

9.4.9. Association 9: *Lonchocarpus nelsii* - *Eragrostis rigidior* low moderately closed bushland

This vegetation appears to be overall very degraded (Figure 48) - 31 % of relevés are considered very poor, 6 % poor, 47 % degraded and 16 % moderate. No sites were considered to be in a good state. Looking at the grasses of degraded sites, the dominant grasses are *Eragrostis rigidior*, *Aristida congesta* and *A. pilgeri*. Valuable grasses consist mostly of *Eragrostis trichophora*, with *Stipagrostis uniplumis* only occasionally occurring. Added to this, cover of 5 to 10 % of the fine *Aristida adscensionis*, *Eragrostis porosa*, *Pogonarthria fleckii* and *Enneapogon cenchroides* are found - all indicating degradation and pioneer status of the herb layer. This vegetation type is situated, as far as rainfall in the study area is considered, in a higher-rainfall region. It can thus be assumed that vegetation here has been over-utilised to a large degree in the past, leading to the often high levels of bush encroachment by *Dichrostachys cinerea* as well as *Acacia mellifera*. This has often been confirmed by farmers in the area - some farmers stated that their grandparents “could” stock up to 4 times as much cattle as they presently can, and that old photos show open grassy plains in these areas. Even species such as *Grewia* and *Combretum apiculatum* tend to form impenetrable thickets of 20 % to 40 % cover where the grass layer has disappeared.

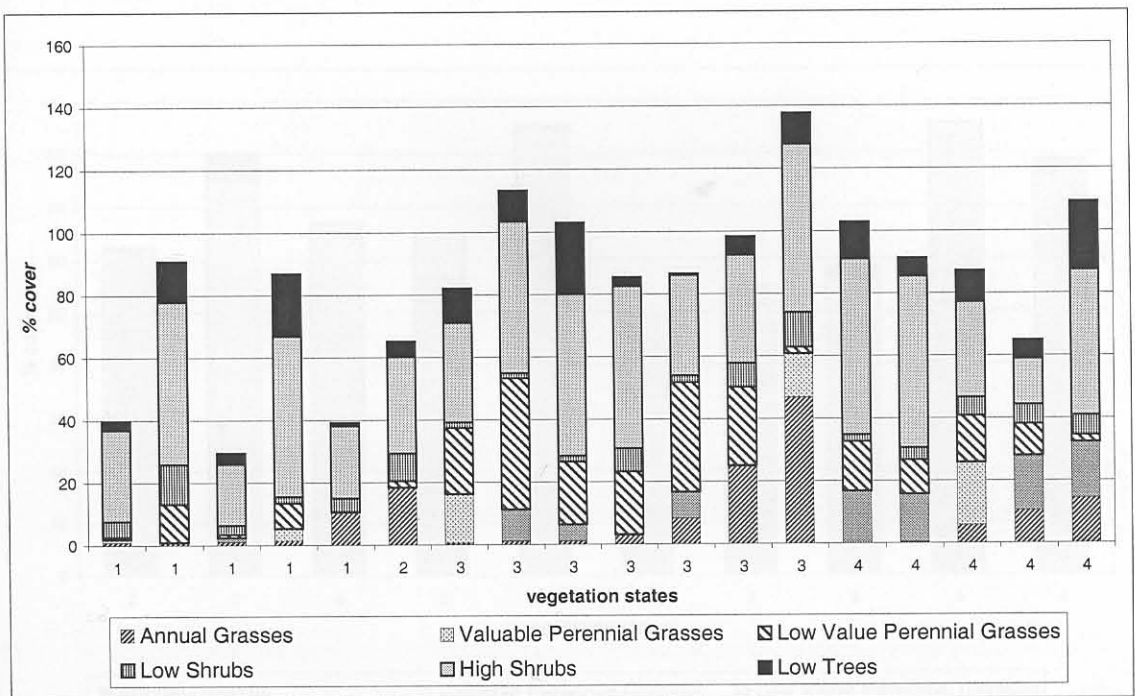


Figure 48: Selection of samples representing the different vegetation states found in association 9.

9.4.10. Association 10: *Boscia foetida* - *Leucosphaera bainesii* low semi-open bushland

This vegetation is typically found on small patches of surface calcrete, which occurs more commonly in the southern regions of the study area. Owing to the more xeric soil moisture regime of this lime-enriched soil, this vegetation type has in general a lower productivity (vegetation states Figure 49) - especially as far as grasses are concerned - and is thus also prone to degradation by overgrazing. Typical grasses found throughout this vegetation are *Aristida adscensionis* - indicating degradation, but also *Enneapogon desvauxii* (typical climax here), *Cenchrus ciliaris* (up to 10 % cover) and *Stipagrostis uniplumis*. As has been mentioned in Section 9.3, many of these calcrete plains are close to farmhouses and subjected to daily trampling and grazing especially by goats. Even where such plains are not daily traversed by e.g. goats, some calcrete plains have been found in very poor, others in moderate to good condition. Of all samples of this vegetation type, 50 % can be regarded as moderate to good, while 50 % can be regarded as poor (Figure 50). It is considered a vegetation type which degrades easily. It is also realised that it is not easy to apply special management practices to such plains either due to their proximity to central paddocks or because of their limited size, which makes it unrealistic to fence off as a separate camp and management unit.

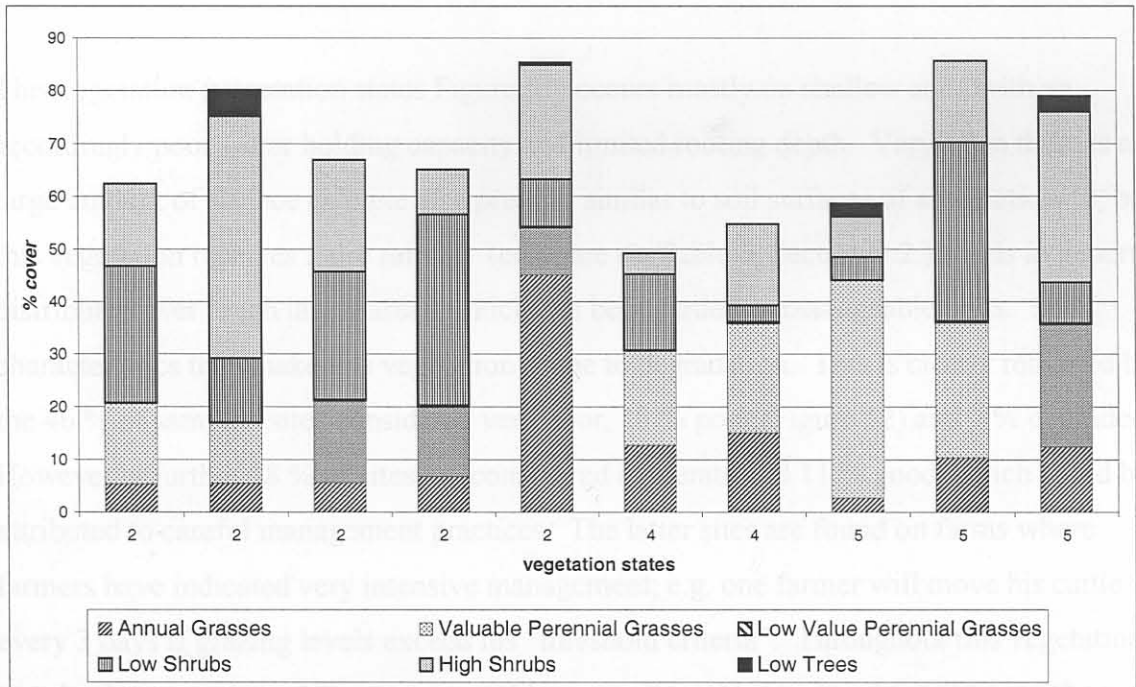


Figure 49: Selection of samples representing the different vegetation states found in association 10.



Figure 50: Example of vegetation of association 10 in state 2 (poor).

9.4.11. Association 11: : *Acacia mellifera* - *Stipagrostis hirtigluma* low moderately closed bushland

This vegetation (vegetation states Figure 51) occurs mostly on shallow soils with an accordingly poor water holding capacity and limited rooting depth. Very often there is a large amount of surface calcrete also present, similar to soil surfaces of association 10, but this vegetation receives more rainfall (compare on Table 6, Section 9.2.) and is in general distributed over much larger areas, which can be regarded as manageable units. Soil characteristics thus make this vegetation prone to degradation. This is clearly reflected by the 46 % of sampled sites considered very poor, 18 % poor (Figure 52) and 7 % degraded. However, a further 18 % of sites are considered moderate and 11 % good, which could be attributed to careful management practices. The latter sites are found on farms where farmers have indicated very intensive management; e.g. one farmer will move his cattle every 3 days if grazing levels exceed his “threshold criteria”. Throughout this vegetation type bush encroachment is a serious problem, most notably by *Acacia mellifera*. The

average % cover of this shrub for all sampled sites of this vegetation is 30 %, but in general ranges between thickets of 30 % and 60 % cover. Also unpalatable low shrubs such as *Clerodendron ternatum* (which can be detected by its strong unpleasant smell from a distance already) are increasingly common in degraded and poor samples.

Opposed to the previous associations where the total cover of valuable perennial grasses comprised of one or two species only, the diversity of valuable grasses here increases (see vegetation description in Section 9.2) - probably due to the higher rainfall regime present. Notably this is the vegetation type where *Antephora pubescens* (a highly valued grass) has been recorded most frequently, although often only as individual plant. This higher rainfall regime also causes reason for concern - the herb layer on most of the poor sites is so denuded that soils below the high shrubs are generally bare, and large scale sheet erosion with associated nutrient and seed loss is evident throughout this vegetation type. Added to this is that should grasses germinate, they will do so under a dense canopy where light levels are considerably reduced.

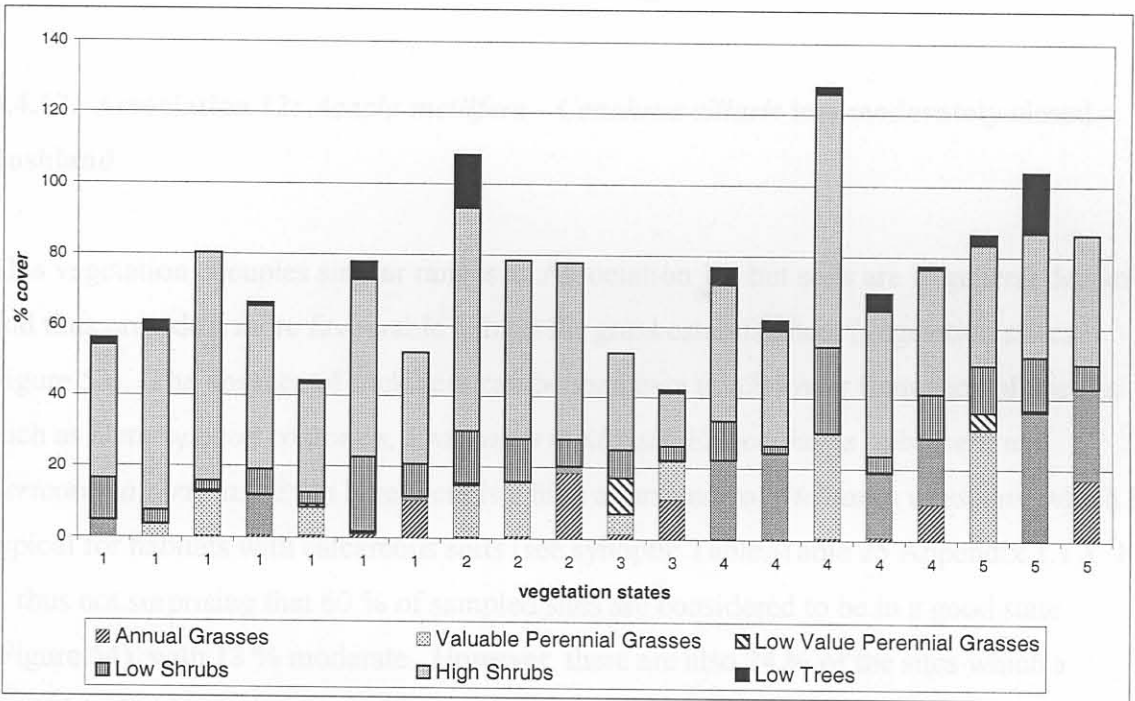


Figure 51: Selection of samples representing the different vegetation states found in association 11.



Figure 52: Example of vegetation of association 11 in state 2 (poor). Note the dense stands of *Acacia mellifera* and *Dichrostachys cinerea*.

9.4.12. Association 12: *Acacia mellifera* - *Cenchrus ciliaris* low moderately closed bushland

This vegetation occupies similar ranges as Association 11, but soils are in general deeper and thus provide a more favourable habitat for grass establishment (vegetation states Figure 53). The absence of rockiness can be seen by a much lower frequency of species such as *Heteropogon contortus*, *Eragrostis nindensis*, *Eriocephalus pubescens* and *Sericorema sericea*. Even here there is a high abundance of *Melhanianthus virescens*, which is typical for habitats with calcareous soils (see synoptic Table, Table 25 Appendix 1.1.). It is thus not surprising that 60 % of sampled sites are considered to be in a good state (Figure 54), with 13 % moderate. However, there are also 24 % of the sites which are considered very poor to poor. Looking at the latter sites, the most dominant grass is *Eragrostis porosa*. Still, in all these sites valuable perennial grasses are present - but only in corners inaccessible to livestock due to the dense shrub layer - which is an added

problem on these sites. Stands of *Acacia mellifera* usually reach densities of 30 % to 50 % cover, occasionally *Dichrostachys cinerea* is equally dense.

Compared to association 11, an increased presence in weedy species can be found. Such species include *Pupalia lappacea*, *Solanum incanum*, *Acalypha indica*, *Tribulus terrestris* and *Chenopodium olukondae*.

On good sites, cover % of *Cenchrus ciliaris* ranged from 15 % to 45 %, with *Eragrostis trichophora*, *Stipagrostis hirtigluma* and *Sporobolus fimbriatus* being amongst the other more common valuable grasses. *Urochloa oligotricha* has also been recorded most abundant in this vegetation type (see Table 25 Appendix 1.1.), although present in mostly low densities. Discussions with farmers here have shown that condition of the veld clearly reflects management strategies. On a farm, which has consistently high densities of *Cenchrus ciliaris*, only conservative numbers of small-frame Sanga-cattle are kept. The farm was de-bushed in 1980, and as necessary, follow-up treatments using fire are applied time and again - but only if fuel loads are sufficient for an intensive fire.

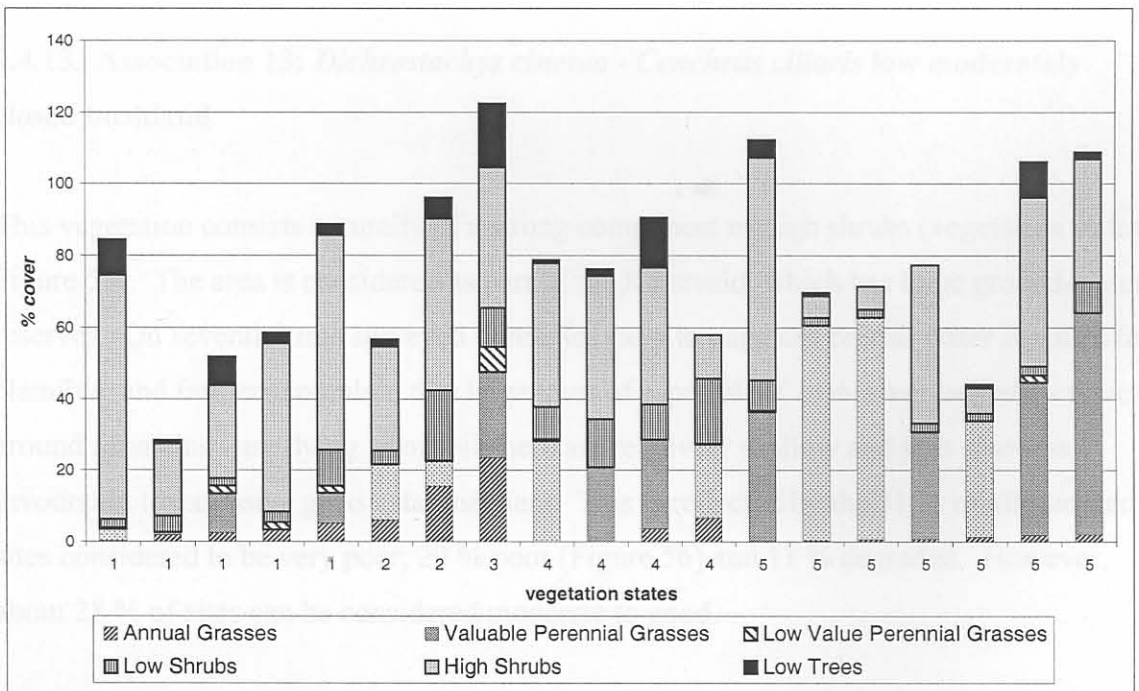


Figure 53: Selection of samples representing the different vegetation states found in association 12.



Figure 54: Example of vegetation of association 12 in state 5 (good). The dominant grass here is *Cenchrus ciliaris*.

9.4.13. Association 13: *Dichrostachys cinerea* - *Cenchrus ciliaris* low moderately closed bushland

This vegetation consists naturally of a strong component of high shrubs (vegetation states Figure 55). The area is considered as part of the Karstveld, which has large ground-water reserves. On several farms surveyed boreholes exist to augment central water supplies for Namibia, and farmers complain that large trees of especially *Combretum imberbe* - typical around fountains - are dying. Topsoils here are relatively shallow and thus also less favourable to extensive grass establishment. This is reflected by the 31 % of all sampled sites considered to be very poor, 29 % poor (Figure 56) and 11 % degraded. However, about 28 % of sites can be considered moderate to good.

Common and abundant grasses in the poor and degraded vegetation states are, in order of importance, *Eragrostis porosa*, *Melinis repens* ssp. *grandiflora*, *Enneapogon cenchroides*

and *Urochloa brachyura* - all indicating the pioneer-like state of the herb layer here. The most common valuable grasses on the better sites are *Cenchrus ciliaris*, *Eragrostis echinochloidea*, *E. trichophora* and *Heteropogon contortus*. Notably there is not, as in previous associations, a clear trend of high shrub invasion couples to weak grass layer. Several sites with very poor grass layer also only have 15 % shrub cover and overall vegetation cover is low. On the other hand, shrub densities on good sites may reach 30 % to 50 % cover - valuable grasses found here include *Enneapogon scoparius* and up to 10 % *Urochloa oligotricha* - grasses which are believed to disappear first under high grazing pressures. These particular sites were found on a farm with very strict rotational grazing management practices. However, even on this farm sites of very poor condition were found - indicating that the condition of grass layer is strongly influenced by habitat conditions.

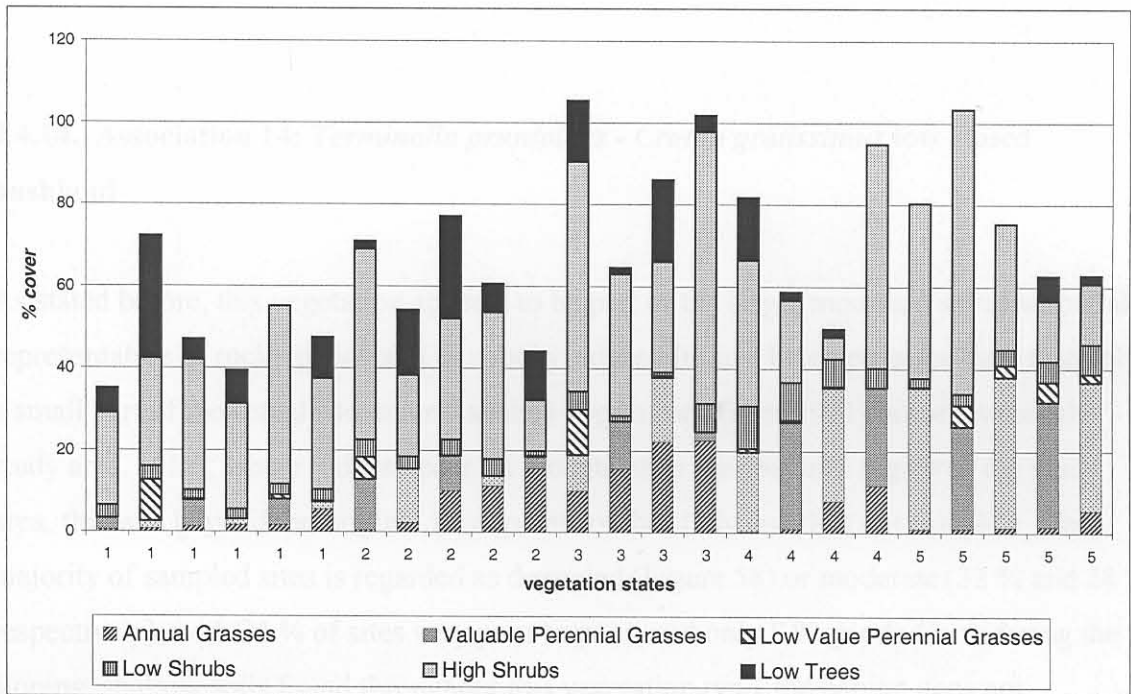


Figure 55: Selection of samples representing the different vegetation states found in association 13.



Figure 56: Example of vegetation of association 13 in state 2 (poor).

9.4.14. Association 14: *Terminalia prunioides* - *Croton gratissimus* low closed bushland

As stated before, this vegetation appears to be part of the larger mountain savanna, but also representative of rocky plains and low rocky ridges. It must be emphasised here that only a small part of the actual Mountain Savanna vegetation (Giess 1971) occurs within the study area. Also, where it does occur on mountains in the southern region of the study area, this was beyond the original focal points of the study and thus not sampled. The majority of sampled sites is regarded as degraded (Figure 58) or moderate (32 % and 28 % respectively), with 24 % of sites very poor to poor, and only 8 % good. Considering the sloping, shallow soils found throughout this vegetation type, the habitat does not necessarily support a dense grass layer and is easily over-utilised (vegetation states Figure 57). Although this vegetation has a naturally dense shrub component, it was found that especially *Terminalia prunioides* but also *Dichrostachys cinerea* and *Acacia mellifera* form impenetrable thickets, especially on footslopes of mountain ridges.

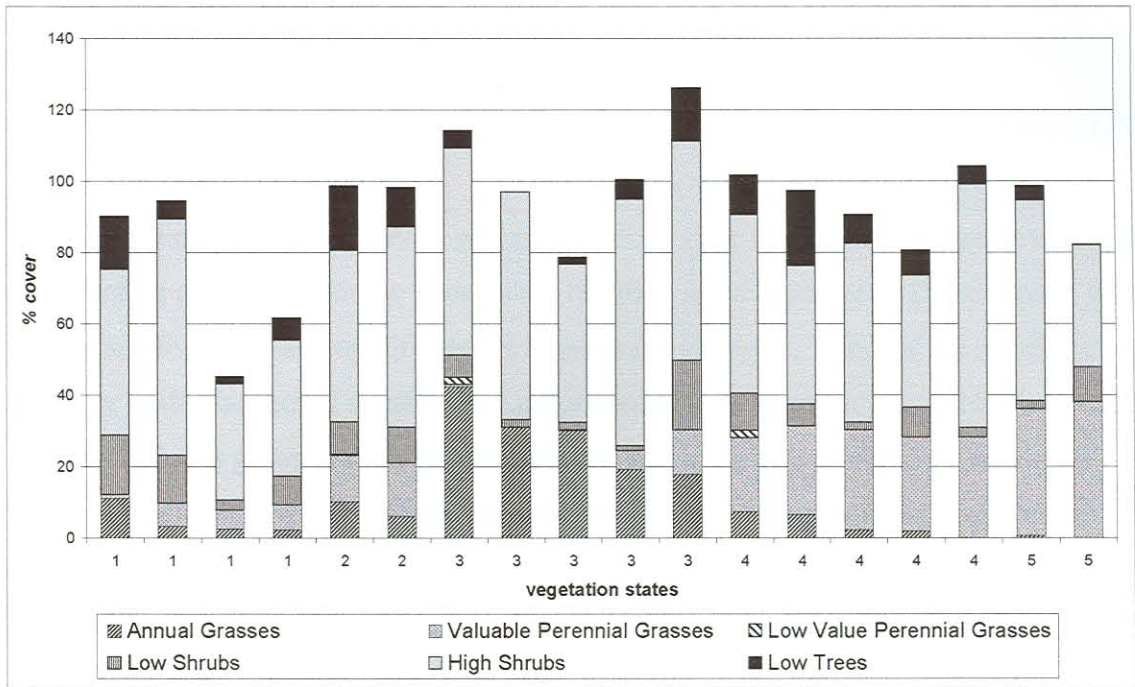


Figure 57: Selection of samples representing the different vegetation states found in association 14.



Figure 58: Example of vegetation of association 14 in state 3 (degraded).