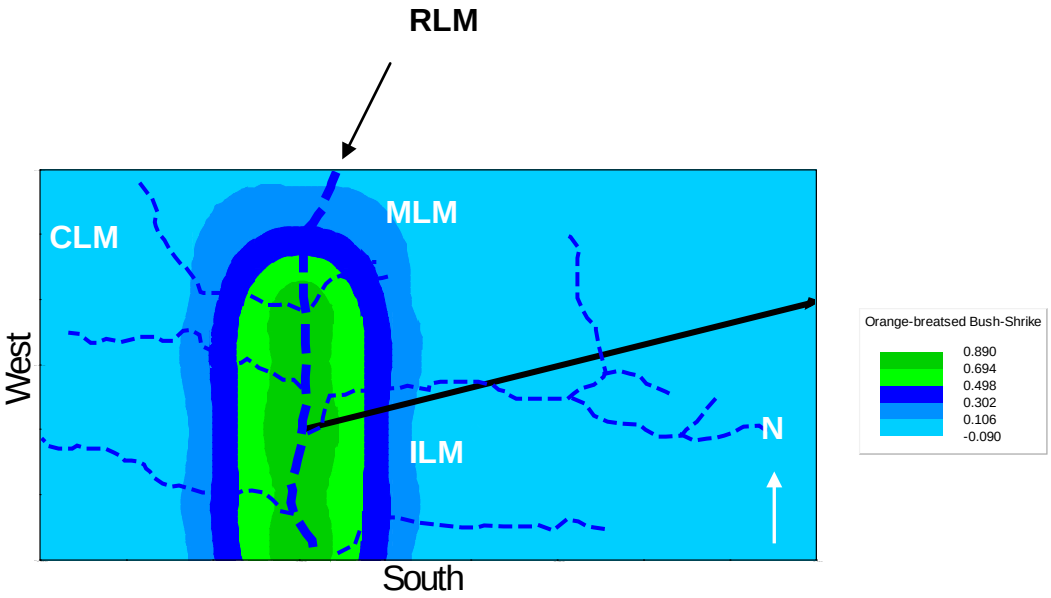

Figure 4.52 Distribution of the Orange-breasted Bush-Shrike

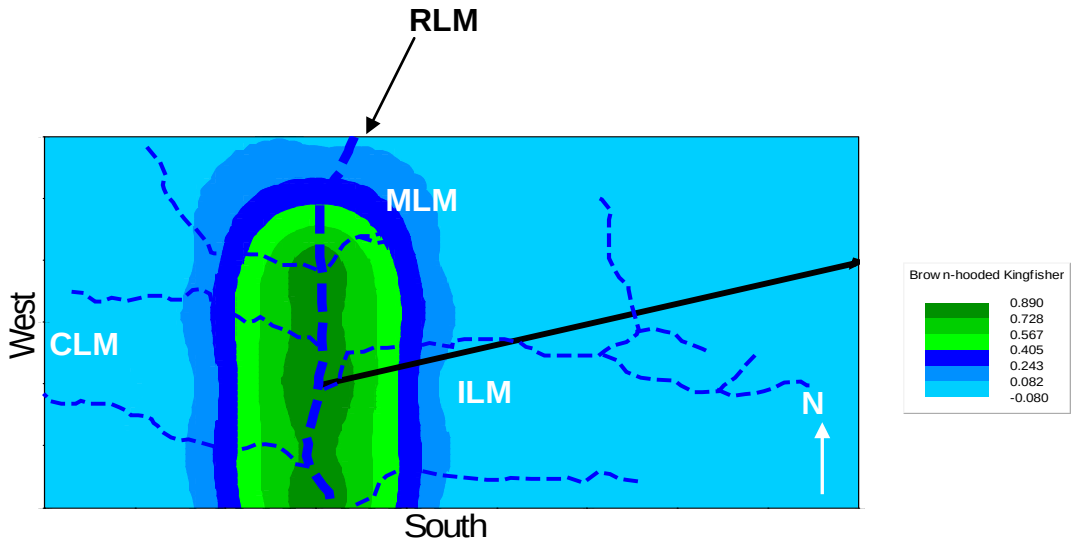

Figure 4.53 Distribution of the Brown-hooded Kingfisher

4.3.11.7 Orange-breasted Bush-Shrike

The Orange-breasted Bush-Shrike was identified as an indicator species. Its distribution was only in the RLM as indicated (Figure 4.52).

4.3.11.8 Brown-hooded Kingfisher

The Brown-hooded Kingfisher was identified as an indicator species. Its distribution was only in the RLM as indicated (Figure 4.53).

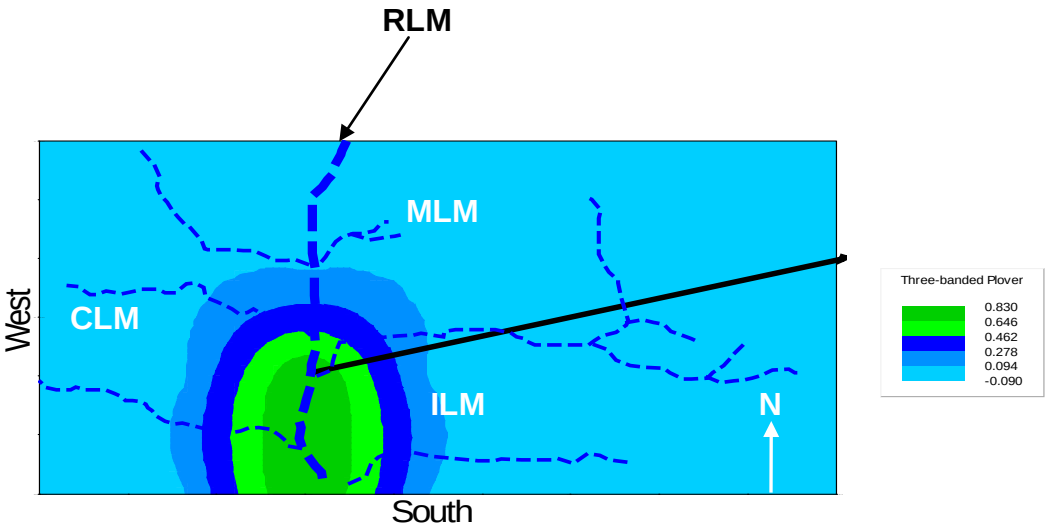

Figure 4.54 Distribution of the Three-banded Plover

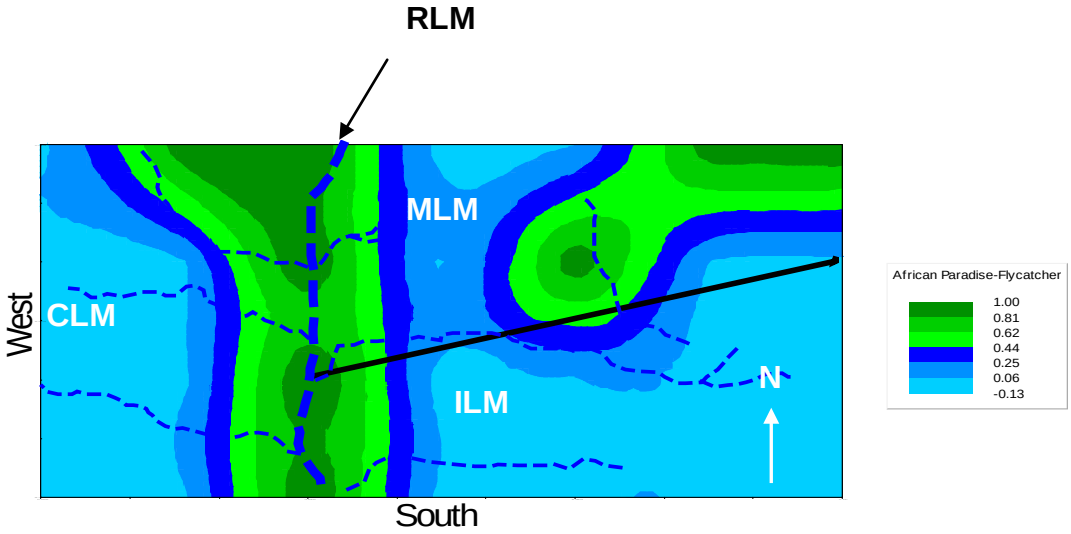

Figure 4.55 Distribution of the African Paradise-Flycatcher

4.3.11.9 Three-banded Plover

The Three-banded Plover was identified as an indicator species. Its distribution was only in the RLM as indicated (Figure 4.54).

4.3.11.10 African Paradise-Flycatcher

The African Paradise-Flycatcher was identified as an indicator species. Its distribution was only in the MLM and RLM as indicated (Figure 4.55).

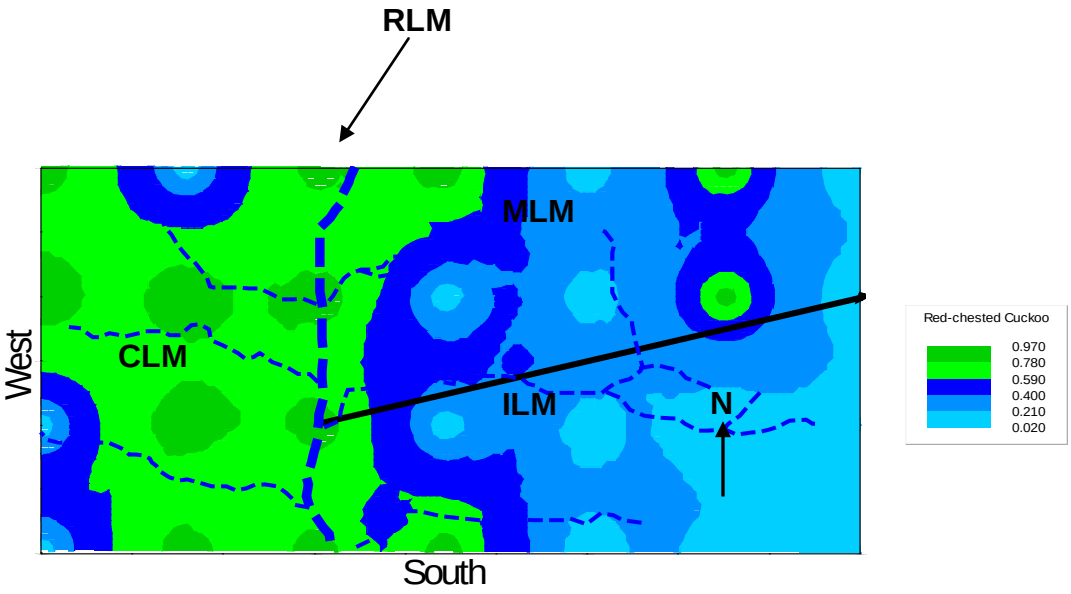

Figure 4.56 Distribution of the Red-chested Cuckoo

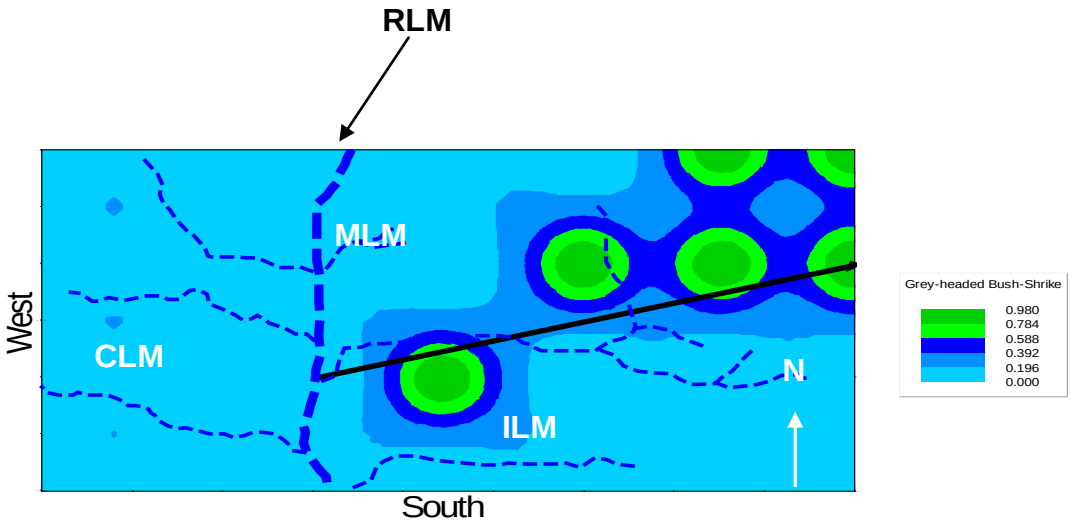

Figure 4.57 Distribution of the Grey-headed Bush-Shrike

4.3.11.11 Red-chested Cuckoo

The Red-chested Cuckoo was identified as an indicator species. Its distribution was only in the MLM and mainly RLM as indicated (Figure 4.56).

4.3.11.12 Grey-headed Bush-Shrike

The Grey-headed Bush-Shrike was identified as an indicator species. Its distribution was primarily in the MLM as indicated with a reduced number in the ILM (Figure 4.57).

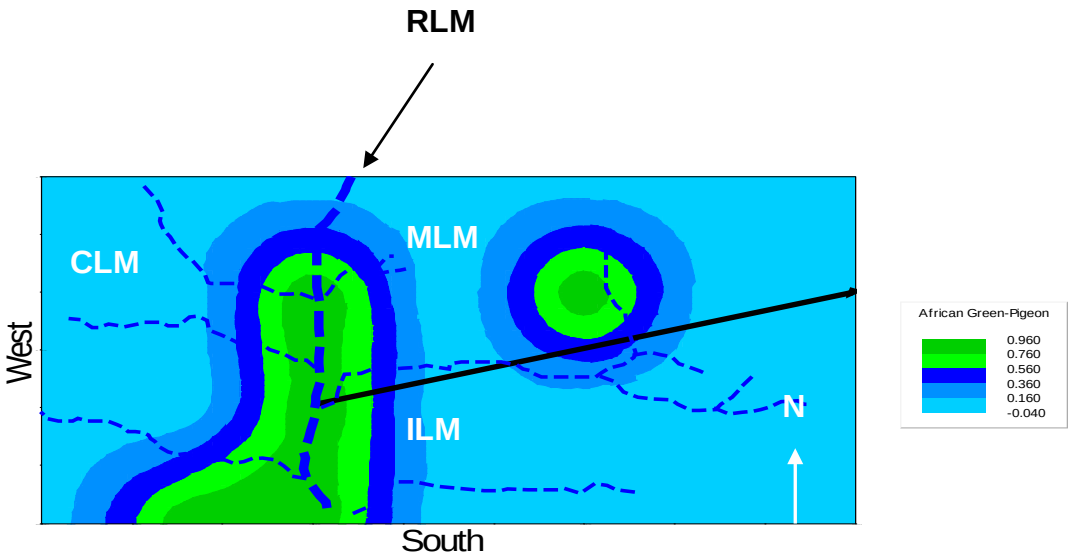

Figure 4.58 Distribution of the African Green-Pigeon

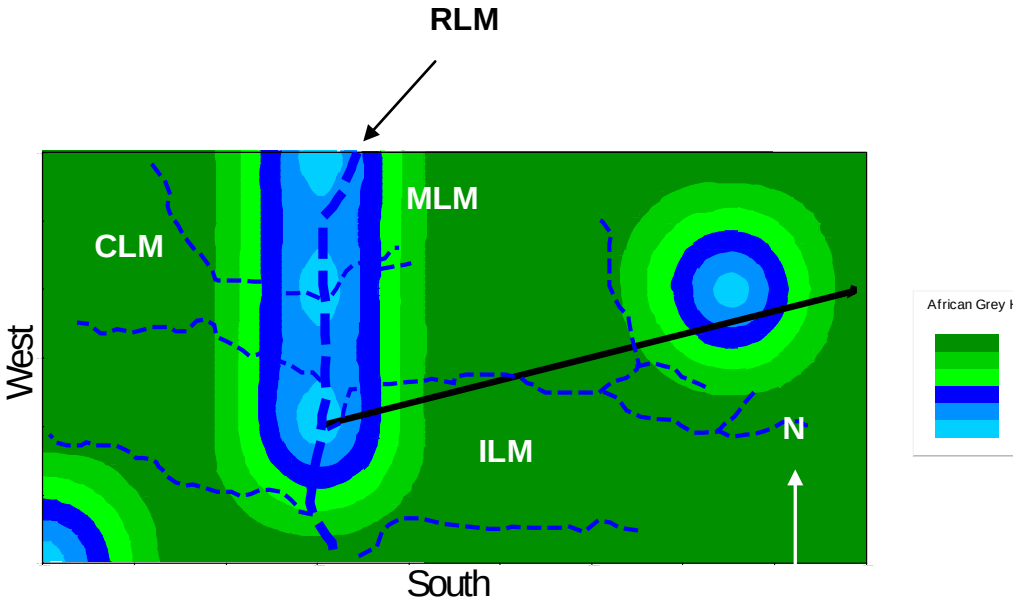

Figure 4.59 Distribution of the African Grey Hornbill

4.3.11.13 African Green Pigeon

The African Green Pigeon was identified as an indicator species. Its distribution was only in the RLM and MLM as indicated (Figure 4.58). The distribution was almost to opposite of the African Grey Hornbill (Figure 4.59)

4.3.11.14 African Grey Hornbill

The African Grey Hornbill was identified as an indicator species. Its distribution was all management practices, with low numbers in the RLM and two further low recordings in the MLM and CLM as indicated (Figure 4.59).

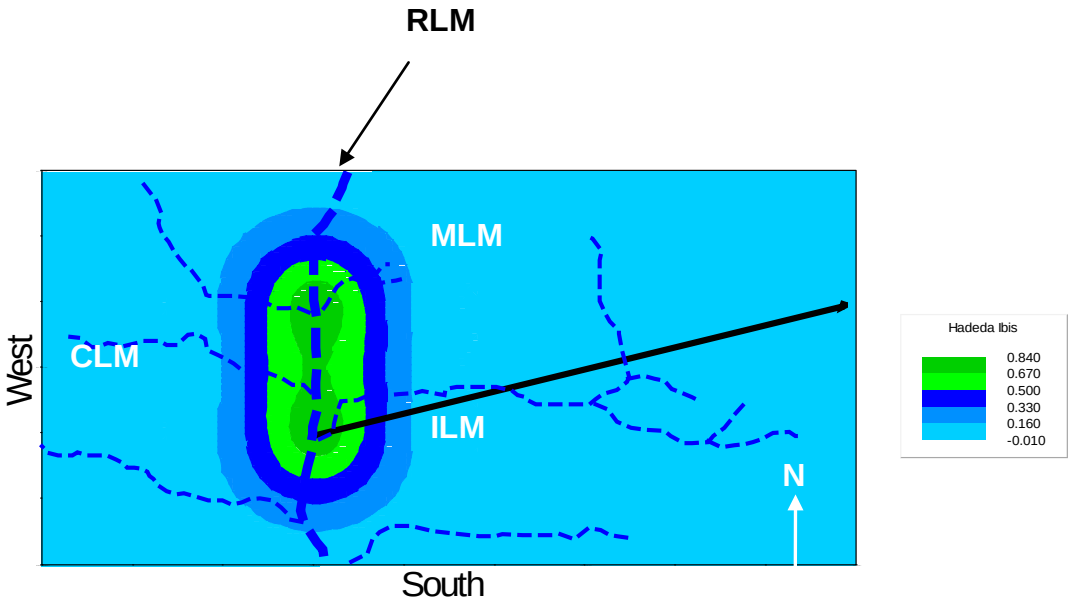

Figure 4.60 Distribution of the Hadeda Ibis

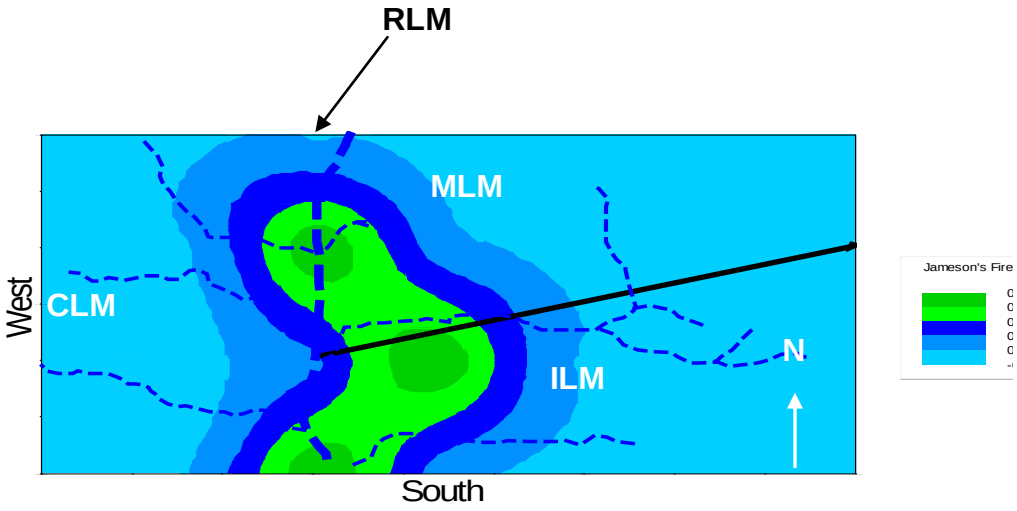

Figure 4.61 Distribution of the Jameson's Firefinch

4.3.11.15 Hadeda Ibis

The Hadeda Ibis was identified as an indicator species. The distribution was recorded in the RLM as indicated (Figure 4.60).

4.3.11.16 Jameson's Firefinch

The Jameson's Firefinch was identified as an indicator species. The distribution was recorded in the RLM and both the ILM and MLM, but close to the Tati River as indicated (Figure 4.61).

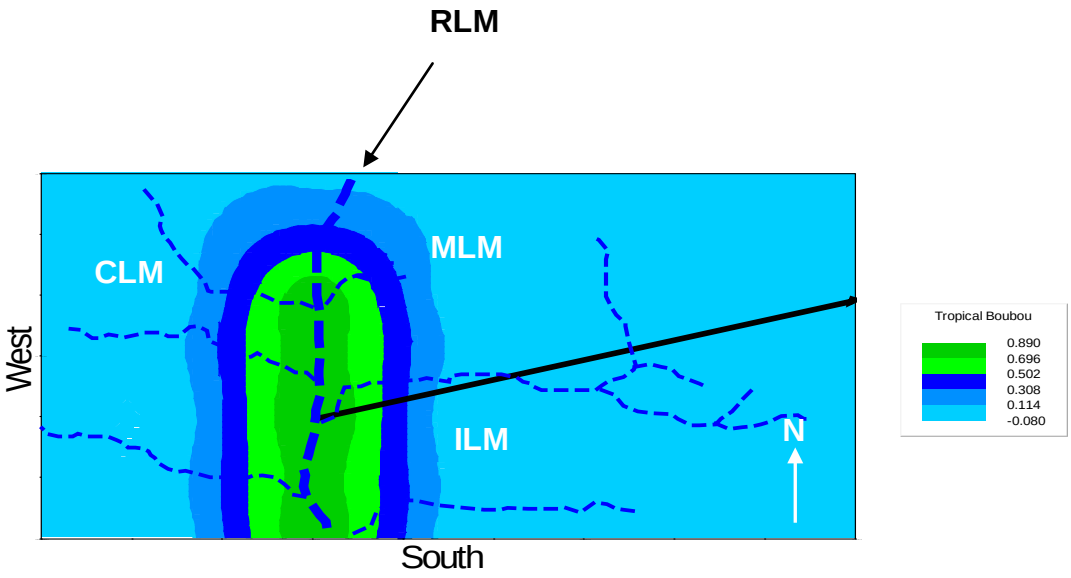

Figure 4.62 Distribution of the Tropical Boubou

4.3.11.17. Tropical Boubou

The Tropical Boubou was identified as an indicator species. Its distribution was in the RLM as indicated (Figure 4.62)

4.4 Analysis of Variance (ANOVA)

Aggregated values or data combined from all the recorded values, were used to create the scatter plots, while mean values were used to create the bar charts. Bonferroni's multiple comparison tests was then used to analyse the variance between the different land use types.

4.4.1 Species richness

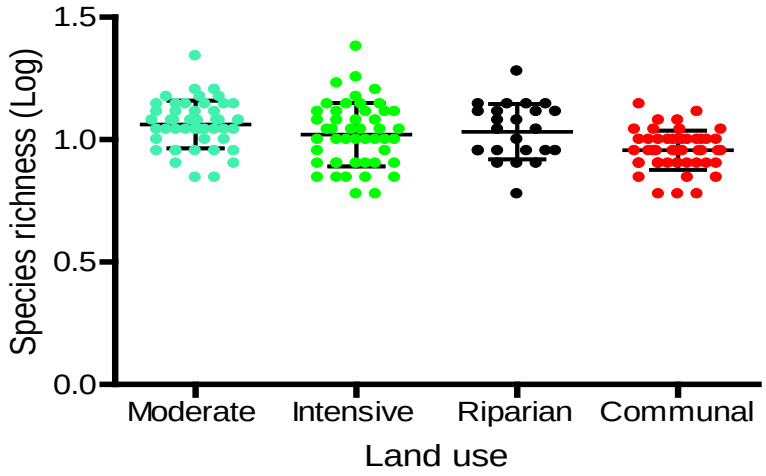

Figure 4.63 Species richness of the different land use types, summer and winter combined

4.4.2 Species richness in summer

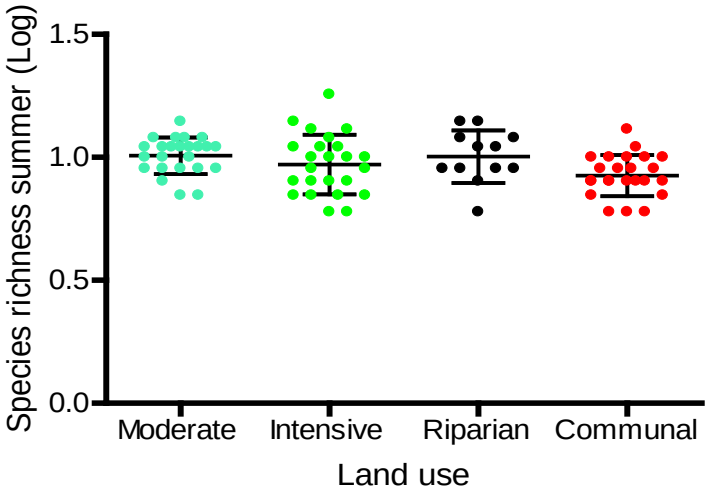

Figure 4.64 Species richness of the different land use types in summer

4.4.1.1 Species richness

There was no significant difference (one-way ANOVA, Bonferroni's test, $p>0.05$) in the species richness when comparing MLM (mean 11.53, SD 1.25) vs ILM (mean 10.47, SD 1.34), MLM (mean 11.53, SD 1.25) vs RLM (mean 10.76, sd 1.30) and ILM (mean 10.47, SD 1.34) vs RLM (mean 10.76, SD 1.30).

There was significantly ($p<0.05$) greater species richness in the ILM (mean 10.47, SD 1.35) and RLM (mean 10.76, SD 1.3) when each was compared to the CLM (mean 9.05, SD 1.2) (Figure 4.56).

There was a very significant difference ($p<0.001$) in species richness when comparing the MLM (mean 11.53, SD 1.25) vs CLM (mean 9.05, SD 1.2) (Figure 4.63).

4.4.2.1 Species richness in summer

No significant difference was found (one-way ANOVA, Bonferroni's test, $p>0.05$) when comparing all land uses and species richness during the summer surveys, with one exception.

A significant difference ($p<0.05$) was found when comparing species richness during the summer surveys of the MLM (mean 10.16, SD 1.18) vs CLM (mean 8.43, SD 1.21) (Figure 4.64).

4.4.3. Species richness in winter

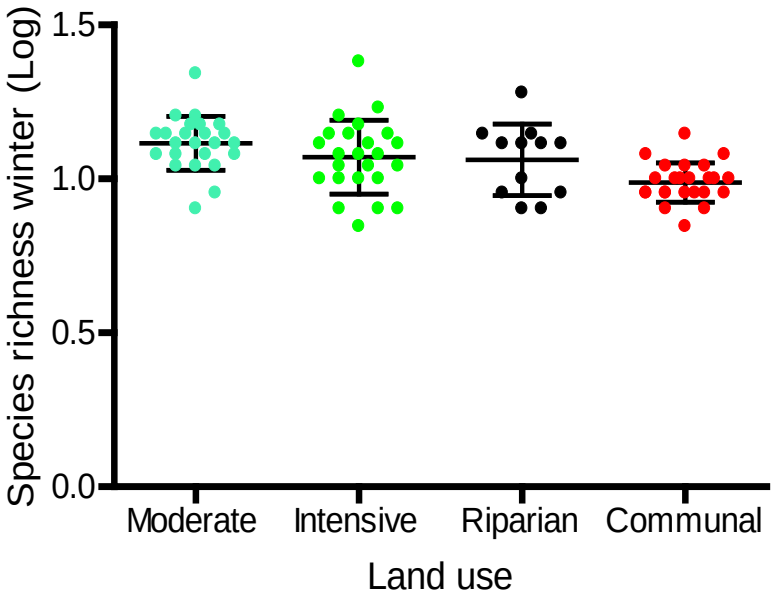

Figure 4.65 Species richness of the different land use types in winter

4.4.4 Numbers of birds

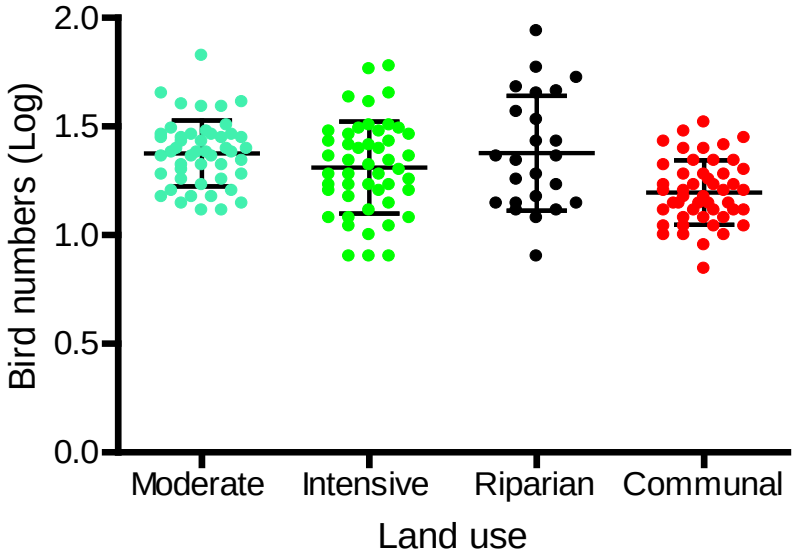

Figure 4.66 Numbers of birds of the different land use types

4.4.3.1 Species richness in winter

There was no significant difference (one-way ANOVA, Bonferroni's test, $p>0.05$) in the species richness in winter when comparing MLM (mean 13.03, SD 1.22) vs ILM (mean 11.75, SD 1.32), MLM (mean 13.03, SD 1.22) vs RLM (mean 11.53, SD 1.31), ILM (mean 11.75, SD 1.32) vs RLM (mean 11.53, SD 1.31) and CLM (mean 9.73, SD1.15) vs RLM (mean 11.53, SD 1.31).

There was a very significant difference ($p<0.001$) in the species richness during winter months when comparing MLM (mean 13.03, SD 1.22) vs CLM (mean 9.73, SD 1.15).

There was a significant difference ($p<0.05$) when comparing ILM (mean 11.75, SD 1.32) vs CLM (mean 9.73, SD 1.15) (Figure 4.65).

4.4.4.1 Numbers of birds

No significant difference was noted (one-way ANOVA, Bonferroni's test, $p>0.05$) when comparing bird numbers and land use between RLM (mean 23.82, SD 1.84) vs MLM (mean 23.7, SD 1.42), RLM (mean 23.82, sd 1.84) vs ILM (mean 20.47, SD 1.63) and MLM (mean 23.7, SD 1.42) vs ILM (mean 20.47, sd 1.63).

A very significant difference ($p<0.001$) was found when comparing bird numbers in the MLM (mean 23.7, SD 1.42) vs CLM (mean 15.70, SD 1.41).

A significant difference ($p<0.05$) was noted when comparing bird numbers in ILM (mean 20.47, SD 1.63) vs CLM (mean 15.70, SD 1.41).

A significant difference was found ($p<0.01$) when comparing bird numbers in RLM (mean 23.82, SD 1.84) vs CLM (mean 15.70, SD 1.84) (Figure 4.66).

4.4.5 Numbers of birds in summer

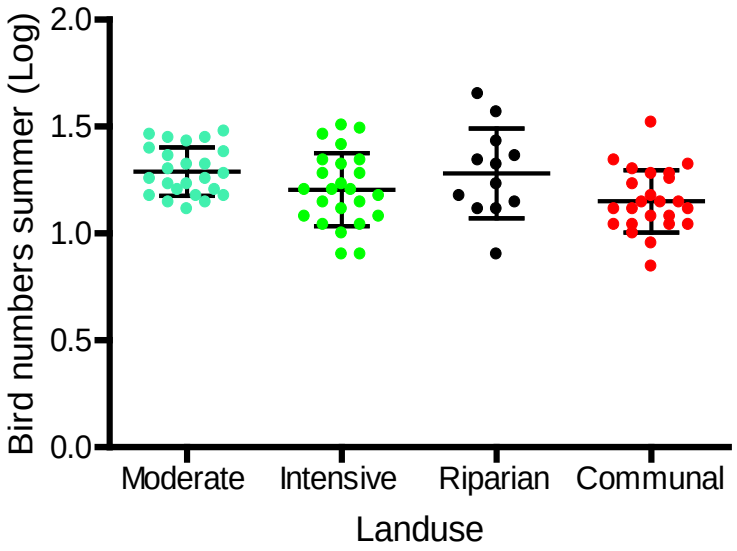

Figure 4.67 Numbers of birds of the different land use types in summer

4.4.6 Numbers of birds in winter

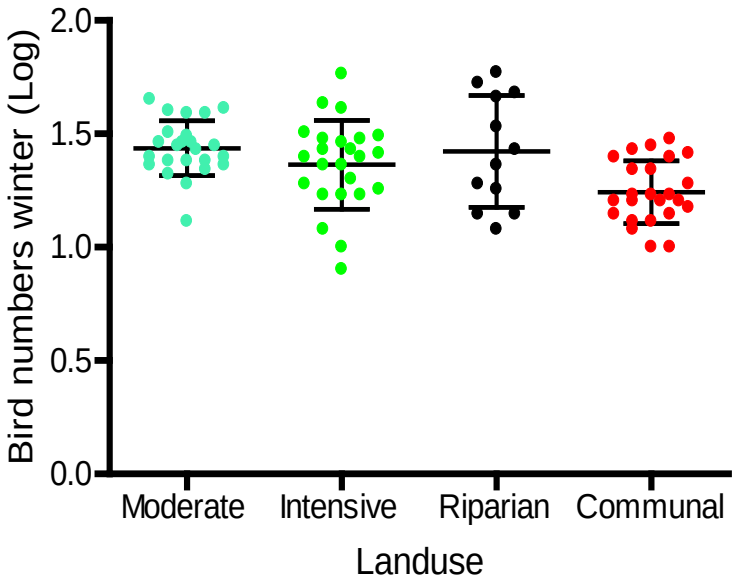

Figure 4.68 Numbers of birds of the different land use types

4.4.5.1 Numbers of birds in summer

No significant difference was noted (one-way ANOVA, Bonferroni's test, $p>0.05$) when comparing bird numbers and land use between MLM (mean 19.45, SD 1.3) vs ILM (mean 16.32, SD 1.5), MLM (mean 19.45, SD 1.3) vs RLM (mean 19.05, SD 1.6) and ILM (mean 16.32, SD 1.5) vs RLM (mean 19.05, SD 1.6), ILM (mean 16.32, SD 1.5) vs CLM (mean 14.12, SD 1.40), RLM (mean 19.05, SD 1.6) vs CLM (mean 14.12, SD 1.40).

There was a significant difference ($p<0.05$) in bird numbers in summer when comparing MLM (mean 19.45, SD 1.3) vs CLM (mean 14.12, SD 1.40) (Figure 4.67).

4.4.6.1 Numbers of birds in winter

No significant difference (one-way ANOVA, Bonferroni's test, $p>0.05$) was found in bird numbers when comparing MLM (mean 27.40, SD 1.32) vs ILM (mean 23.12, SD 1.6), MLM (mean 27.40, SD 1.32) vs RLM (mean 26.4, SD 1.77), ILM (mean 23.12, SD 1.6) vs CLM (mean 17.46, SD 1.37), and ILM (mean 23.12, SD 1.6) vs RLM (mean 26.4, SD 1.77).

There was a very significant difference ($p<0.01$) in bird numbers in winter when comparing MLM (mean 27.40, SD 1.32) vs CLM (mean 17.46, SD 1.37).

There was a significant difference ($p < 0.05$) in bird numbers when comparing RLM (mean 26.4, SD 1.77) vs CLM (mean 17.6, SD 1.37) (Figure 4.68).

4.4.7 Biomass of birds

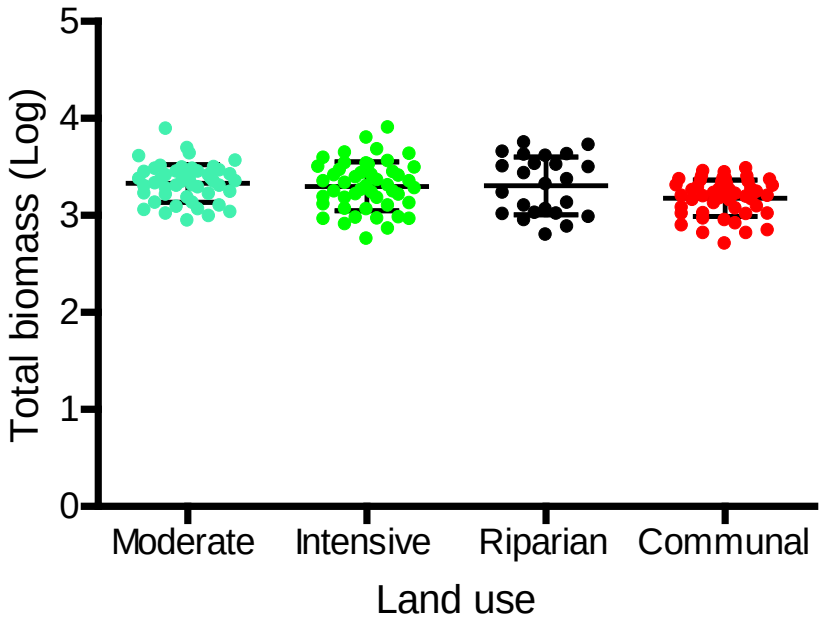

Figure 4.69 Biomass of birds of the different land use types

4.4.8 Biomass of birds in summer

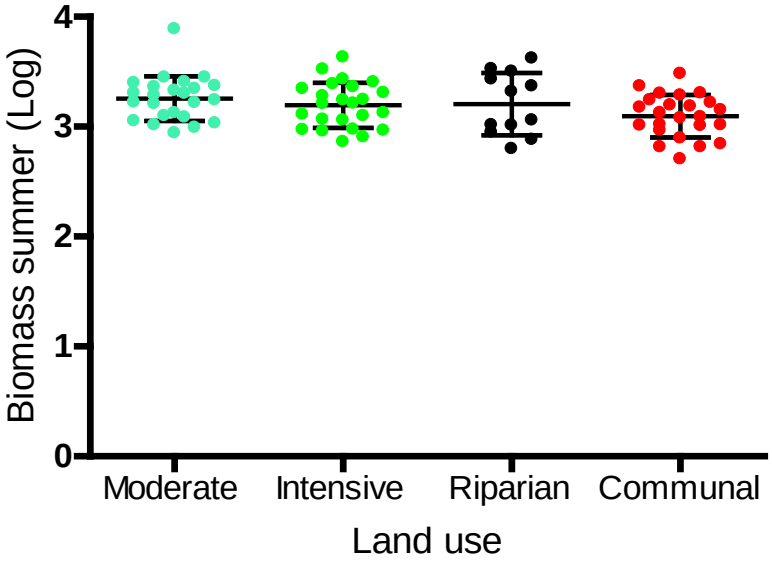

Figure 4.70 Biomass of birds of the different land use types in summer

4.4.7.1 Biomass of birds

No significant difference (one-way ANOVA, Bonferroni's test, $p>0.05$) was found in total biomass when comparing MLM (mean 2,142.80, SD 1.56) vs ILM (mean 1,990.67, SD 1.78), MLM (mean 2,142.80, SD 1.56) vs RLM (mean 2,018.37, SD 2.0), ILM (mean 1,990.67, SD 1.78) vs RLM (mean 2,018.37, SD 2.0), ILM (mean 1,990.67, SD 1.78) vs CLM (mean 1,510.1, SD 1.54) and RLM (mean 2,018.37, SD 2.0) vs CLM (mean 1,510.1, SD 1.54) .

There was a very significant difference ($p<0.01$) in total biomass when comparing MLM (mean 2,142.80, SD 1.56) vs CLM (mean 1,510.08, SD 1.54) (Figure 4.69).

4.4.8.1 Biomass of birds in summer

No significant difference (one-way ANOVA, Bonferroni's test, $p>0.05$) was found in biomass during the summer counts when comparing MLM (mean 1,798.87, SD 1.60) vs ILM (mean 1,566.75, SD 1.60), MLM (mean 1,798.87, SD 1.60) vs RLM (mean 1,610.65, SD 1.92), MLM (mean 1,798.87, SD 1.60) vs CLM (mean 1,244.51, SD 1.56), ILM (mean 1,566.75, SD 1.60) vs RLM (mean 1,610.65, SD 1.92), ILM (mean 1,566.75, SD 1.60) vs CLM (mean 1,244.51, SD 1.56) and RLM (1,610.65, SD 1.92) vs CLM (mean 1,244.51, SD 1.56) (Figure 4.70).

4.4.9 Biomass of birds in winter

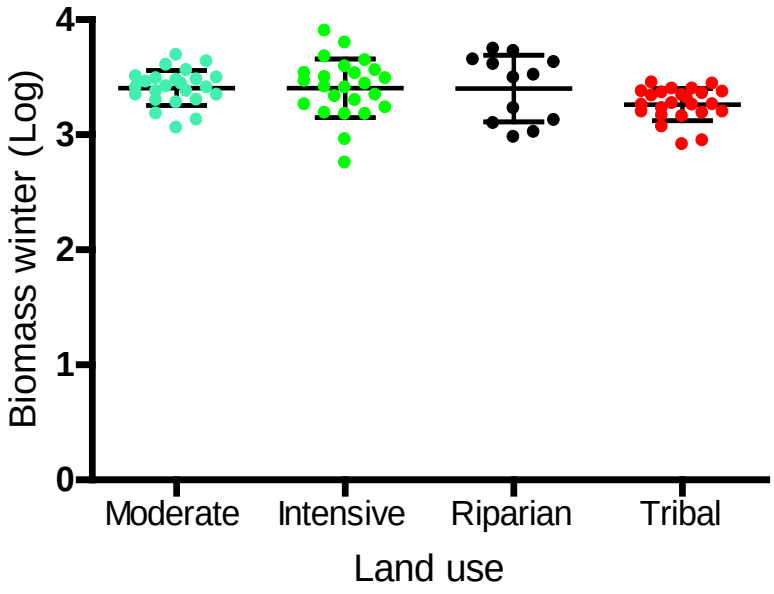

Figure 4.71 Biomass of birds of the different land use types in winter

4.4.9.1 Biomass of birds in winter

No significant difference (one-way ANOVA, Bonferroni's test, $p>0.05$) was found in the biomass during the winter counts when comparing MLM (mean 2,552.70, SD 1.42) vs ILM (mean 2,535.12, SD 1.80), MLM (mean 2,552.70, SD 1.42) vs RLM (mean 2,529.30, SD 1.95), MLM (mean 2,552.70, SD 1.42) vs CLM (mean 1,828.10, SD 1.38), ILM (mean 2,535.12, SD 1.80) vs RLM (mean 2,529.30, SD 1.95), and RLM (mean 2,529.30, SD 1.95) vs CLM (mean 1,828.10, SD 1.38).

There was a significant difference ($p<0.05$) when comparing the biomass in the winter of the ILM (mean 2,535.12, SD 1.80) vs CLM (mean 1,828.10, SD 1.38) (Figure 4.71).

4.4.10 Differences in the mean number of birds inhabiting the four land use types

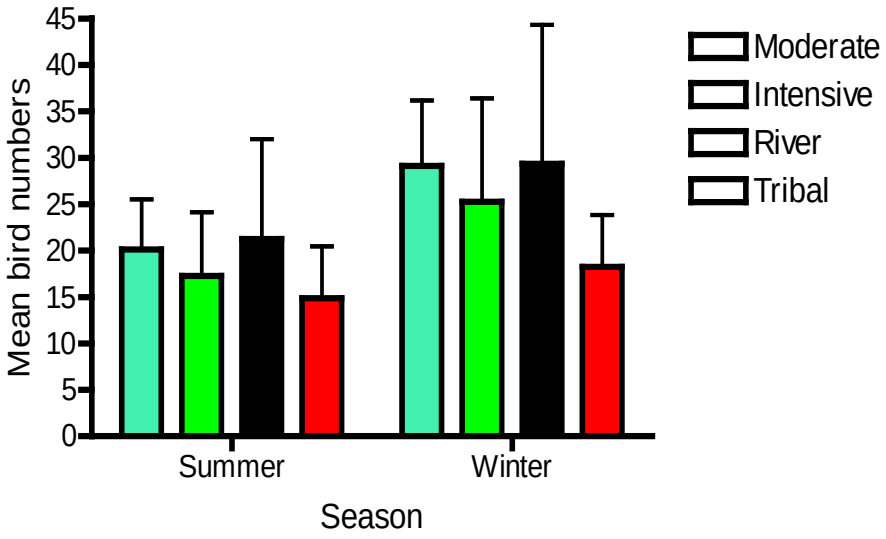

Figure 4.72 Mean numbers of birds recorded for each land use during summer and winter

4.4.11 Species richness

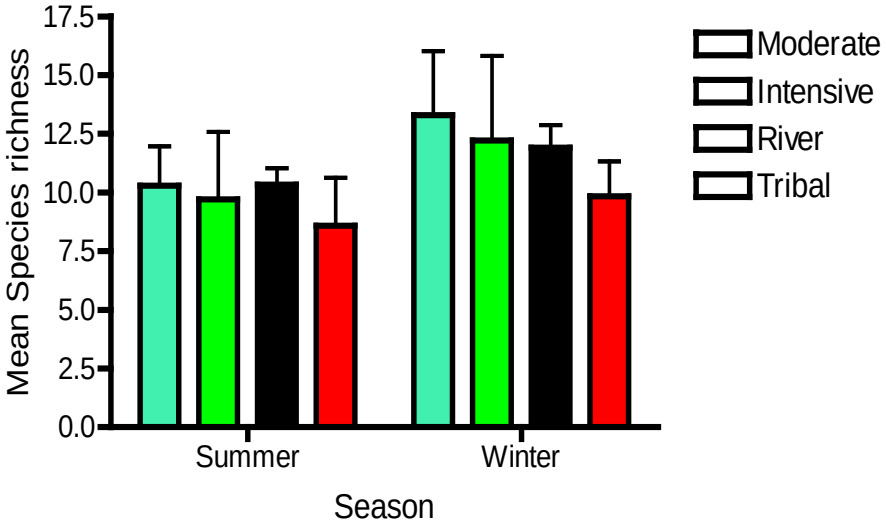

Figure 4.73 Mean species richness recorded for each land use during the summer and winter

4.4.10.1 Numbers of birds

The numbers of birds (Figure 4.72) was assessed, with the land use and seasons as variables.

Land use does affect the result, accounting for 12.3% of the variance ($p<0.0001$). The effect of land use on the variance of the numbers of birds was regarded as very significant.

The season does affect the result, accounting for 13.04% of the variance ($p<0.0001$). The effect of the season on the variance of the numbers of birds was regarded as very significant.

4.4.11.1 Species richness

The species richness (Figure 4.73) was assessed, with the land use and seasons as variables.

The land use does affect the result, accounting for a 10.12% variance ($p=0.0002$). The effect of land use on species richness was regarded as being very significant.

The season does affect the result, accounting for a 12.03% variance ($p<0.0001$). The effect of the season on species richness variance was regarded as being very significant.

4.4.12 Granivores

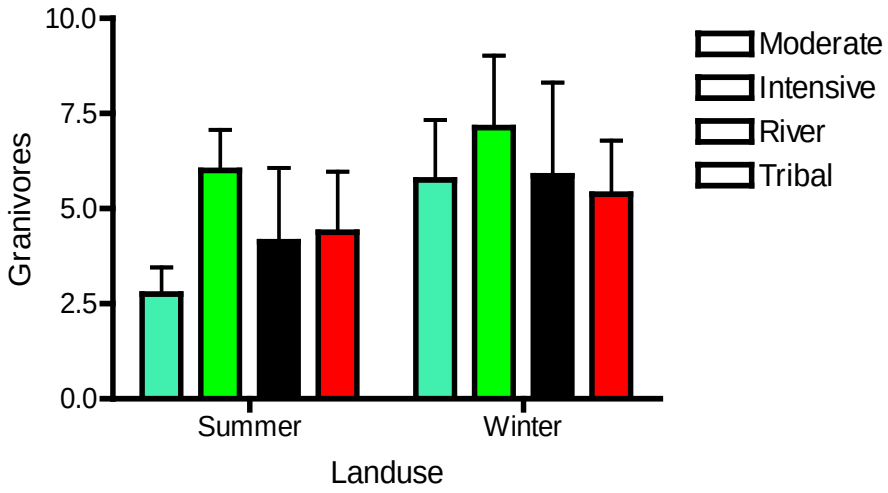

Figure 4.74 The mean number of granivores recorded for each land use during summer and winter

4.4.13 Insectivores

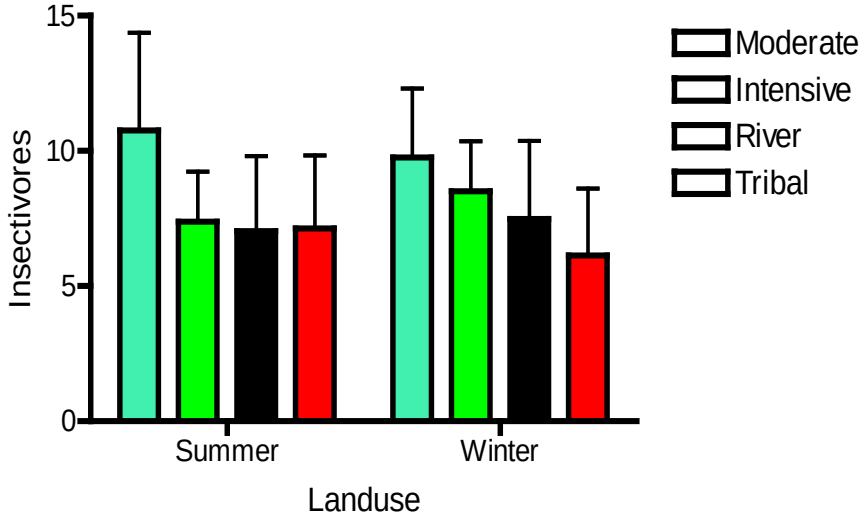

Figure 4.75 The mean number of insectivores recorded for each land use during summer and winter

4.4.12.1 Granivores

Granivore distribution (Figure 4.74) was assessed, with the land use and seasons as variables.

The variance resulting from the effect of the land use on the result accounts for 17.51% of the total variance ($p<0.0001$). The effect of land use on granivore variance is regarded as very significant.

The season affects the results by 17.72% of the total variance ($p<0.0001$). The effect of the season on the distribution of granivores is regarded as very significant.

4.4.13.1 Insectivores

Insectivore distribution (Figure 4.75) was assessed with the land use and seasons as variables.

Land use does account for 20.36% of the total variance ($p<0.0001$). The effect of land use on the variance of insectivores is considered very significant.

The season effects the total variance by <0.1% ($p=0.7991$). The effect of the season on insectivore variance is considered insignificant.

4.4.14 Frugivores

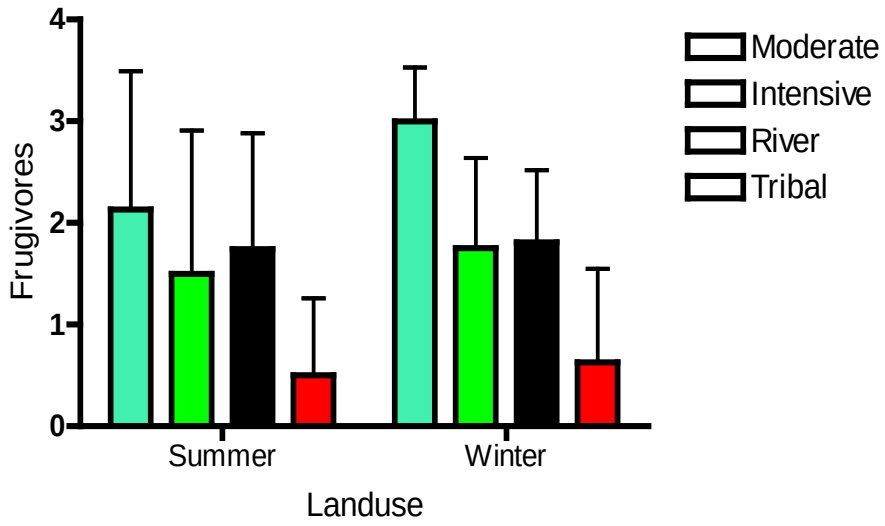

Figure 4.76 The mean number of frugivores recorded for each land use during summer and winter

4.4.15 Omnivores

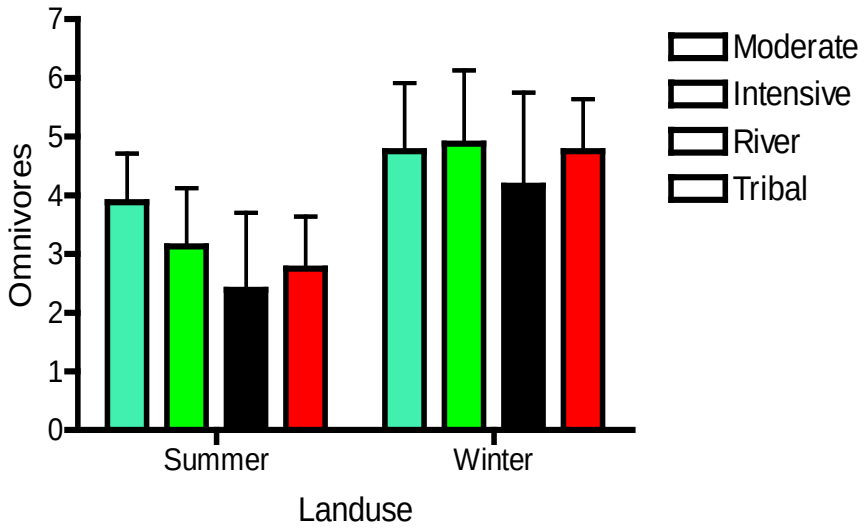

Figure 4.77 The mean number of omnivores recorded for each land use during summer and winter

4.4.14.1 Frugivores

Frugivore distribution (Figure 4.76) was assessed, with the land use and seasons as variables.

Land use affects the result by 30.98% ($p<0.0001$). The effect of land use on frugivore distribution is regarded as very significant.

The seasons account for 1.66% of the total variance ($p=0.0461$). The effect of the seasons on frugivore distribution is regarded as significant.

4.4.15.1 Omnivores

Omnivore distribution (Figure 4.77) was assessed, with the land use and season as variables.

Land use does affect the total variance by 7.05% ($p=0.0005$). The effect of land use on the omnivore distribution is regarded as very significant.

The season accounts for 31.03% of the total variance ($p<0.0001$). The effect of the season on omnivore distribution is regarded as very significant.

4.4.16 Tree nesters

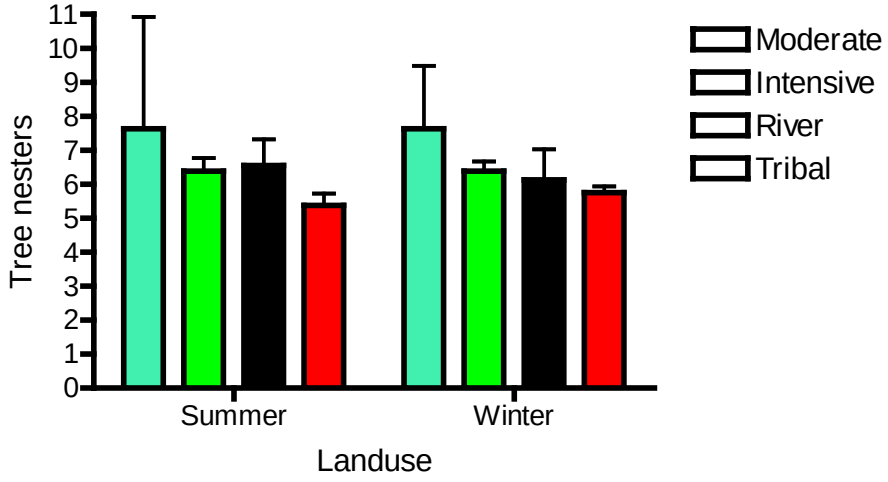

Figure 4.78 The mean number of tree nesting birds recorded for each land use during the summer and winter

4.4.17 Cavity nesters

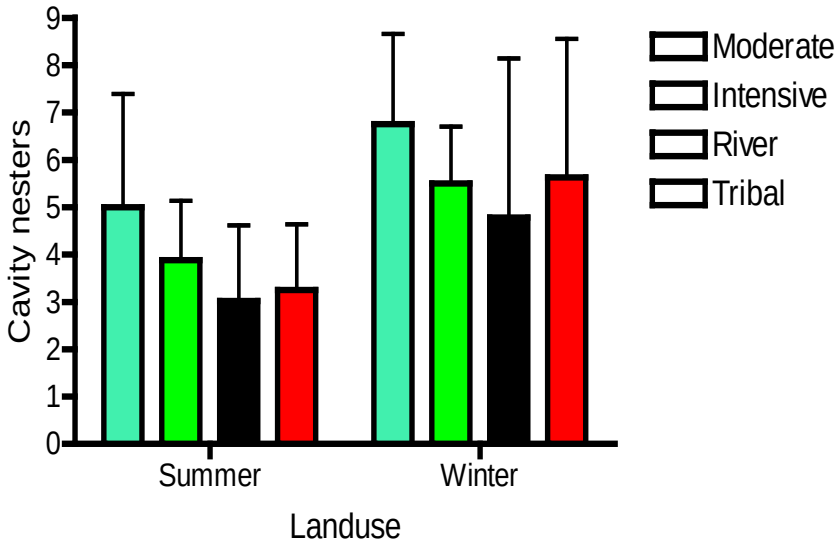

Figure 4.79 The mean number of cavity nesting birds recorded for each land use during the summer and winter

4.4.16.1 Tree nesters

Tree nester distribution (Figure 4.78) was assessed, with land use and seasons as variables.

The effect of land use on the result accounts for 10.33% of the total variance (p=0.0005). The effect of land use on the distribution of tree nesting birds is regarded as very significant.

The effect of the season on the result accounts for <0.1% of the total variance (p=0.9711). The effect of the season on the distribution of tree nesting birds is regarded as not significant.

4.4.17.1 Cavity nesters

Cavity nester distribution (Figure 4.79) was assessed, with land use and seasons as variables.

The effect of land use on the result accounts for 8.94% of the total variance (p=0.0005). The effect of land use on the distribution of cavity nesting birds is regarded as very significant.

The effect of the season on the result accounts for 15.11% of the total variance (p<0.0001). The effect of the season on the distribution of cavity nesting birds is regarded as very significant.

4.4.18 Shrub nesters

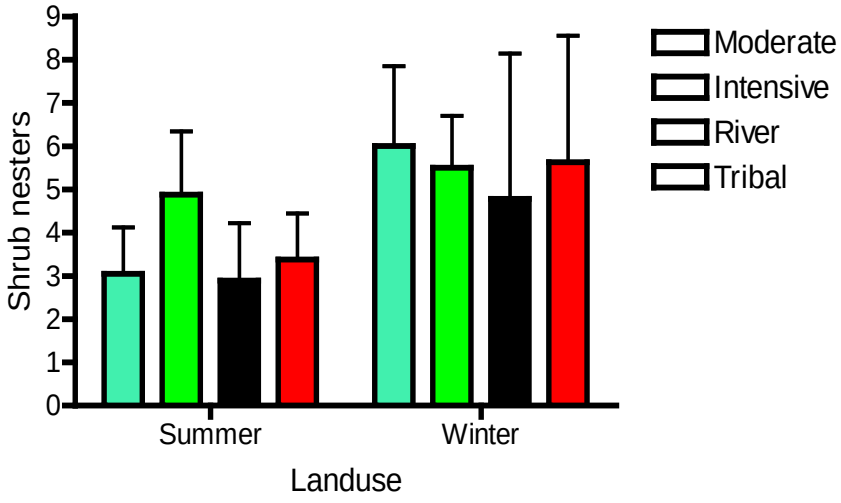

Figure 4.80 The mean number of shrub nesting birds recorded for each land use during the summer and winter

4.4.19 Ground nesters

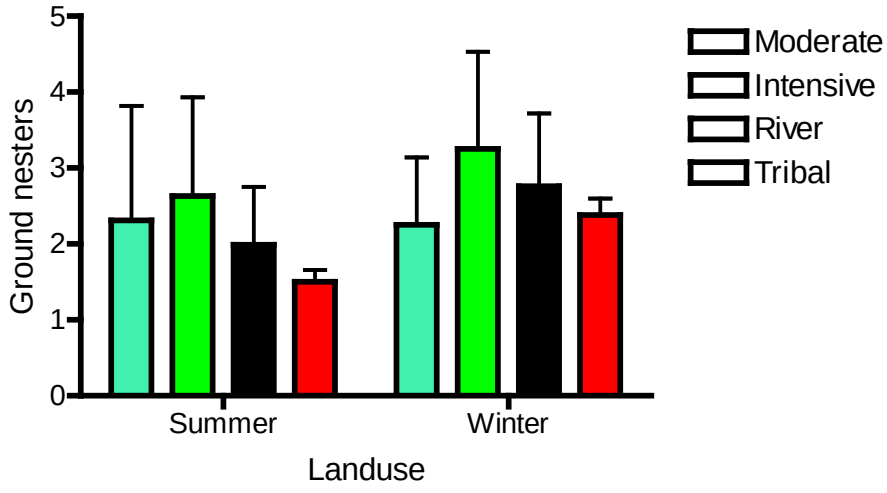

Figure 4.81 The mean number of ground nesting birds recorded for each land use during the summer and winter

4.4.18.1 Shrub nesters

Shrub nesting distribution (Figure 4.80) was assessed, with land use and seasons as variables.

The effect of land use on the result accounts for 4.65% of the total variance ($p=0.0192$). The effect of land use on the distribution of shrub nesting birds is regarded as significant.

The effect of the season on the result accounts for 18.82% of the total variance ($p<0.0001$). The effect of the season on the distribution of shrub nesting birds is regarded as very significant.

4.4.19.1 Ground nesters

Ground nesting distribution (Figure 4.81) was assessed, with land use and seasons as variables.

The effect of land use on the result accounts for 7.67% of the total variance ($p=0.0002$). The effect of land use on the distribution of ground nesting birds is regarded as very significant.

The effect of the season on the result accounts for 4.52% of the total variance ($p=0.0006$). The effect of the season on the distribution of ground nesting birds is regarded as very significant.

4.5 Non-metric Multi-dimensional Scaling (NMS)

4.5.1 Bird numbers and land use

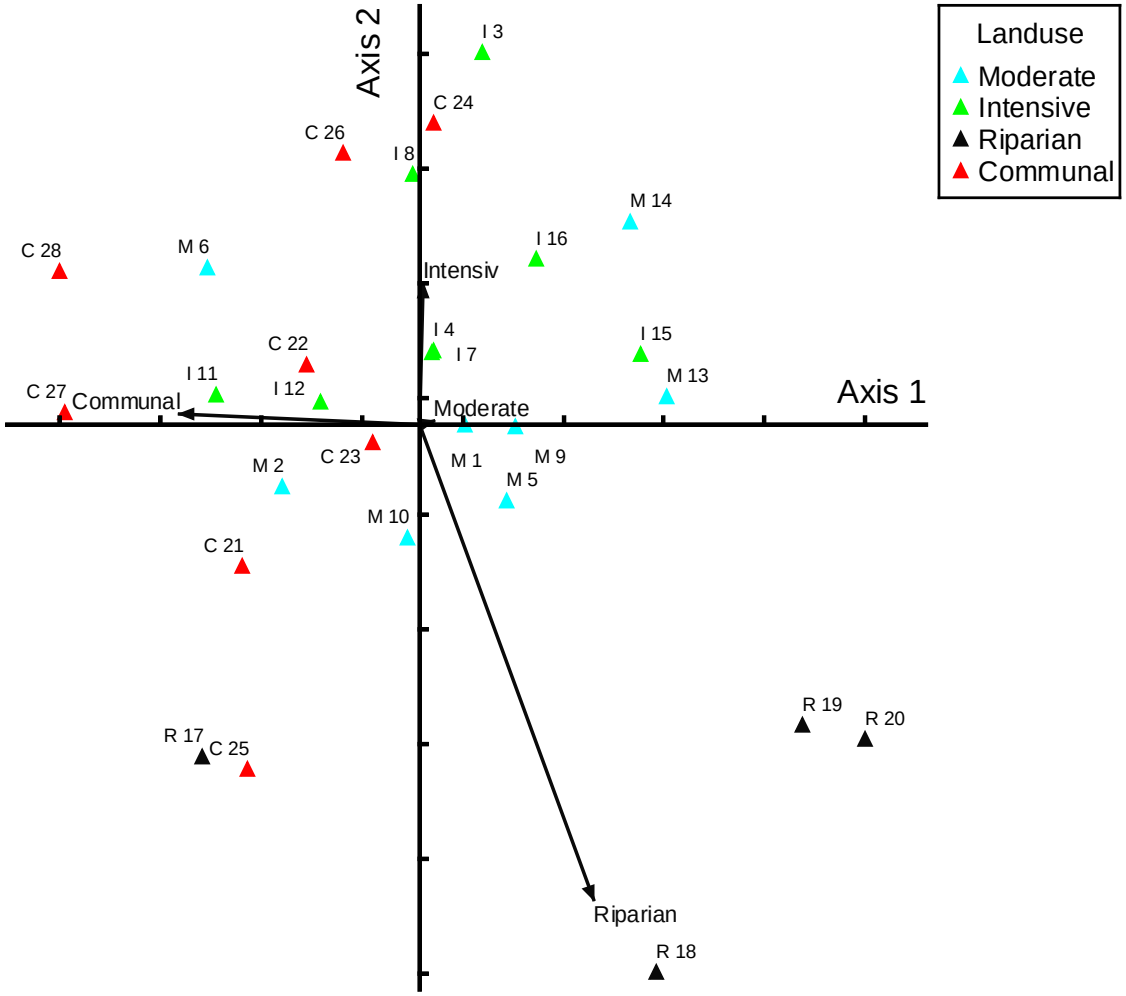

Figure 4.82 NMS bi-plot of point count distribution of the number of birds per point for all land use types with land use types indicated

4.5.1.1 Bird numbers and land use

To investigate all sites and species together, an NMS treatment of the data was done. The main matrix was the number of birds per species per point and the second matrix was the land use type (Figure 4.82). Three dimensions were recommended with a final stress of 15.53985 and a final stability of 0.00024 after 500 iterations. Monte Carlo tests were significant for three axes. All three axes had a p=0.0004 with axis 1 accounting for 50.6% of the variation, axis 2 for 27.5% of the variation and axis 3 accounting for 18.6% of the variation.

There is a grouping of points by land use type. The location of R17 was a distance of 200 metres from the Tati River, although grouped under the RLM. The vegetation at R17 was more open with a number of kraals and small fields of crops in close proximity, which was very different to the Riparian vegetation of the other RLM points. The outlier analysis identified R17 at position 1 with a standard deviation of 2.7. The influence of the remaining RLM points on the distribution of the numbers of birds is strongly evident.

4.5.2. Species presence / absence and land use

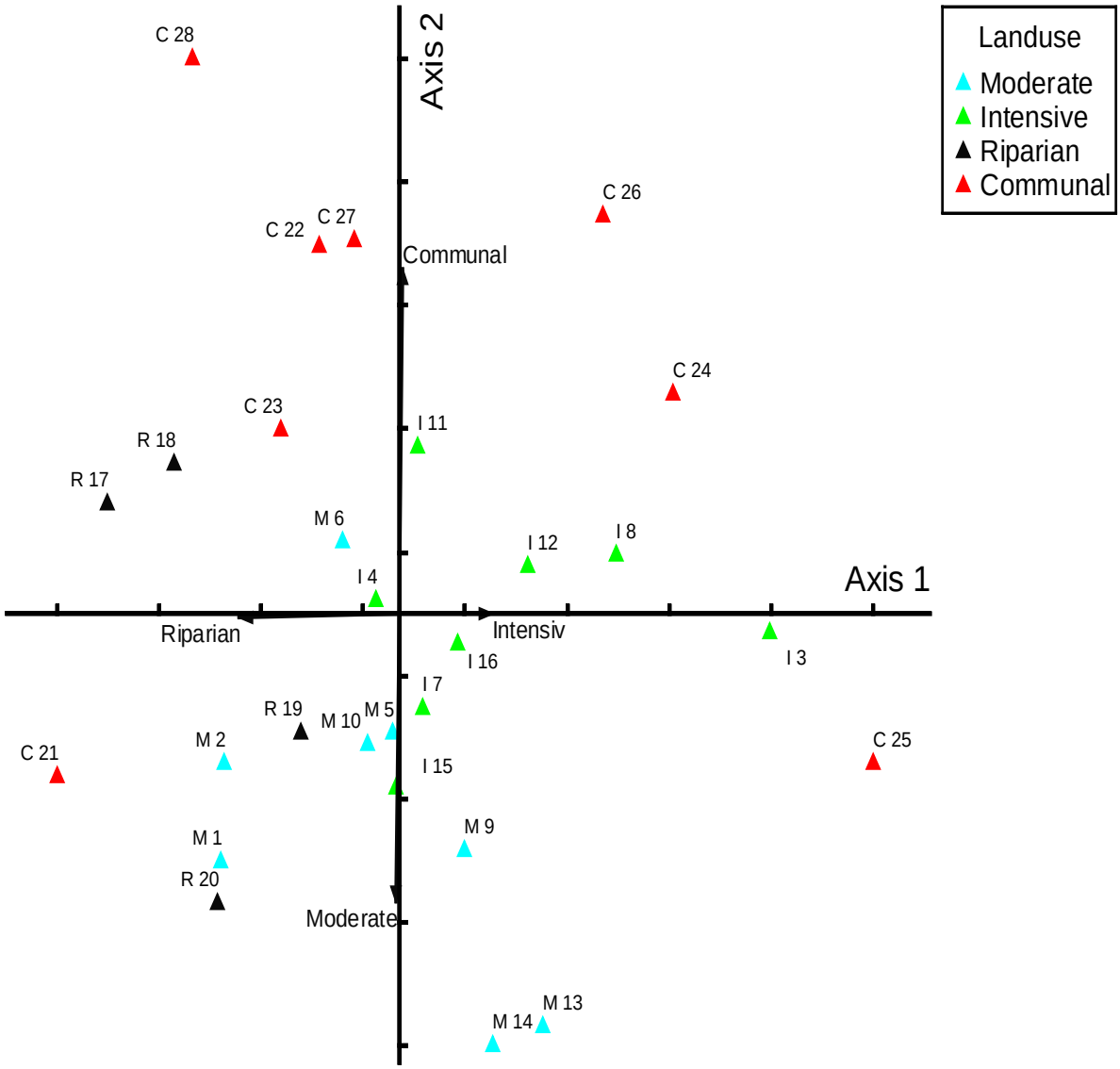

Figure 4.83 NMS bi-plot of point count distribution of the species presence / absence per point for all land use types with land use types indicated

4.5.2.1 Species presence / absence and land use

To investigate the interaction between sites and the presence or absence of species, an NMS treatment of data was done. The main matrix was presence or absence of each species per point while the second matrix was the land use type (Figure 4.83). The final stress of 17.37791 and a final instability of 0.00345 were achieved after 500 iterations. Monte Carlo Tests recommended three dimensions. All three axes had a $p<0.04$. Axis 1 accounted for 48.6% of the variation, axis 2 accounted for 29.7% of the variation and axis 3 accounted for 21.9% of the variation.

The grouping of the C21 and C25 shows a similar trend to distribution of points by numbers in Figure 4.82. The effect of the hills and their different vegetation was evident in the species surveyed at these points.

4.5.3 Vegetation and land use

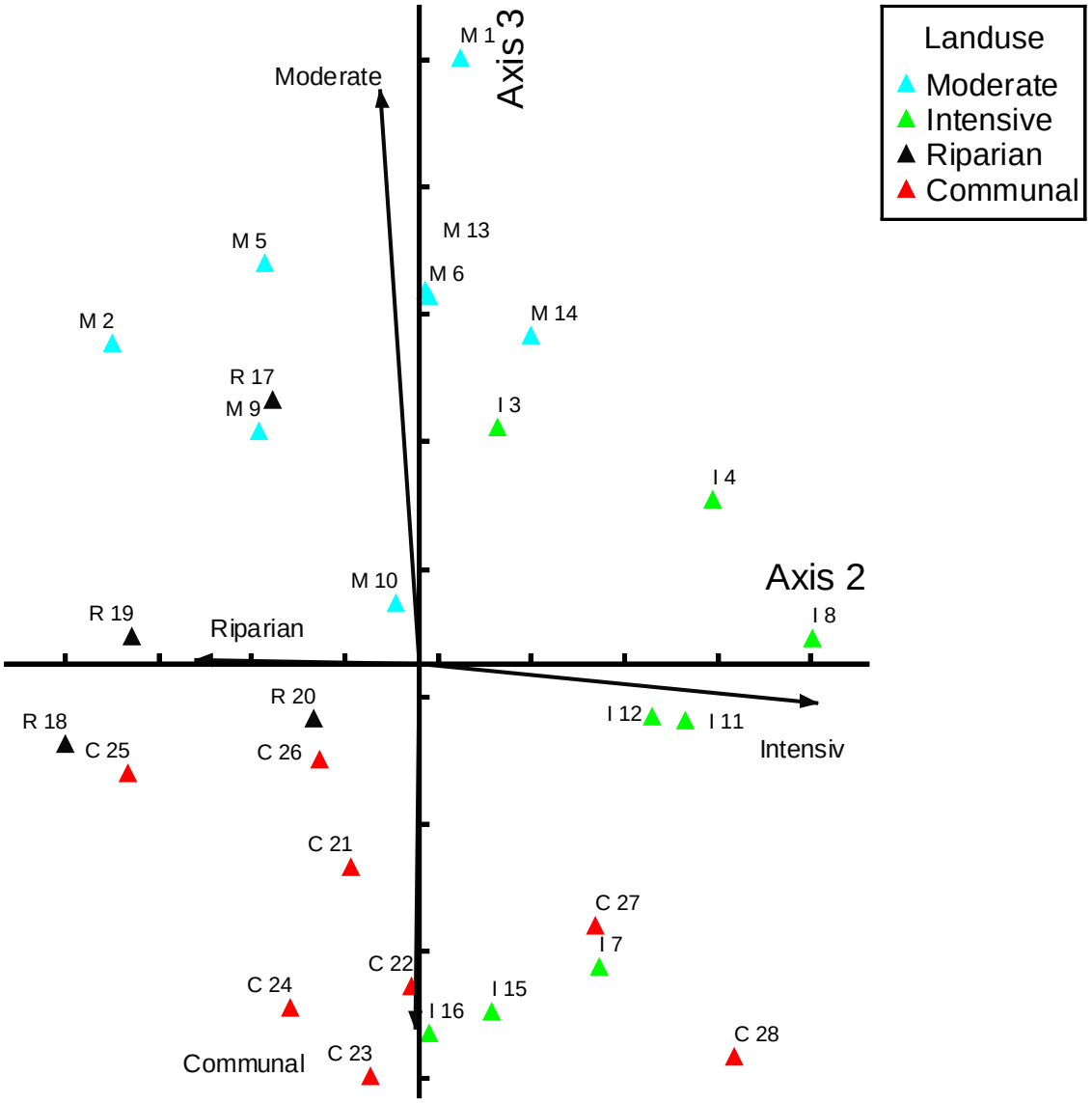

Figure 4.84 NMS bi-plot of point count distribution of vegetation structure for all land use types with land use types indicated

4.5.3.1 Vegetation and land use

To investigate the interaction between land use and vegetation, an NMS treatment of the data was done. The main matrix was the vegetation structure per point while the second matrix was the land use type (Figure 4.84). The final stress was 13.50267 and final stability of 0.00725 after 500 iterations. The Monte Carlo recommended three dimensions. Axis 1 had a p=0.004, axis 2 had a p=0.008 and axis 3 had a p=0.0120. Axis 1 accounted for 51.1% of the variation, axis 2 accounted for 27.8% of the variation and axis 3 accounted for 19.7% of the variation.

The grouping of the MLM points indicates a common vegetation structure of this land use. I3 and I4 were associated with the MLM points as these points were further from the river and less influenced by the grazing program of the ILM.

The position of R17 indicates a very different position to the three remaining RLM points and was associated with the CLM points. The influence of the land use and resultant vegetation may have effected the location of R17 (Figure 4.84).

The ILM and CLM points follow a vegetation trend that groups these points as the resultant vegetation was created by similar land use types.

4.5.4 Vegetation and feeding guilds

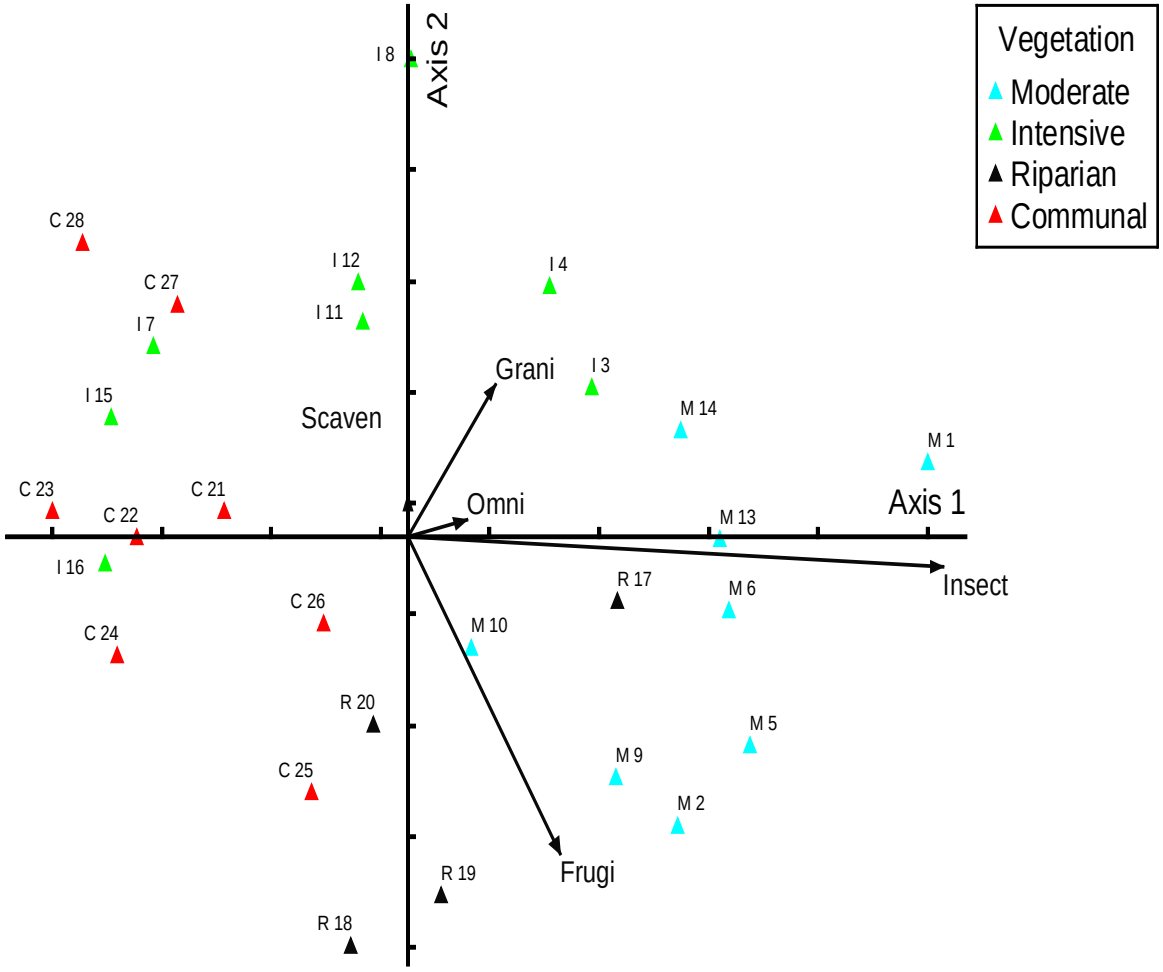

Figure 4.85 The NMS bi-plot of point count distribution of vegetation structure for all land use types with feeding guilds indicated

4.5.4.1 Vegetation and feeding guilds

To investigate the interaction between the vegetation structure and feeding guilds an NMS treatment of the data was done. The main matrix was vegetation structure per point while the second matrix was the feeding guild. The final stress of 13.59794 and a final stability of 0.01841 were achieved after 500 iterations. The Monte Carlo Tests recommended three dimensions. All three axes had a p=0.004. Axis 1 accounted for 51% of the variation, axis 2 accounted for 27.8% of the variation and axis 3 accounted for 19.3% of the variation (Figure 4.85).

The insectivore and frugivore feeding guilds showed a trend of being surveyed more in the MLM and RLM, which is understandable as both numbers of birds and species richness decreased from the MLM through the RLM to CLM (Figures 4.8 & 4.5).

The granivore feeding guild had a trend of being surveyed predominantly in the ILM and CLM. The granivore species include the Blue Waxbill, Cape Turtle-Dove, Cinnamon-breasted Bunting, Double-banded Sandgrouse, Emerald-spotted Wood-Dove, Golden-breasted Bunting, Green-winged Pytilia, Harlequin Quail, Helmeted Guineafowl, House Sparrow, Jameson's Firefinch, Laughing Dove, Long-tailed Paradise-Whydah, Namaqua Dove, Red-billed Quelea, Red-capped Lark, Scaly-feathered Finch, Shaft-tailed Whydah, Swainson's Spurfowl, and Yellow-fronted Canary.

4.5.5 Vegetation and nesting guilds

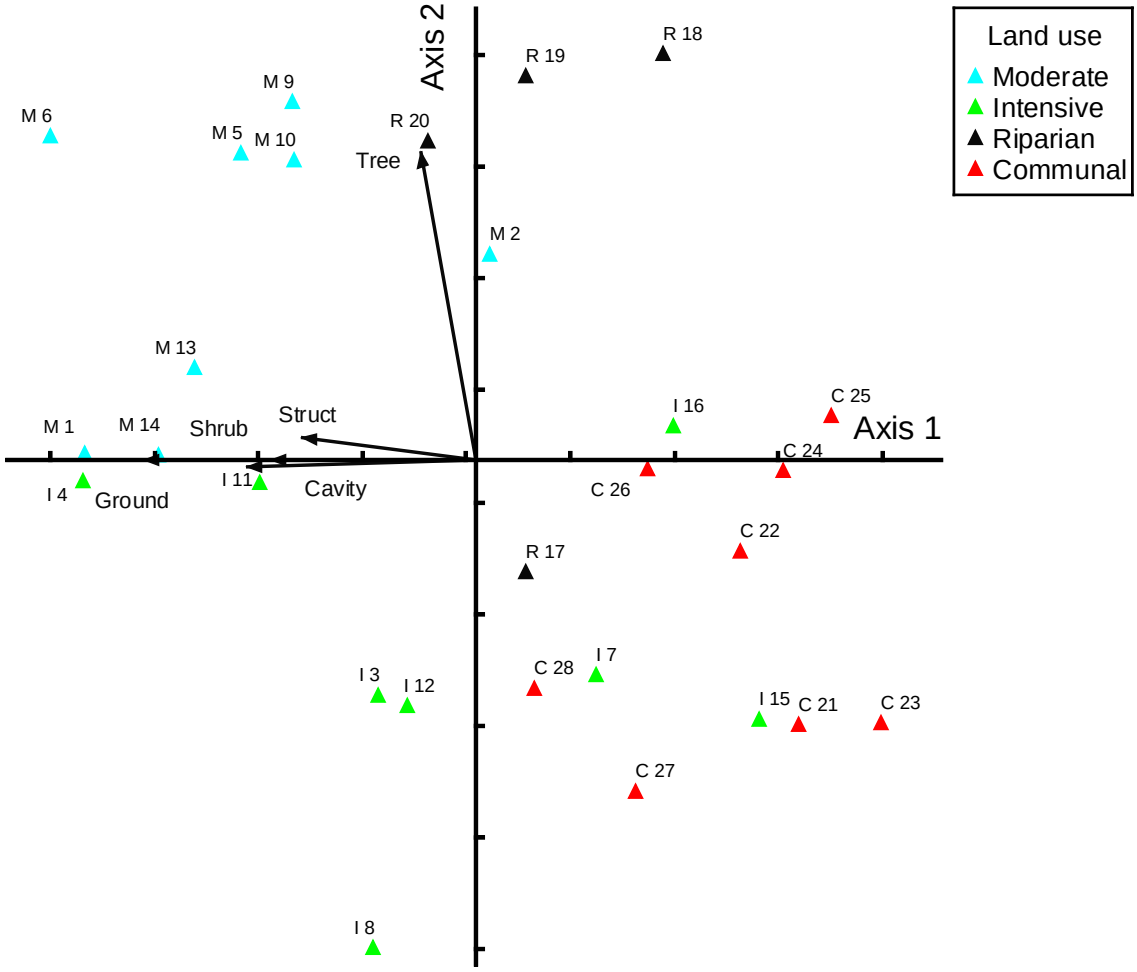

Figure 4.86 NMS bi-plot of point count distribution of vegetation structure per point for all land use types with nesting guilds indicated

4.5.5.1 Vegetation and nesting guilds

To investigate the interaction between vegetation structure and nesting guilds an NMS treatment of data was done. The main matrix was the vegetation per point, while the second matrix was the nesting guilds (Figure 4.86). The final stress of 13.58214 and final stability of 0.01976 were achieved after 500 iterations. The Monte Carlo Tests recommended three dimensions. Axes 1 and 3 had a p=0.008 and axis 2 had a p=0.004. Axis 1 accounted for 50.6% of the variation, axis 2 accounted for 27.5% of the variation and axis 3 accounted for 18.6% of the variation (Figure 4.82).

The nesting guilds had a trend of being surveyed predominantly in the MLM and RLM, which is understandable as both numbers of birds and species richness decreased from the MLM through the RLM to CLM (Figures 4.8 & 4.5).

Figure 4.87 indicates a grouping of points that have tree cover in the categories 10–20m, 5–10m and <5m. These points, which are closely associated with tree nesting species, include M5, M6, M2, M9, M10, R18, R19 and R20 (Figure 4.86).

Shrub, cavity, structure and ground nesting species are associated with an environment with good vegetation structure. These points include M1, M13, M14, I4 and I11 (Figures 4.86 & 4.87).

The structure of the vegetation at I7, I15, I16, C22, C24, C21, C23, C27, C28 and I8 was markedly different to the points referred to above, as shown in Figure 4.87. The vegetation structure of these points clearly influences the nesting guilds (Figure 4.86).

4.5.6 Vegetation two-way cluster dendrogram

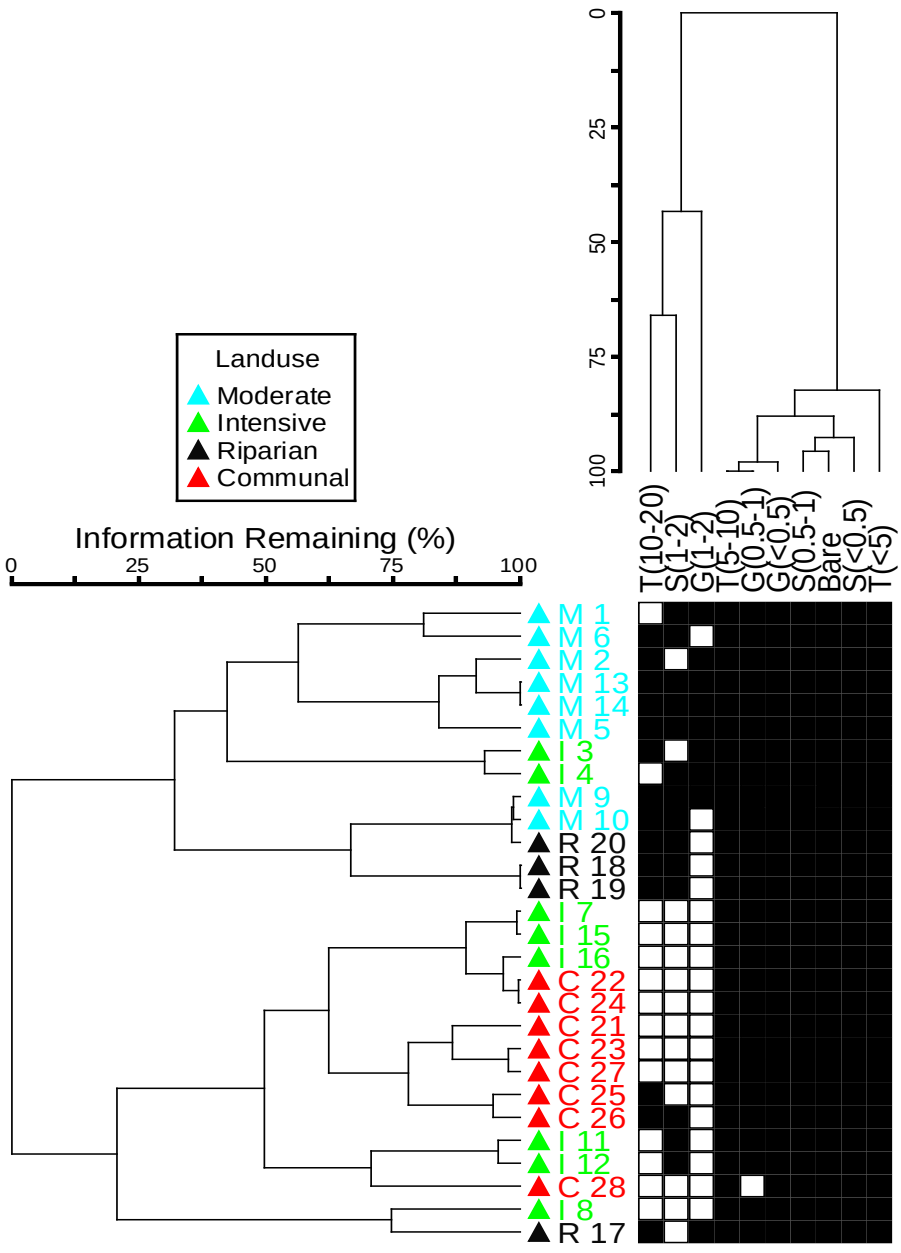

Figure 4.87 Two-way dendrogram shows the grouping of points according to the vegetation structure with categories of vegetation for each point indicated

4.5.6.1 Vegetation two-way cluster dendrogram

To investigate the interaction between the vegetation structure and the different vegetation categories, an NMS treatment of the data was done. The main matrix was the vegetation structure per point, while the second matrix was vegetation category (Figure 4.87). The final stress of 13.53404 and final stability of 0.03448 were achieved after 500 iterations. The Monte Carlo test recommended three dimensions. All three axes had a p=0.004. Axis 1 accounted for 50.8% of the variation, axis 2 accounted for 27.9% of the variation and axis 3 accounted for 19.9% of the variation.

The vegetation structure indicated groupings of points per land use type and should be viewed in conjunction with Figures 4.41 – 4.45. The similarity of the MLM and RLM was evident. Both the ILM and the CLM had a similar grouping with reduced tree cover in the 10–20m category, reduced shrubs in the 1–2m category and reduced grasses in the 1–2m category. Two main groupings of observation points according to vegetation structure was evident (Figure 4.83).

4.5.7 Species two-way cluster dendrogram showing species grouping and vegetation cover

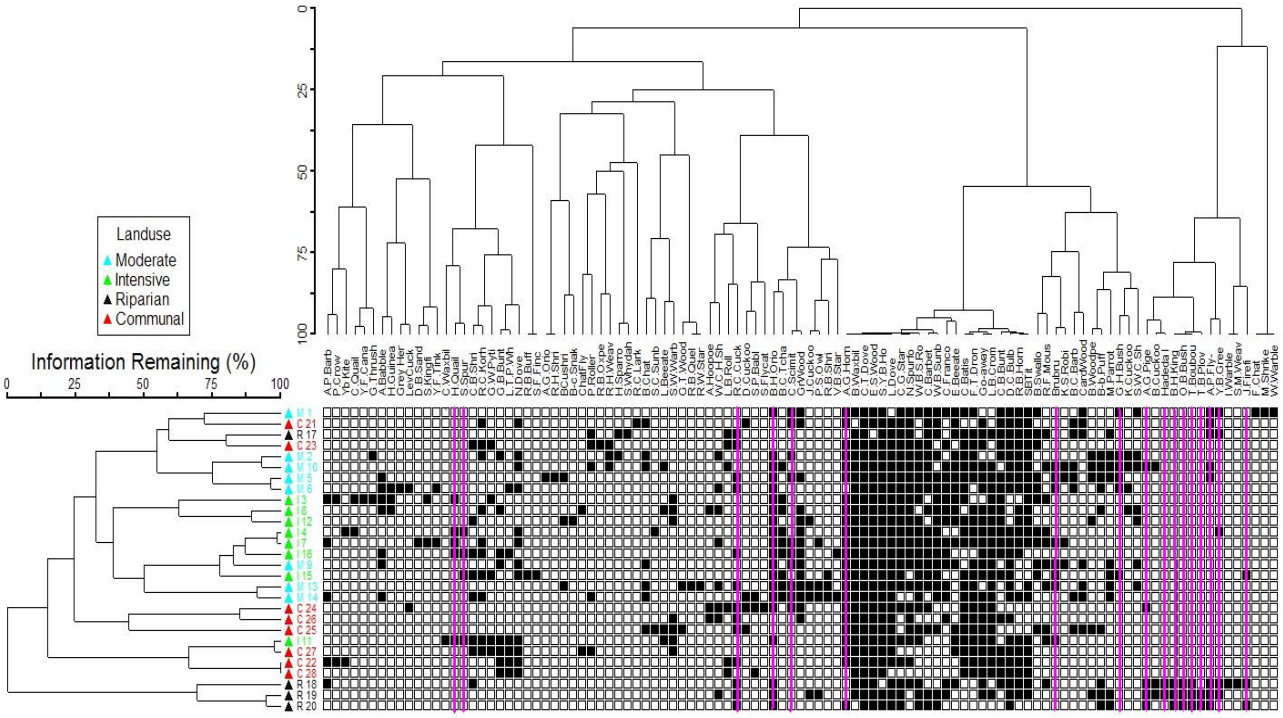

Figure 4.88 The two-way dendrogram shows the distribution of bird species and land use. Indicator species have been highlighted

4.5.7.1 Species two-way cluster dendrogram showing species grouping and land use

To investigate the interaction between land use and species presence / absence, an NMS treatment of data was done. The main matrix was land use while the second matrix was species presence / absence. The final stress of 16.70556 and final stability of 0.00219 were achieved after 500 iterations. The Monte Carlo test recommended three dimensions. All three axes had a p=0.004. Axis 1 accounted for 48.79% of the variation, axis 2 accounted for 29.86% of the variation and axis 3 accounted for 22.31% of the variation.

The dendrogram (Figure 4.88) indicates bird species presence / absence when compared to land use. There were two main species groupings. One group included species of the RLM and the second group included generalist species of the all land use types. Indicator species are highlighted and should be observed in conjunction with distribution maps (Figures 4.46 – 4.62).