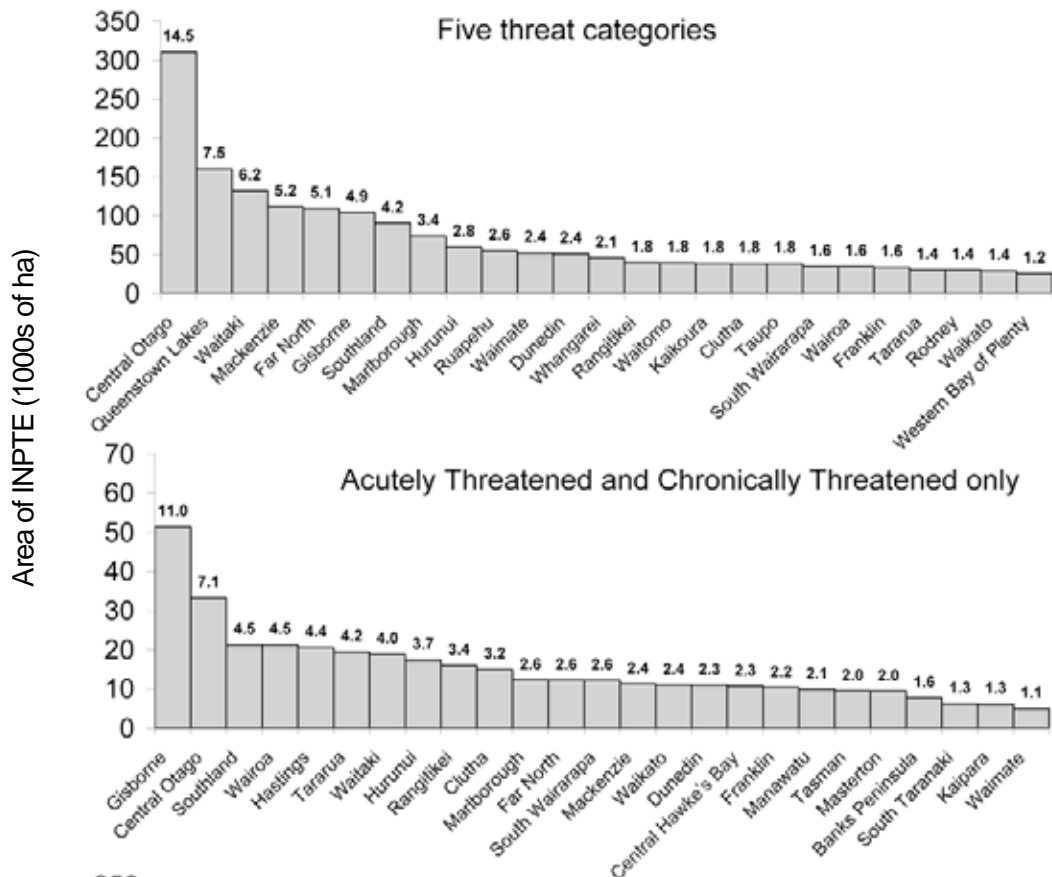


A.



B.

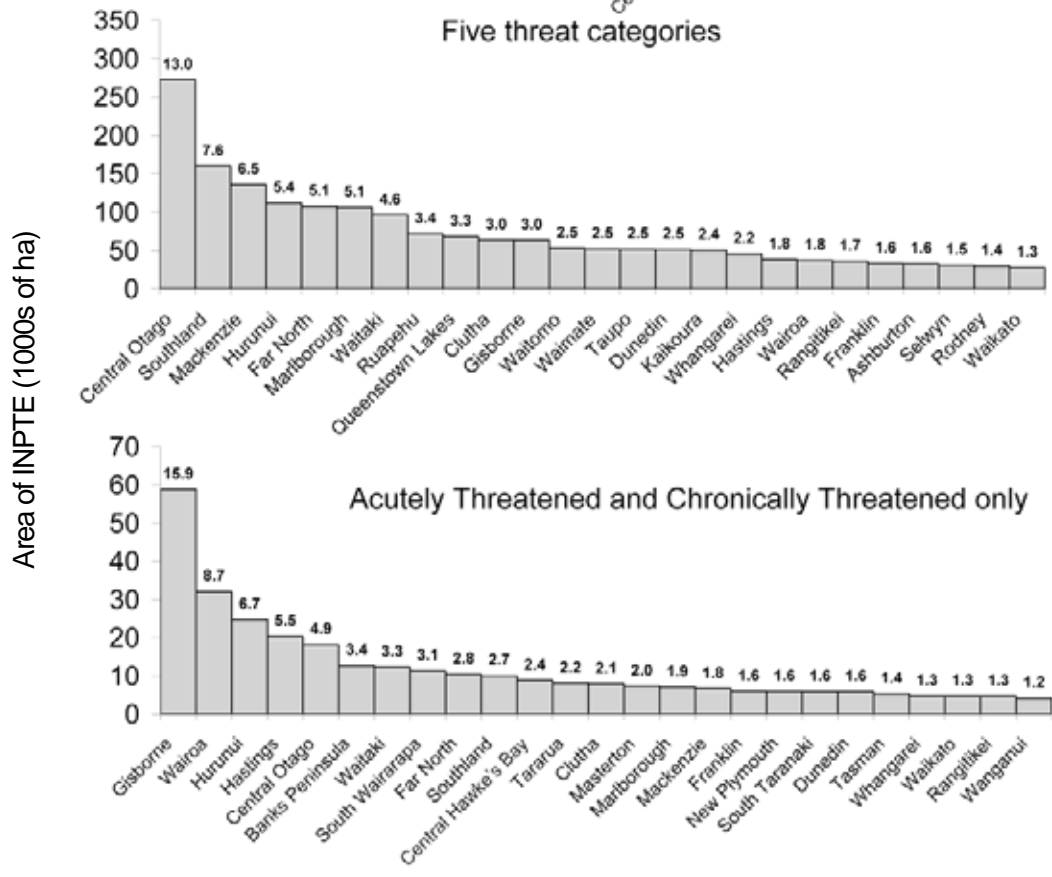


Figure 6. The 25 councils with the greatest area of INPTE (indigenous cover not protected in threatened environments). A: Level IV of LENZ. B: Level II of LENZ. Figures associated with each district are the percentage of the total national INPTE represented.

It is also intuitively obvious to land managers and administrators that Level IV better distinguishes variation in the environment, loss of indigenous cover and threat to biodiversity at the regional, district and local (e.g. property) scales at which they work. For example, a biodiversity officer in Tararua District Council would find little credibility in Level II information classifying remaining indigenous cover in environment F1.1g within the Less Reduced and Better Protected category (see Appendix 3), since it would be obvious to that officer that there was negligible indigenous cover of its type left in the area, and that it was poorly protected. Clearly, Level IV would be the better choice for identifying vulnerable biodiversity and prioritising future protection needs in this local authority area.

Having established that it was more appropriate to assess the vulnerability of remaining biodiversity at local, district and regional scales at Level IV than Level II, we were able to quantify two issues resulting from less effective identification of threatened biodiversity that arise through threat classification at Level II. Less effective identification of areas containing much reduced or poorly protected biodiversity can result either in *less effective* protection, because the areas are assigned to a lower category of threat, or to the Less Reduced and Better Protected category (e.g. remaining areas of indigenous vegetation in environment F1 in central Rangitikei District; Appendix 3). Less effective identification of areas containing much reduced or poorly protected biodiversity can also result in *less efficient* protection, because some areas of INP will be classified as ‘threatened’ that are, in fact, less reduced and/or better protected.

Overall, the bias will be towards the former—less effective identification resulting in less effective protection—rather than the latter because a few well-protected or relatively intact Level IV environments will weight Level II environment totals and averages towards the Less Reduced and Better Protected category. Again, drawing on the example of F1 (Appendix 3), 12 of the 19 Level IV environments are threatened, but when categories are defined at LENZ Level II, the whole area is classified as Less Reduced and Better Protected.

The magnitude of these drawbacks can be quantified. Table 10 shows that threat classification at Level II assigned between 38% and 62% of the area of INP identified in the five threatened environment categories at Level IV (hereafter ‘Level IV

TABLE 10. NUMBER OF ENVIRONMENTS AND AREA OF INDIGENOUS COVER NOT PROTECTED (INP) IN THE SIX LAND ENVIRONMENT CATEGORIES DETERMINED AT LEVEL IV (ROWS), BUT ASSIGNED TO THE SAME LAND THREAT ENVIRONMENT CATEGORIES DETERMINED AT LEVEL II.

THREAT CATEGORIES DETERMINED AT LENZ LEVEL IV	NUMBER OF ENVIRONMENTS		INP		
	TOTAL, LEVEL II	PERCENTAGE, LEVEL II (%)	TOTAL AREA, LEVEL IV (ha)	TOTAL AREA, LEVEL II (ha)	PERCENTAGE, LEVEL II (%)
Acutely Threatened	117	74.1	182 573	113 435	62.1
Chronically Threatened	24	32.4	285 416	115 230	40.4
At Risk	18	34.6	468 195	273 390	58.4
Critically Underprotected	13	39.4	708 816	270 033	38.1
Underprotected	9	50.0	497 697	204 827	41.2
Less Reduced and Better Protected	143	86.7	2 651 940	2 191 702	82.6

INPTE') to the same threat category. The lowest correspondence (38%) was in Critically Underprotected environments identified with a threat classification at Level IV. Of total Level IV INPTE (i.e. across the five threatened environment categories), 503 896 ha (24%) were not assigned to a threat category when Level II was used; in other words, identification of threatened biodiversity was 24% less effective with a Level II threat classification. Furthermore, the cost of less efficient identification was that 17% of INP (460 239 ha) that was not within a threatened Level IV environment was included in one of the five threatened environment categories when classification was performed at Level II (Table 11). We note that using Level IV rather than Level II to more effectively and efficiently target vulnerable biodiversity did not result in very large increases in the area identified as under threat: total area of INPTE increased only by 43 657 ha nationally (or less than 0.2% of New Zealand's total land area).

Of the 467 988 ha of Level IV INPTE in Acutely Threatened and Chronically Threatened environments, only 69% (322 078 ha) of INPTE area was assigned to one of these two threat categories when classification was performed at Level II. Thus 31% of threatened, unprotected indigenous cover in these two highest categories of threat was not identified as highly threatened through less effective targeting. Level II classification was less efficient by 47 936 ha (13% of total INP); this was the area of indigenous cover identified as threatened when a finer level of detail indicated that it was in a better-protected or less-reduced environment.

In 42 district councils (58% of the 73), more than 10% of the total area of Level IV INPTE was not included when threat classification was performed at Level II, 19 (26% of the 73) district councils had more than half of the area of Level IV INPTE not included, and three (4% of the 73) had more than 90% of the

TABLE 11. COMPARISON OF AREAS OF INDIGENOUS COVER NOT PROTECTED (INP) IN THE SIX LAND ENVIRONMENT CATEGORIES DETERMINED AT LENZ LEVELS IV (ROWS) AND II (COLUMNS).

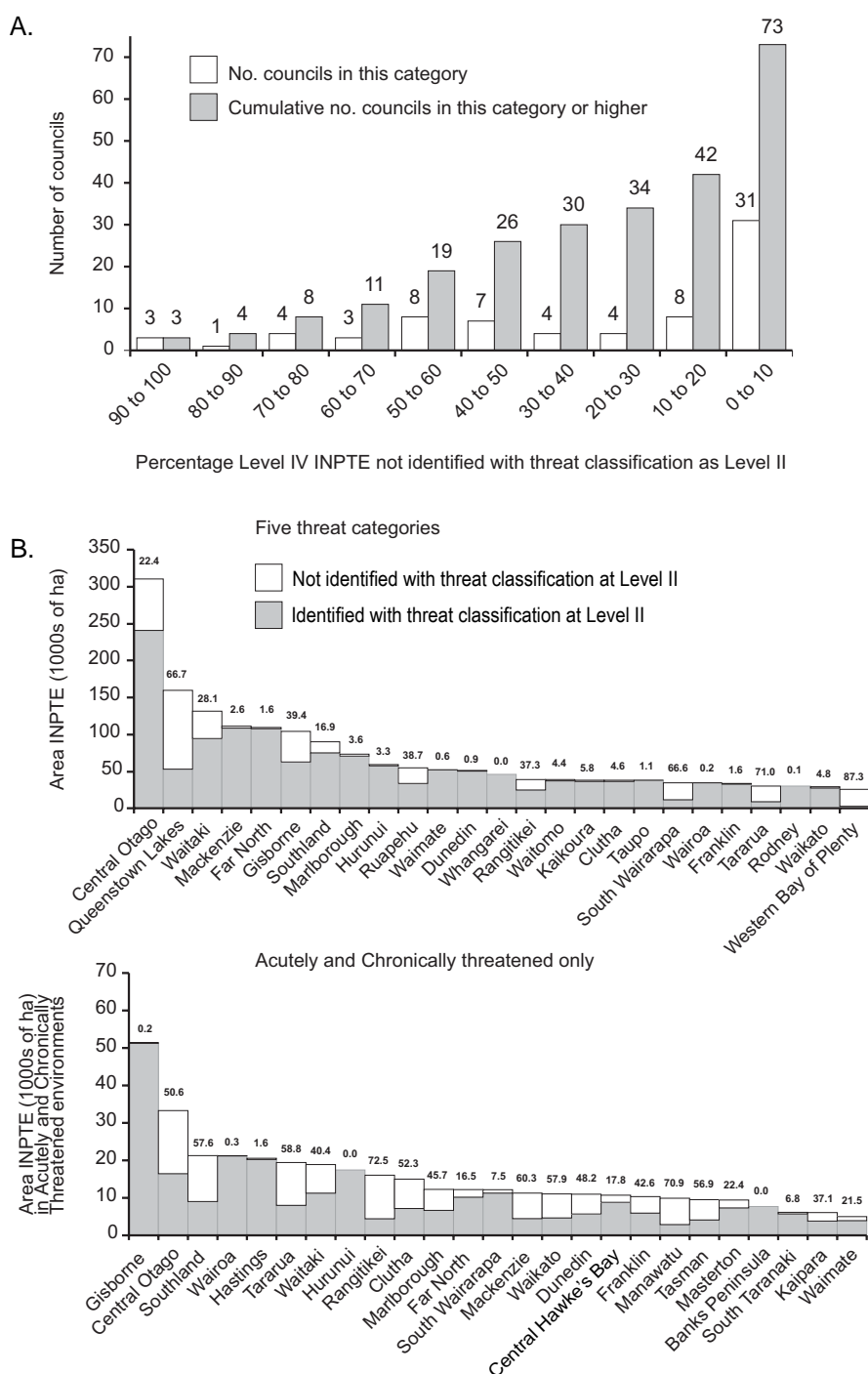
Numbers are the area of INP (Level IV classification) not identified by classification at Level II. **Bold** numbers show the area assigned to the same threat category. Numbers in the 'less reduced and better protected' category (right column) show INP determined at LENZ Level IV, but not assigned to any one of the five threat categories by Level II classification, and not identified as within a threatened environment.

LENZ LEVEL IV	LENZ LEVEL II					
	ACUTELY THREATENED	CHRONICALLY THREATENED	AT RISK	CRITICALLY UNDER- PROTECTED	UNDER- PROTECTED	LESS REDUCED AND BETTER PROTECTED
Acutely Threatened (182 573 ha)	113 435	29 543	14 353	1	1924	23 316
Chronically Threatened (285 416 ha)	63 870	115 230	55 197	2609	23 339	25 171
At Risk (468 195 ha)	6338	34 247	273 390	16 109	73 093	65 020
Critically Under-protected (708816 ha)	0	1938	175 161	270 033	126 326	135 358
Under-protected (497 697 ha)	0	0	36 029	1810	204 827	255 031
Less Reduced and Better Protected (2651940 ha)	84	5330	133 939	0	320 886	2 191 702

area of Level IV INPTE not included (Fig. 7A). Queenstown Lakes (106 534 ha), Central Otago (69 493 ha), Gisborne (41 172 ha) and Waitaki (37 139 ha) districts contained the largest areas of Level IV INPTE not identified as threatened when threat classification was undertaken at Level II (Fig. 7B).

In Acutely Threatened and Chronically Threatened environments only (Fig. 7B), Central Otago (16 832 ha), Southland (12 250 ha), Rangitikei (11 635 ha), Tararua (11 415 ha) and Clutha (7846 ha) districts had the greatest areas of Level IV INPTE not identified as threatened when threat classification was undertaken at Level II (these areas accounted for more than half of the INP in Acutely Threatened and

Figure 7. Less effective identification of threat through Level II threat classification. A: Percentage Level IV INPTE (indigenous cover not protected in threatened environments) not identified when threat classification was carried out at Level II. B: Area of Level IV INPTE identified or not in threatened environments in the 25 top-ranking councils when threat classification was carried out at Level II. Figures associated with columns show the percentage area of Level IV INPTE not identified.

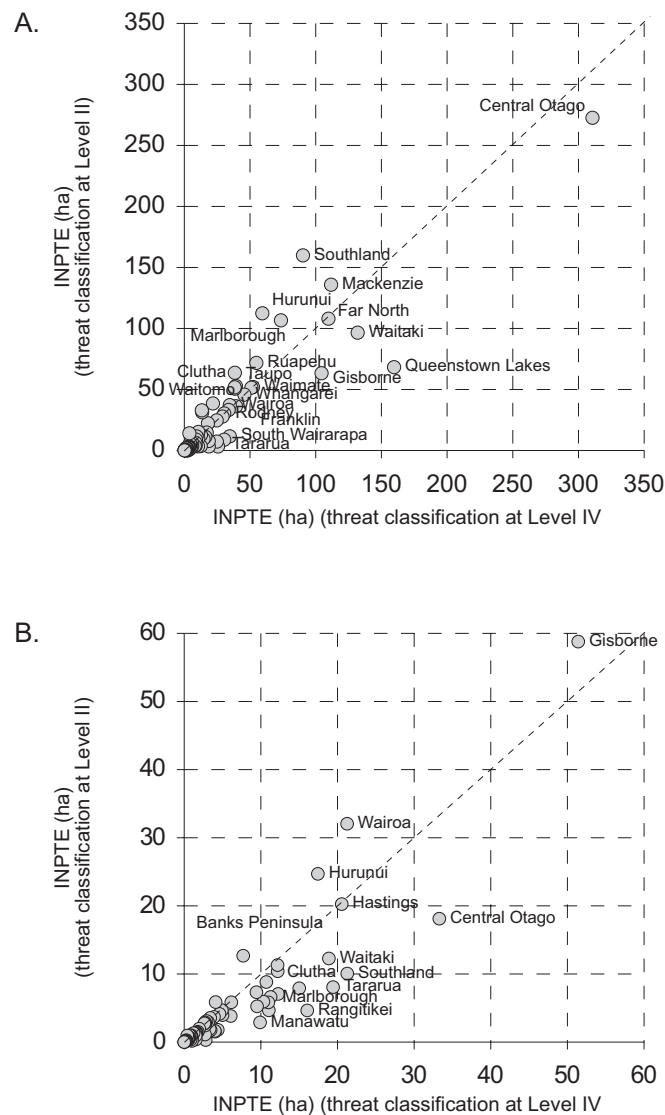


Chronically Threatened environments in those districts, and included some of New Zealand's most threatened ecosystems and species).

Figure 8 illustrates the inefficiency costs of Level II classification for individual districts. The area of INPTE estimated with Level II threat classification substantially exceeded the Level IV INPTE area in Mackenzie, Southland, Marlborough, Hurunui, Ruapehu, Dunedin, Waitomo, Kaikoura, Clutha, Taupo and Wairoa districts (Fig. 7A). The largest excesses were in Southland (c. 70 000 ha) and Hurunui (c. 53 000 ha) districts. In environments identified at Level IV as Acutely and Chronically Threatened alone, the area of Level II INP was greater than the actual area in 17 districts, with largest excesses in Gisborne, Wairoa, Hurunui and Banks Peninsula districts.

In summary, although a Level II analysis provides a simpler framework for an overview of national data, it is less suitable than Level IV for assessing (and hence facilitating protection of) vulnerable biodiversity at local and regional scales (Leathwick et al. 2003b; MfE, DOC & LGNZ 2004).

Figure 8. The consequences for districts (each represented by a dot) of less efficient targeting through Level II threat classification. A: All threatened environments. B: Acutely Threatened and Chronically Threatened environments only.



4.4 LAND-USE CAPABILITY OF INDIGENOUS COVER NOT PROTECTED

The characteristics of the eight land-use capability (LUC) classes of the NZLRI are summarised in Table 12.

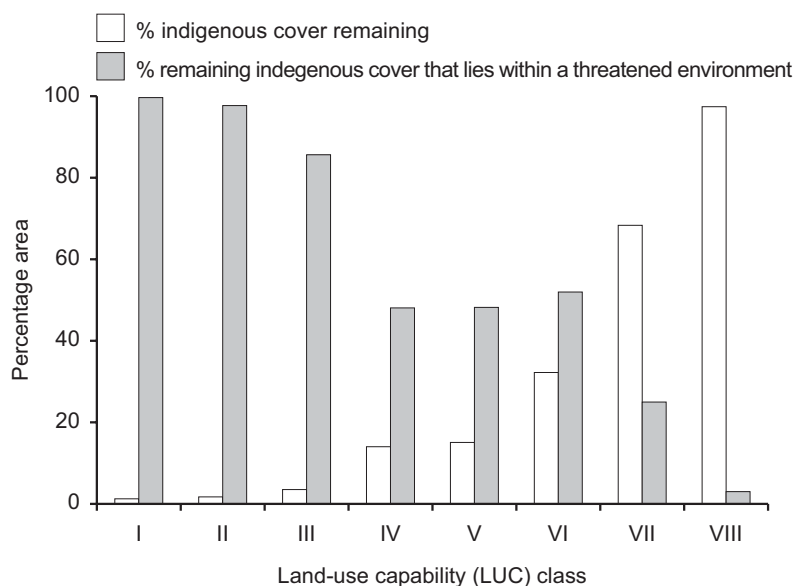
Figure 9 illustrates that indigenous vegetation clearance in New Zealand has historically been concentrated in high-versatility LUC classes and that high proportions of indigenous cover on versatile soils lie within threatened environments. Consequently, there may be a high risk of loss of what little indigenous biodiversity remains in higher LUC classes today.

TABLE 12. SUITABILITY OF THE EIGHT LAND-USE CLASSES IN THE NZLRI FOR DIFFERENT LAND-USE TYPES (REPRODUCED FROM MINISTRY OF WORKS AND DEVELOPMENT (1979)).

CLASS	CROPPING SUITABILITY	PASTORAL & PRODUCTION FORESTRY SUITABILITY ^a	GENERAL SUITABILITY	Increasing limitations to use ↓	Decreasing versatility ↓
I	High	High	Multiple use		
II					
III	Medium				
IV					
V	Unsuitable	Medium	Pastoral or forestry		
VI					
VII		Low			
VIII			Unsuitable	Catchment protection land	

^a LUCs 4-7 that have wetness as the major limitation, and those units in very low rainfall areas or on shallow soil, are normally not suited to production forestry.

Figure 9. Indigenous cover and percentages of it in threatened environments, across Land-use capability classes in 2001/02.



Tables 13 and 14 show the areas of INP in all environments, and in each threat category (INPTE), across the eight LUC classes of the NZLRI. The great majority of INPTE area was on land with low value for agricultural production. Just 0.1% of INPTE was on elite soils (Class I). We inspected the relevant pixels in a GIS, and found some of this ‘elite’ land was on river scarps or floodplains under forest or shrubland (e.g. in Manawatu District) or in gullies (e.g. around Hamilton City). Because these places present severe hazards for productive use, we suggest misclassification error in the NZLRI may account for some of this land area.

Soils in Classes I to IV together accounted for 11% (at Level IV) or 12% (at Level II) of the total INPTE area (Tables 13 & 14). The highest portion of INPTE was in LUC Class VI (‘non-arable land with moderate limitations and hazards’), which accounted for 51% (at Level IV) or 47% (at Level II) of the total INPTE area (Tables 11 & 12). Although some of this Class VI land supporting INPTE was listed as relatively stable (i.e. with a low erosion hazard), a large amount (c. 65%) of it has wetness, low rainfall, shallow soil or erosion limitations. Over one-third of INPTE was in the lowest LUC Classes VII and VIII; these classes accounted for 37% (at Level IV) or 41% (at Level II) of the total INPTE area. Therefore, the greatest opportunity for protection of INPTE lies in land that has the lowest suitability for cropping, pastoral production and forestry.

TABLE 13. INDIGENOUS COVER NOT PROTECTED (INP) IN THE EIGHT NZLRI LAND-USE CAPABILITY CLASSES, WITHIN EACH OF THE SIX LAND ENVIRONMENT CATEGORIES DETERMINED AT LEVEL IV OF LENZ.

LUC CLASS	TOTAL	ACUTELY THREATENED	CHRONICALLY THREATENED	AT RISK	CRITICALLY UNDER-PROTECTED	UNDER-PROTECTED	LESS REDUCED AND BETTER PROTECTED
Area (ha)							
I	2222	2042	165	3	6	0	7
II	19 168	12 881	3443	702	1318	424	400
III	71 199	31 645	13207	9857	4321	3693	8476
IV	213 363	35 716	29182	44 834	18 299	10 611	74 721
V	22 311	2027	1431	4186	4134	275	10 258
VI	1 497 129	61 389	136 387	298 201	356 544	151 580	493 029
VII	1 989144	25 960	88 223	87 168	296 708	278 776	1 212 311
VIII	943202	5749	11 472	18 511	23 292	51 716	832 462
Misc. ^a	10206	2780	905	2813	2844	358	507
Unclass. ^b	27424	2871	1143	1935	1378	296	19 802
Subtotal	4 795 368	183 058	285 556	468 209	708 843	497 728	2 651 973
NIRD ^c	732	485	140	14	27	31	33
Total	4 794 636	182 573	285 416	468 195	708 816	497 697	2 651 940
Percentage area of INP in first five threat categories (%; INPTE; 2 142 696 ha)							
I		0.1	0.0	0.0	0.0	0.0	
II		0.6	0.2	0.1	0.0	0.0	
III		1.2	0.7	0.9	0.1	0.1	
IV		1.6	0.8	3.9	0.2	0.8	
V		0.0	0.1	0.5	0.2	0.1	
VI		3.5	3.7	21.5	7.3	14.6	
VII		1.3	2.9	4.5	5.6	17.0	
VIII		0.2	0.3	1.2	0.3	3.2	

^a Miscellaneous = towns, water, etc.

^b Unclassified = Stewart Island/Rakiura and other offshore islands not included in the NZLRI.

^c NIRD = non-indigenous vegetation recently disturbed, not included as indigenous cover in this work.

TABLE 14. INDIGENOUS COVER NOT PROTECTED (INP) IN THE EIGHT NZLRI LAND-USE CAPABILITY CLASSES, WITHIN EACH OF THE SIX LAND ENVIRONMENT CATEGORIES DETERMINED AT LEVEL II OF LENZ.

LUC CLASS	TOTAL	ACUTELY THREATENED	CHRONICALLY THREATENED	AT RISK	CRITICALLY UNDER-PROTECTED	UNDER-PROTECTED	LESS REDUCED AND BETTER PROTECTED
Area (ha)							
I	2222	1470	561	32	0	112	48
II	19 168	12 654	3610	1338	158	70	1338
III	71 199	25 078	13 950	18 387	2108	1624	10 052
IV	213 363	33 607	17 266	82 196	4578	16 157	59 559
V	22 311	669	2649	10 071	4804	1307	2810
VI	1 497 129	72 865	78 473	451 656	153 335	307 102	433 699
VII	1 989 144	26 944	60 801	93 813	117 294	356 267	1 334 025
VIII	943 202	4821	7338	25 564	6002	67 231	832 246
Misc. ^a	10 206	2664	1053	2632	2082	60	1714
Unclass. ^b	27 424	3457	708	2423	226	466	20 144
Subtotal	4 795 368	184 229	186 410	688 111	290 588	750 395	2 695 635
NIRD ^c	732	503	122	43	26	2	37
Total	4 794 636	183 726	186 287	688 068	290 562	750 394	2 695 598
Percentage area of INP in first five threat categories (%; INPTE; 2099038 ha)							
I		0.1	0.0	0.0	0.0	0.0	
II		0.6	0.2	0.0	0.1	0.0	
III		1.5	0.6	0.5	0.2	0.2	
IV		1.7	1.4	2.1	0.9	0.5	
V		0.1	0.1	0.2	0.2	0.0	
VI		2.9	6.4	13.9	16.6	7.1	
VII		1.2	4.1	4.1	13.8	13.0	
VIII		0.3	0.5	0.9	1.1	2.4	

^a Miscellaneous = towns, water, etc.

^b Unclassified = Stewart Island and other offshore islands not included in the NZLRI.

^c NIRD = non-indigenous vegetation recently disturbed, not included as indigenous cover in this work.

At the time of writing, pastoral leases in the South Island high country contained more than a quarter (c. 552 000 ha or 29%) of the total area of INPTE in low versatility LUC Classes V to VIII, but a far smaller percentage (7%) of New Zealand's INPTE on more versatile soils (c. 15 500 ha in LUC Classes I-IV). Much of the INPTE on pastoral leases was in At Risk, Critically Underprotected and Underprotected threat categories, because there has been a tendency for pastoral leases to retain mainly indigenous cover. Pastoral leases contained just 5.5% of the total national INPTE in the Acutely Threatened and Chronically Threatened threat categories (c. 25 500 ha). Of INPTE in the Acutely Threatened and Chronically Threatened categories on pastoral leases, c. 21% (c. 5300 ha) was in the more versatile LUC Classes I-IV.

4.5 CHANGES IN INDIGENOUS COVER FROM 1996/97 TO 2001/02 AND THEIR CONSEQUENCES TO REMAINING BIODIVERSITY

In this section, we present data for threatened environments from threat classification at Level IV of LENZ only.

4.5.1 Nature of indigenous cover lost

Broadleaved Indigenous Hardwoods (6745 ha), Manuka and/or Kanuka (5609 ha), Tall-Tussock Grassland (2482 ha) and Indigenous Forest (2232 ha) were the indigenous cover types that experienced the largest conversion to non-indigenous cover types nationally from 1996/97 to 2001/02 (Table 15). Harvesting or felling of c. 2000 ha of Indigenous Forest (Forest - Harvested LCDB 2 class) accounted for 11% of the change, conversion to exotic forestry accounted for c. 13 500 ha or 66% of the total change, conversion to High-Producing Grassland (i.e. pasture) or cropland for 6%, and conversion to Low-Producing Grassland for 16%.

TABLE 15. LAND AREA THAT CHANGED FROM INDIGENOUS TO NON-INDIGENOUS COVER TYPES (ha) FROM 1996/97 TO 2001/02 BY LCDB 2 CLASS.

	BUILT-UP AREA	SURFACE MINE	SHORT-ROTATION CROPLAND	HIGH-PRODUCING EXOTIC GRASSLAND	LOW-PRODUCING GRASSLAND	GORSE AND/OR BROOM	AFFORESTATION (NOT IMAGED)	AFFORESTATION (IMAGED, POST LCDB 1)	FOREST-HARVESTED	OTHER EXOTIC FOREST	TOTAL
Coastal Sand and Gravel	0	0	0	0	32	0	0	22	0	1	55
River and Lakeshore Gravel and Rock	0	0	0	0	0	3	0	0	0	0	3
Landslide	0	0	0	0	172	6	0	0	0	0	178
Tall-Tussock Grassland	0	0	0	0	0	0	54	1196	0	1236	2486
Herbaceous Freshwater Vegetation	0	2	0	55	0	0	38	6	0	0	101
Herbaceous Saline Vegetation	0	0	0	86	0	0	0	0	0	0	86
Fernland	0	0	0	0	0	0	0	90	0	0	90
Manuka and/or Kanuka	0	8	0	565	2052	0	797	2148	3	42	5615
Matagouri	0	0	0	0	0	0	6	0	0	0	6
Broadleaved Indigenous Hardwoods	2	1	3	361	490	227	1802	3815	46	0	6748
Subalpine Shrubland	0	0	0	0	0	0	0	46	0	0	46
Indigenous Forest	3	4	0	0	34	0	0	259	1934	0	2233
Total change	5	16	3	1067	2779	236	2697	7582	1982	1278	17 646
Percentage of 17646 ha (%)	0.0	0.1	0.0	6.0	15.7	1.3	15.3	43.0	11.2	7.2	100
Total in first five threatened environment categories	5	3	3	801	1765	222	1079	2947	1368	1238	9431
Percentage of 9431 ha (%)	0.0	0.1	0.0	5.6	15.8	1.3	15.4	43.2	11.3	7.3	100

The patterns of net loss of indigenous cover were very similar to those seen in the changes from indigenous to exotic land cover types. This is because the databases showed that, nationally, only 347 ha changed from a non-indigenous cover class to an indigenous cover class; of this, 270 ha was succession to Manuka and/or Kanuka shrubland, and much of the remainder was a change to Broadleaved Indigenous Hardwoods. The same indigenous cover types that showed the largest changes to non-indigenous cover across all environments accounted for the most loss in threatened environments (Table 16): 47% of the total loss of Broadleaved Indigenous Hardwoods, 53% of the total loss of Manuka and/or Kanuka, 66% of the total loss of Tall-tussock Grassland and 65% of the total loss of Indigenous Forest were in threatened environments.

TABLE 16. INDIGENOUS COVER LOSS (ha) FROM 1996/97 TO 2001/02 IN EACH OF THE SIX LAND ENVIRONMENT CATEGORIES, WHICH WERE DETERMINED AT LEVEL IV OF LENZ.

	TOTAL	ACUTELY THREATENED	CHRONICALLY THREATENED	AT RISK	CRITICALLY UNDER- PROTECTED	UNDER- PROTECTED	LESS REDUCED AND BETTER PROTECTED
Change from indigenous cover to non-indigenous cover							
Coastal Sand and Gravel	55	0	0	53	2	0	0
River and Lakeshore Gravel and Rock	2	1	0	0	0	0	1
Landslide	177	0	0	0	0	1	177
Tall-Tussock Grass- land	2482	47	462	7	478	655	833
Herbaceous Fresh- water Vegetation	101	16	35	25	0	0	24
Herbaceous Saline Vegetation	4	1	0	3	0	0	0
Fernland	90	0	0	25	2	0	63
Manuka and/or Kanuka	5609	371	1154	551	798	81	2654
Matagouri	6	6	0	0	0	0	0
Broadleaved Indig- enous Hardwoods	6745	552	635	1303	598	98	3559
Subalpine Shrubland	46	7	2	0	1	1	35
Indigenous Forest	2232	145	249	313	534	210	781
Total change	17 550	1147	2537	2281	2413	1046	8126
Change from non-indigenous cover to indigenous cover							
All non-indigenous cover classes	347	20	8	74	6	0	238
Net loss of indigenous cover							
Net loss of indig- enous cover	17 204	1127	2529	2207	2407	1046	7888
Net loss of indig- enous cover not protected	16 271	1121	2483	2201	2360	956	7151
(% of net loss of indigenous cover)	(94.6%)	(99.5%)	(98.2%)	(99.7%)	(98.1%)	(91.4%)	(90.7%)
Change from low-producing grassland to other non-indigenous cover							
Low-Producing Grassland	29 338	3157	9135	6840	1287	3510	5409

Indigenous cover loss in threatened environments was also due to very similar activities: harvesting or felling of Indigenous Forest accounted for 11% (1368 ha) and exotic forestry for 66% (5264 ha) of the total change in threatened environments, conversion to High-Producing Exotic Grassland (i.e. pasture) or cropland for 6% (804 ha), and conversion to Low-Producing Grassland for 16% (1765 ha).

Table 16 (final row) also highlights that 29 338 ha changed from Low-Producing Grassland cover (classified as 'Non-indigenous') to other non-indigenous classes between 1996/97 and 2001/02. A large portion of this change (29 160 ha) was conversion to exotic forestry, and much of this conversion (c. 81%) occurred in threatened environments, particularly in Chronically Threatened and At Risk environments (9135 and 6840 ha, respectively). The land area of Low-Producing Grassland affected by these changes (29 338 ha) was greater (i.e. 1.67 times) than the total national decrease in indigenous cover classes (17 204 ha). Since many areas of Low-Producing Grassland contain mixtures of indigenous and exotic species, significant further loss of indigenous biodiversity may have been incurred owing to these changes.

4.5.2 Indigenous cover loss across land environments and threat categories

There was a net loss of indigenous cover in almost half (245, or 49%) of New Zealand's 500 Level IV land environments between 1996/97 and 2001/02 (Table 17). One Level IV environment (F1.3d, in central Rangitikei District) changed threat category from Chronically Threatened to Acutely Threatened owing to indigenous cover loss. Of the 500 Level IV environments, 251 (50%) showed no change in indigenous cover, and indigenous cover increased in just four (0.8%)

TABLE 17. PERCENTAGE LOSS AND RATE OF LOSS OF INDIGENOUS COVER FROM 1996/97 TO 2001/02 IN EACH OF THE SIX LAND ENVIRONMENT CATEGORIES, WHICH WERE DETERMINED AT LEVEL IV OF LENZ.

	TOTAL	ACUTELY THREATENED	CHRONICALLY THREATENED	AT RISK	CRITICALLY UNDER- PROTECTED	UNDER- PROTECTED	LESS REDUCED AND BETTER PROTECTED
Probability of loss in 5 years (% of environments with a net loss of indigenous cover)							
Probability	49.0	48.1	64.9	50.0	39.4	55.6	43.6
Five-year change (% of whole environment area)							
All environments							
Average	-0.07	-0.02	-0.10	-0.11	-0.09	-0.16	-0.07
Changed environments only							
Average	-0.13	-0.04	-0.16	-0.21	-0.22	-0.28	-0.15
Median	-0.04	-0.02	-0.08	-0.08	-0.13	-0.07	-0.05
Maximum	-2.39	-0.34	-1.86	-1.68	-1.00	-1.79	-2.39
Five-year rate of change (% of indigenous cover)							
All environments							
Average	-0.37	-0.49	-0.73	-0.42	-0.22	-0.41	-0.11
Changed environments only							
Average	-0.74	-1.00	-1.13	-0.81	-0.55	-0.74	-0.25
Median	-0.27	-0.51	-0.47	-0.30	-0.36	-0.16	-0.07
Maximum	-14.77	-11.06	-14.77	-5.86	-2.91	-5.53	-6.39

environments. These four net increases were relatively small in area (i.e. 1, 3, 6 and 35 ha, respectively).

Approximately 54% of the total area that changed from indigenous to non-indigenous cover from 1996/97 to 2001/02 (9316 ha) was in threatened environments. Of the five threat categories, the largest total decrease was in Chronically Threatened environments (2537 ha), but total losses in At Risk and Critically Underprotected environments were almost as large. Most of the indigenous cover lost had not been legally protected (95% of total loss). In threatened environments, 98% of indigenous cover lost was on land not legally protected (according to our database), whereas within environments assigned to the Less Reduced and Better Protected category, 91% of indigenous cover lost had had no legal protection status.

There was no significant relationship between the area of indigenous cover lost within a given land environment and the percentage of indigenous cover remaining in that environment in 1996/97 (Fig. 10A). However, it is very likely that a relatively small total area of indigenous cover was lost in the 158 Acutely Threatened Level IV environments (only 6.5% of the total area of indigenous cover lost from 1996/97 to 2001/02) because relatively little indigenous cover was left to lose in those environments, and because clearance occurs more rapidly in environments where more indigenous cover remains. Loss of indigenous cover in New Zealand's most intact environments (i.e. those with more than 90% indigenous cover remaining) also accounted for a relatively small portion of the total area lost, probably because these environments are remote, well protected and have few alternative land uses.

Although there is less indigenous cover to lose in threatened environments, rates of loss of indigenous cover (expressed as a percentage of indigenous cover remaining in 1996/97) were higher in most threatened environments than in environments that are Less Reduced and Better Protected (Fig. 10B; Table 17). Median rates of loss were highest in Critically Underprotected environments, but were also relatively high in Chronically Threatened, At Risk and Underprotected environments. The percentage of environments in which indigenous cover decreased was higher in Chronically Threatened environments than in other threat categories; loss occurred in almost 65% of Chronically Threatened environments, whereas in other threat categories probability of loss was between 39% and 50%. Figure 11A shows the geographic distribution of the rate of indigenous cover change within New Zealand's Level IV land environments.

4.5.3 SBL across land environments and threat categories

Change in the index SBL allowed us to identify those environments and districts where the loss of indigenous cover from 1996/97 to 2001/02 resulted in the greatest increase in risk to remaining biodiversity.

Table 18 shows that the majority (78%) of the summed increase in SBL was in the 158 Acutely Threatened Level IV environments. A further 15% of that increased risk to indigenous biodiversity was in the 74 Chronically Threatened environments.

Percentage indigenous cover in 1996/97

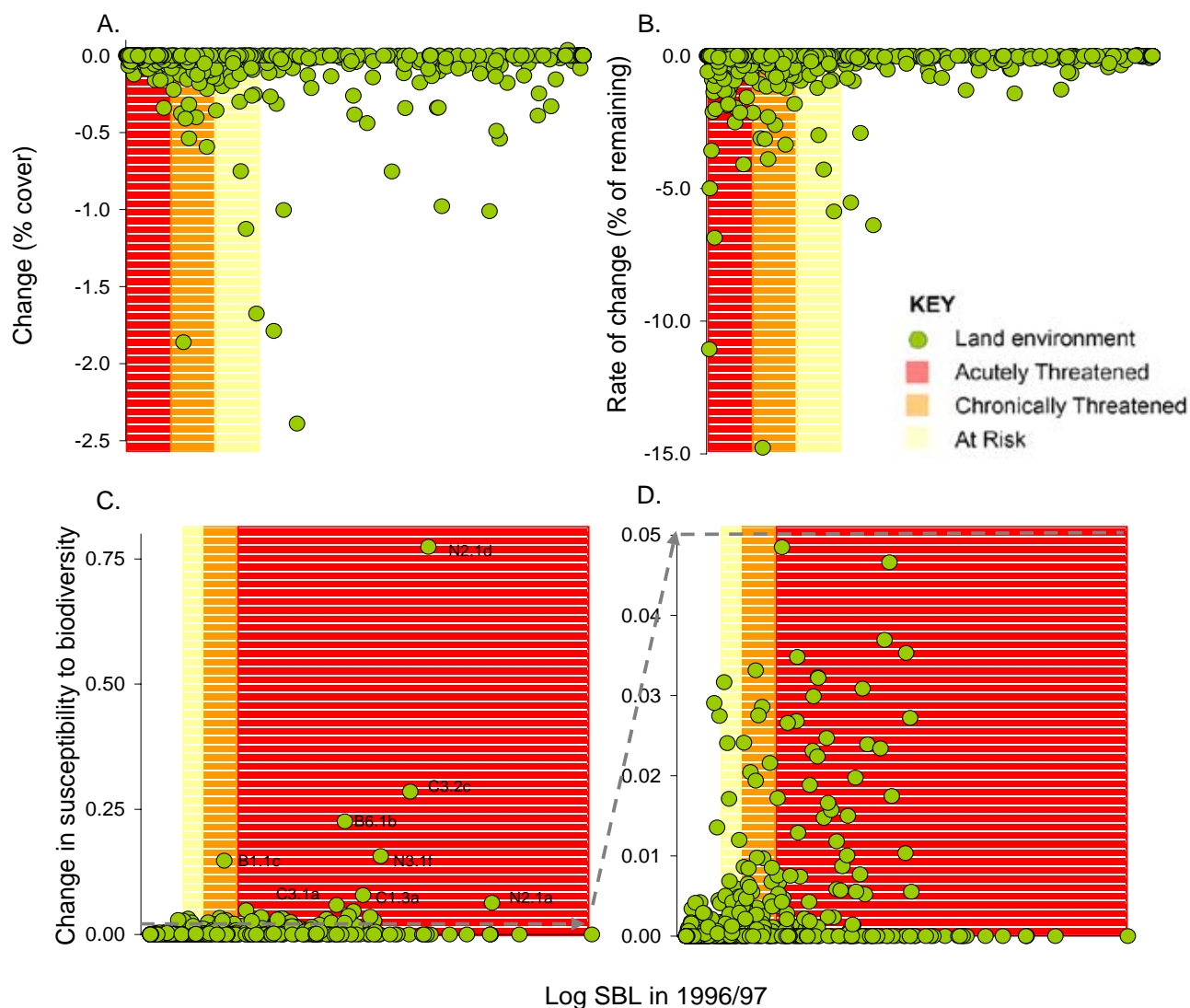


Figure 10. Change from 1996/97 to 2001/02 in New Zealand's Level IV land environments (represented by green circles). A: Change in indigenous cover (as a percentage of whole environment). B: Rate of change in indigenous cover (as a percentage of indigenous cover in 1996/97). C & D: Change in susceptibility to biodiversity loss (SBL; note different y-axis scales). A few environments that showed large increases in SBL are labelled and referred to in the text.

TABLE 18. SUMMED, AVERAGE AND MAXIMUM CHANGE IN SUSCEPTIBILITY TO BIODIVERSITY LOSS (SBL) FROM 1996/97 TO 2001/02 ACROSS LEVEL IV LAND ENVIRONMENTS, IN THE SIX LAND ENVIRONMENT CATEGORIES, WHICH WERE DETERMINED AT LEVEL IV OF LENZ.

	TOTAL	ACUTELY THREATENED	CHRONICALLY THREATENED	AT RISK	CRITICALLY UNDER-PROTECTED	UNDER-PROTECTED	LESS REDUCED AND BETTER PROTECTED
No. Level IV environments	500	158	74	52	33	18	165
Summed change	3.202	2.483	0.465	0.122	0.031	0.034	0.066
Percentage of total	100.0	77.5	14.5	3.8	1.0	1.1	2.1
Average change	0.006	0.016	0.006	0.002	0.001	0.002	<0.001
Maximum change		0.774	0.147	0.032	0.014	0.027	0.029