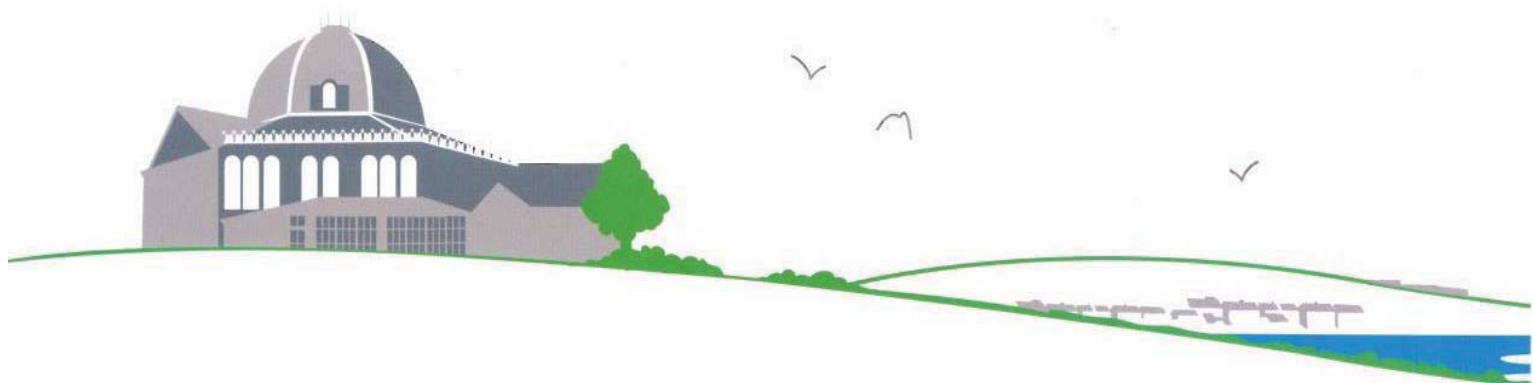




THE STATES OF JERSEY –
PLANNING AND ENVIRONMENT DEPARTMENT

VEGETATION MAPPING, LES BLANCHES BANQUES, 2014



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This project has been undertaken in accordance with PAA policies and procedures on quality assurance.

Signed: 

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1. INTRODUCTION

- 1.1 This report has been produced by Penny Anderson Associates Ltd (PAA) on behalf of The States of Jersey, Planning and Environmental Department. It presents the results of undertaking a new vegetation mapping exercise on the Les Blanchés Banques sand dunes, Jersey and compares the results with similar exercises undertaken in 2005 and 1994, which itself compared a similar mapping exercise that was not presented on GIS, undertaken in 1983.
- 1.2 Les Blanchés Banques sand dunes were mapped by PAA in 1983, 1994 and 2005 prior to the 2014 survey. This provides a unique set of measures of the changes that have taken place. Aerial photographs were examined under a stereoscope to identify the boundaries of and types of vegetation communities present in the first two mapping events. The interpretation was then ground-truthed to ensure accurate representation of vegetation community boundaries, and final vegetation maps prepared. However, in both the earlier surveys, the photographs were not ortho-rectified, and did not completely fit together due to distortion. Since then, the 1994 map has been generated in GIS to provide a continuous and interpretable representation of the vegetation. This provides the opportunity to compare more accurately the 2005 situation with that in 1994 and, in turn, the 2005 mapping can be compared readily with that undertaken in 2014.
- 1.3 The vegetation community types were classified using a subjectively derived system of plant communities first developed for the 1983 mapping exercise, which was expanded from Ranwell's (1975) list.
- 1.4 In 2005 and 2014 up to date aerial photographs were used to re-survey roughly the same area as in 1983 and 1994. In 2014, the main area of the dunes was extended for the first time to map the vegetation on the dunes between the sea wall and the coastal road (the Frontal Dunes) and an area at the north west end of the dunes (Bosdet), also a small area on La Moye Golf Course was added. The photographs used in 2014 were of equally high quality and clarity as those used in 2005 and were available digitally, ortho-rectified, and at a large scale. The clear resolution of the aerial photographs meant that the vegetation interpretation could be marked directly onto the aerial photographs.
- 1.5 The report sets out the methods applied in some detail, before describing the results of the 2014 mapping. Chapter 4 then compares the vegetation found in 2014 with that recorded in 2005 and 1994, and discusses the possible reasons for the changes found. Some conclusions are drawn in the final chapter.

2. METHODOLOGY

Field Survey

- 2.1 The vegetation communities across Les Blanches Banques dunes were initially identified from aerial photographs and traced, which were then taken into the field and checked for accuracy. The aerial photographs used were at a scale of 1:13,000 with a 1979/1980 black and white version used for the 1983 survey and a colour version used in 1994. Figure 1 shows the extent of the 1994, 2005 and 2014 surveys, with the area outlined that is in common between them. This overlapping area between the 2005 and 2014 surveys constitutes the major part of the dunes and covers 106.04ha.
- 2.2 For the fourth survey visit in 2014, a new set of colour aerial photographs were used. The photographs were printed out in colour from an electronic source onto A3 sized paper with the 2005 community types shown and used directly for checking in the field. The scale used was 1:1,000 and resulted in a set of 27 maps. Map numbers are used occasionally in the report and datasets to aid location of various features or species. The scale is much greater than in the first two mapping exercises and will, therefore, have resulted in the definition of more detail in 2014 than in previous years. This will influence how the results compare with earlier vegetation mapping.
- 2.3 The same approach that was used in the earlier surveys to classify the vegetation communities has been adopted. The descriptions, which are summarised below, are physiognomic; that is, they describe the patterns of frequency and abundance of species and the vegetation structure in a way that gives a picture of the community which supplements the raw data of the species tables (Appendix 1). Consistency of approach in allocating vegetation to different community types was practiced on the first day of survey with all five surveyors as a measure of quality control. However, as the vegetation varies considerably, there is likely to have been some variance between the surveyors in interpretation, especially where the vegetation was of mixtures of communities. This is taken into consideration when the results are analysed.
- 2.4 The 1983 survey was conducted in May and August, whilst in 1994 it was undertaken over a week in May with supplementary checking in July. In 2005, three surveyors, including one that had also mapped the vegetation in both the earlier surveys, undertook the work in early July. In 2014, the mapping was repeated with five surveyors, one of whom had been involved in all the earlier mapping work, in the same period in late June/early July as the 2005 survey. However, the weather had been very dry in the June preceding the 2014 survey, resulting in some plants being shrivelled and undistinguishable. This is unlikely to have made any significant differences to the vegetation communities, but some of the early-flowering species would have been recorded less often. This would not affect the species lists significantly (although a few species may appear to be missing) but could affect the perceived abundance of selected species on the site as each list represents all species found within that community type throughout the site. The earlier date for part of the 1983 and for the 1994 surveys permitted the identification of more annuals, some of which have not been recorded in the later 2005 or 2014 surveys. The differences in the species listed (Appendix 1) are more likely to be a product of this seasonal difference, than in losses in the flora for the annuals in particular.

The Plant Communities

A - The Disturbed, Tall Herb Community

- 2.5 This community mostly occurs along the road-side banks and areas near the car parks. It was established when the car parks were developed in 1974 (Walker 1980) and was colonised by a range of easily dispersed species, including many indicative of an enriched soil which is often

associated with this type of disturbance. The main species were marram (*Ammophila arenaria*), cock's-foot (*Dactylis glomerata*), and ribwort plantain (*Plantago lanceolata*). The conspicuous plants of hogweed (*Heracleum sphondylium*) and fennel (*Foeniculum vulgare*) stood out amongst the tall herbage, whilst smaller species compete for space nearer the ground.

- 2.6 Since the 1983 mapping, the incidence of this community declined and little was found in 2005. However, the number of patches and area had increased by 2014. This is partly due to the additional areas of ruderal communities found within La Moye Golf Course that was not included in previous surveys. The species in 2014 were similar to those in 1994, but with additional quantities of some of the ruderal annual grasses such as large quaking grass (*Briza maxima*), barren brome (*Anisantha sterilis*) and great brome (*Anisantha diandra*) and thistles (*Cirsium* species). Bur chervil (*Anthriscus caucalis*) is no longer a feature of this habitat as it was in 1994.

T – Tall Ruderal

- 2.7 A new type of ruderal community was found within La Moye Golf Course, which is longer established and with fewer annual species but a number of common 'weedy' types of species. The core of the vegetation is common nettle (*Urtica dioica*), but with frequent Yorkshire fog (*Holcus lanatus*) and ruderal species like hemlock (*Conium maculatum*), smooth sow thistle (*Sonchus oleraceus*), hogweed, cleavers (*Galium aparine*) and cock's-foot.

The Generic B Vegetation

- 2.8 The B vegetation represents the richer grasslands of the grey dunes (Plate 1). Overall, there are many variations in the species-rich communities which have been combined into this group B vegetation, usually with a selection of perennials and a wide range of the small dune annuals. In some areas, bare ground is more common, whilst elsewhere a more complete turf with grasses (mostly fescue species) or burnet rose (*Rosa pimpinellifolia*), is prominent. All share an open habitat with low competition, in which the annuals can thrive. In general, it is these species-rich communities which used to support some of the orchids now rare or extinct in Jersey (Le Sueur 1984). These include the butterfly-orchid (*Platanthera bifolia*) and lady orchid (*Orchis purpurea*) and several other species that are now re-appearing. Pyramidal orchid (*Anacamptis pyramidalis*) was re-found on the dunes in 2005 and still persists in 2014 in both B and Bi and other communities (Appendix 1). In addition, although not on Les Blanchés Banques, bee orchid (*Ophrys apifera*) was found in 2012 just north of El Tico café on the edge of the footpath, whilst early spider-orchid (*Ophrys sphegodes*) appeared in 2013 near the perimeter fence around La Mielle de Morville ponds on the landward side of La Grande Route des Mielles. With both in the area, re-colonisation of Les Blanchés Banques is a real possibility.
- 2.9 There are a number of types of B vegetation. B is open, with some bare ground on a small intimate scale, species-rich, short, mostly rabbit dug and grazed, with less than 50% cover of burnet rose. It is extensive lichens like *Cladonia* and *Peltigera* that characterise B, plus mosses of open ground such as *Tortula* species. *Scleropodium purum* is also an abundant moss in this community. Sometimes bracken (*Pteridium aquilinum*) can invade the B community, both the diverse one and the more robust fescue sward (Bi).
- 2.10 With less rabbit grazing and no significant influx of sand, this vegetation becomes Bi which is largely a *Festuca* vegetation (red and sheep's-fescue *Festuca rubra*, *F. ovina*), with much less space and fewer mosses of open ground. Bi supports far fewer lichens, is less open, and is taller and denser, although still probably under about a 15cm-20cm height. This in turn merges with the rose dominant (J) vegetation, which occurs when there has been considerable sand blow and the rose has grown up through it to become more than 50%, usually about 80% dominant with much less richness than is characteristic of B. These community types are, therefore, all inter-related. There are a number of places where it is difficult to decide whether

the vegetation is B or J and these have then been identified as co-dominant between these types when it is estimated that there is about 50% of each.

B - Short Species-rich Vegetation with Moss and Lichens

- 2.11 This community occurs wherever there is an abundance of rabbits. The community is relatively rich in broadleaved species, such as those listed below for Bi, but also has an abundant cover of lichens and moss. In some areas, however, burnet rose can attain local prominence, although if this reached more than half the cover, the community was defined as a mixture of this and the rose community (J). Due to a high level of rabbit activity in these areas there are often several patches of sand within them, which can be identified on the aerial photographs. Plate 1 shows a good example of this community, with Plate 2 showing a mixture with open marram.
- 2.12 There are a wide variety of accompanying species in this species-rich community including common bird's-foot trefoil (*Lotus corniculatus*), common restharrow (*Ononis repens*), field wood-rush (*Luzula campestris*), wild thyme, (*Thymus polytrichus*), fragrant evening-primrose (*Oenothera stricta*) and the two plantains, ribwort and buck's-horn (*Plantago lanceolata* and *P. coronopus*). Annuals are also conspicuous, such as early sand-grass (*Mibora minima*) one of the rarer species, sand cat's-tail (*Phleum arenaria*), early and silver hair-grasses, (*Aira praecox* and *A. caryophyllea*), hare's-tail (*Lagurus ovatus*) and dune fescue (*Vulpia fasciculata*). The grey hair-grass (*Corynephorus canescens*) and crested hair-grass (*Koeleria macrantha*) are also frequent associate species. This community richness has not changed significantly since 2005, although a few additional species have been recorded and some of the early flowering annuals were not found along with lizard (*Himantoglossum hircinum*) and green-winged orchids (*Anacamptis morio*). These two orchids were recorded earlier in May, the latter in good numbers, by local recorders on the site. The B community, along with the following one, was one of the richest found on the dunes in terms of the number of species recorded for it (94 in 2014).¹

Bi - A Variable, Short Turf Species-rich Community

- 2.13 This community is characterised by a more dense cover of vegetation with less burnet rose and rabbit activity, and less moss and lichen cover. Where there is insufficient rabbit grazing the vegetation develops towards the tall rank grass community E. Areas of this community comprise a complete plant cover with abundant red fescue and sometimes burnet rose. A variety of perennials provide the community matrix – especially biting stonecrop (*Sedum acre*), common restharrow, smooth hawk's-beard (*Crepis capillaris*), lady's bedstraw (*Galium verum*), common bird's-foot trefoil, ribwort plantain, sand sedge (*Carex arenaria*) and wild thyme. Species like bulbous buttercup (*Ranunculus bulbosus*) that had been recorded as abundant in the community were not recorded from the survey in 2014 owing to the preceding dry period. Within this permanent structure, over 70 other species of plant were found in all three surveys, with a high of 110 in 2014 (again bearing in mind that there were more patches of this community in the wider survey area this year). Many were other perennials; some are of particular interest in Jersey, such as Jersey thrift (*Armeria arenaria*) and rough star-thistle (*Centaurea aspera*).
- 2.14 In addition, there are good numbers of annuals, especially winter annuals, in this sward which include several pretty little grasses like early and silver hair-grass (although these seemed to be abundant in particular areas and scarce in others) and dune fescue. There are several small

¹ The species list is also longer owing to more areas of this habitat being surveyed in 2014 owing to the inclusion of the frontal dunes and Bosdet.

crucifers and chickweeds, thyme-leaved sandwort (*Arenaria serpyllifolia*), red bartsia (*Odontites verna*) and early sand-grass representing the annual interest. The very rare childing pink (*Petrorhagia nanteuilii*) was not recorded in 2005 but was found on the frontal dunes in 2014, but had been in this Bi community in the 1983 survey in the centre of the dune plain. The nationally rare small hare's-ear (*Bupleurum baldense*) was recorded regularly, sometimes in some abundance, in this community type in 2014. The June/July survey period after droughted conditions proved too late to re-find a number of species. Nevertheless, 108 species were recorded in this vegetation type in 2014, albeit across a larger number of patches than in previous years.

- 2.15 One group of plants which is particularly well represented in this community type is the clovers. Fourteen species have been recorded on the sand dune system (although the area surveyed is not clear) (Ranwell 1972), and a further four medick species can be included here too, although few were found during the June/July 2014 work, when many of these species would have been over.

Bii - Trampled, Species-rich Community

- 2.16 On the vegetated paths (mostly those on the plain), trampling reduces the height and vigour of many species and can eliminate those which are more sensitive from the plant community. On the other hand, there are plants which are more tolerant of being trampled and which will spread into the vacated niches. Thus, different trampling intensities produce different communities. Furthermore, there is often a gradation of use across a path, producing a lightly trampled fringe and more heavily used central section. More than one path community, therefore, can be present on each path section.
- 2.17 On the more intensively used paths, especially those near the car parks and used by dog walkers, most of the species typical of the rich community are replaced by perennial rye-grass (*Lolium perenne*). On the edges of these paths and on the less trampled areas, the species-rich community is maintained, although with a lower diversity. Here, trampling-resistant plants like buck's-horn plantain can be particularly abundant.
- 2.18 Many of the same dune annuals and perennials as are present in the untrampled community Bi also occupy the fringes of, and on less heavily used paths. A few species were recorded in Bii in 2014 which have not been recorded previously, but this will depend on where the boundary is placed on the ground between this and neighbouring vegetation and all the additional species were typical of other B communities. The quantity of bare ground is small, usually less than 20%, and patchy on the whole. Once trampling intensities reach the level at which all the plants are destroyed, the path becomes completely bare of vegetation, at least in a narrow strip, and this is mapped as bare sand if large enough to be visible on the aerial photographs.

C - Open Tussocky Marram Grass

- 2.19 This community incorporates those areas where marram is abundant, but where bare ground is also prominent. The assemblages of other species vary from few to a species-rich turf or bracken. Marram tends to be the main species where it has colonised mobile sand and few other species have been able to invade. These few include sea-holly (*Eryngium maritimum*), lesser hawkbit (*Leontodon saxatilis*), Portland spurge (*Euphorbia portlandica*) and grey hair-grass. The fragrant evening-primrose is particularly conspicuous in some of the plateau dunes immediately above the plain and in the frontal dunes.
- 2.20 In other areas the marram is no doubt a vestige of a former period of sand blow, which has subsequently been colonised by a species-rich turf described as type B, with species such as lesser hawkbit in particular (see Plates 2 and 3). The marram is often in very poor condition in these areas where sand is no longer accumulating. The mixture with bracken can be explained

on the slopes east of La Carrière Quarry and continuing from here onto the frontal dunes by the close proximity of the underlying granite to the surface, and the deeper rhizomes of the bracken. On the main dunes, bracken is abundant at the foot of these granite-underlain slopes to the north, and on the dunes south-west, north and north-west of the houses on Le Chemin de Basses Mielles. It is possible that leaching has been sufficient to produce pockets of more acid soils, or alternatively, that the bracken is rooted in buried older soils beneath a cover of freshly blown sand which marram subsequently colonised.

- 2.21 Where this vegetation occurs along the sides of paths, the marram grass sward is often lacking in vigour, with bare sand in the middle or in between tussocks. In contrast, where this occurs in blow outs then the marram grass is upright, a little more vigorous, but often with large spaces in between and an early colonising semi-mat of mosses with a range of other species. There are places where this has been shown as C/S (sand) where it is simply a much more open, tussocky vegetation than normal. Most of the areas on paths could be described as C/S, where trampling has reduced the vegetation to just marram and bare sand.
- 2.22 Several species have been recorded for the first time in this community (although typical of other vegetation types). These include hare's-foot clover (*Trifolium arvense*), red, white and rough clovers (*T. pratense*, *T. repens* and *T. scabrum*) and, more rarely, dwarf pansy (*Viola kitaibeliana*). Since large areas of this vegetation type occur on the frontal dunes which have not been recorded previously in the vegetation surveys, then new species might be expected.

D - Closed Marram

- 2.23 In some areas marram forms dense vigorous swards, often being invaded by other species of rank grassland after the marram has stabilised the sand. There are other plants which can be found amongst this marram such as wild carrot (*Daucus carota*), cock's-foot and ribwort plantain (Plates 4, 5 and 6).
- 2.24 One situation in which marram is prominent in a closed community is where it is co-dominant with grasses. In some areas, particularly amongst the low dunes at the landward end of the plain, it forms a dense sward with the stronger growing grasses downy oat-grass (*Avenula pubescens*), sea couch (*Elytrigia atherica*) and cock's-foot. Other species like fragrant evening primrose, hare's-tail, fennel and Yorkshire-fog are also prominent. In this more nutrient enriched vegetation there is rarely any bare ground, but species like wild carrot, smooth hawk's-beard and lady's bedstraw are able to compete for space.
- 2.25 Several species were recorded in this community in 2014 that had not previously been recorded in it, but this needs to be qualified by the fact that large patches of D were located on the frontal dunes that had not been recorded previously in these surveys. The species were characteristic dune ones such as sand cat's-tail, smooth cat's-ear (*Hypochaeris glabra*), sea holly, sand (*Elytrigia juncea*) and sea couch, grey hair-grass and smooth hawk's-beard.
- 2.26 It is not clear whether C (open marram) precedes B (species-rich vegetation) in vegetation development, it is thought that it probably does, but there are no clear areas where C seems to be developing into D or vice versa. Thus D/E mixtures seem to represent a much more stable, longer established vegetation in which tall grasses have developed, probably relating more to lack of rabbit grazing. So C to B may be the grazed route and D to E the ungrazed route for marram vegetation development, or C and D could simply occupy different situations in relation to sand accumulation rates, slope and time.

E - Rank Grassland

- 2.27 The nature of the community indicates a stable soil with increased organic matter and nutrient content. The plants themselves provide a continuous, tall cover with no bare ground visible

(unless a few rabbit burrows and scrapes are present), and a thick litter layer has developed on the soil surface.

- 2.28 Five grasses form the bulk of this community - sweet vernal-grass (*Anthoxanthum odoratum*), red fescue, cock's-foot, downy oat-grass and common bent (*Agrostis capillaris*) - and dominate or co-dominate in swards throughout the plain. The last species, which is indicative of more acid soil conditions, is less abundant than the rest on the main area of the dunes, but is more widespread on Bosdet (Plate 7) and grasslands on the plateau in La Moye Golf Course. Downy oat-grass and sweet vernal-grass are the most widespread species.
- 2.29 Other species are common in this rank grassland, but the overall diversity is substantially reduced in comparison with the shorter, more open turf and path fringes. Burnet rose, common restharrow, wild carrot, lady's bedstraw, ribwort plantain, sand sedge and field wood-rush are prominent associates.
- 2.30 The community is much taller than B, although it does grade from Bi to E, when sweet vernal-grass is beginning to increase, but there is still good *Festuca*-rich vegetation. In these situations species-richness is declining and other tall rank grasses have not yet colonised extensively in this transition. A number of areas were identified that were of this transitional nature and labelled B/E or Bi/E. Plate 4 shows areas of rank grass. The dynamics between B and E communities seems to be dictated by the degree and effect of rabbit grazing. Well grazed vegetation with plenty of rabbit scrapes is more likely to be richer B community, whereas where there is insufficient grazing, soils stabilise and mature, and the taller grasses and burnet rose increase the vegetation height, increase litter and swamp out the smaller species over time. The level of grazing varies with a wide range of factors.

F - Gorse Scrub

- 2.31 Scrub dominated by gorse (*Ulex europaeus*) occurs in patches encompassing a wide variety of areas on the dunes (Plates 4 and 7). Some are present on the dune plain and higher dunes and these tend to be small in size, but more extensive patches are spread on the banks below La Moye Golf Course and on slopes (in particular). The gorse seems to pass through a growth cycle similar to that of heather (*Calluna vulgaris*) (Gimingham 1972), where the young colonising plants are intermingled with other species dependent on the type of community being colonised. Mature gorse is dense and impenetrable, thus reducing the light to the ground below and effectively eliminating many of the species previously present. At a later stage, the gorse canopy breaks open and the increased light allows the invasion of other species. However, with the concomitant change in soils produced by the gorse itself, the species which invade are not necessarily those which were ousted earlier in the life cycle of the gorse.
- 2.32 The range of species found with the gorse in the 1983 survey including sweet vernal-grass and burnet rose in the earlier stages, and a variety of species like madder (*Rubia peregrina*), common dog-violet (*Viola riviniana*), Nottingham catchfly (*Silene nutans*) and common sorrel (*Rumex acetosa*) in the latter stages of development. Butcher's-broom (*Ruscus aculeatus*), broom (*Cytisus scoparius*) and sea campion (*Silene uniflora*) occurred with the gorse around granite outcrops east of La Carrière Quarry. Cleavers and common chickweed (*Stellaria media*) are good indicators of the nutrient enrichment which the gorse induces, whilst ivy (*Hedera helix*) is a characteristic coloniser under an opening canopy. A variety of other shrubs have been found to invade the opening gorse canopy, all of which feature in the next plant community.
- 2.33 By 2005, the associated species were much more restricted, and bramble (*Rubus fruticosus*), burnet rose and sweet vernal-grass were the main ones, with wild privet (*Ligustrum vulgare*) mixed with the gorse on a regular basis. This possibly indicates the regrowth of the gorse after the 1990 storm, and thus it would still be in the early stages of development in 2005, compared with much older gorse in 1983 that then succumbed to the gale.

- 2.34 By 2014, the gorse tended to be mostly dense and of moderate height, with little reaching maturity. The main species mixed with gorse is still privet, but burnet rose is a frequent associate with a scattering of evergreen oak (*Quercus ilex*). Herbaceous species include ivy, cock's-foot, thistles and honeysuckle (*Lonicera periclymenum*) which suggests a maturing thicket of gorse rather than young patches, in line with the development pattern suggested above after the 1990 gale.
- 2.35 It is not clear how the gorse might develop in the future. Severe gales with salt laden winds can destroy it in different areas, depending on the degree of shelter. Older plants with rabbit warrens beneath may open out and be re-colonised by dune vegetation as the gorse matures. In some areas, mixed gorse with other shrubs could indicate where new scrub species have invaded (it is possible that many berry-bearing shrubs like hawthorn, privet and blackthorn establish from bird droppings after the birds have been perching/roosting or breeding in the gorse) and grown up through the shelter of the gorse canopy. There are many patches of mixed scrub and gorse (about 50% of each), particularly on the Bosdet section of the site. The future of each patch is, therefore, dependent on particular local circumstances.

G - Mixed Shrubs

- 2.36 Although gorse is often present, this community represents a more intimate mixture of different shrubs. The most widespread are wild privet and hawthorn (*Crataegus monogyna*). Blackthorn (*Prunus spinosa*), elder (*Sambucus nigra*), occasional evergreen oak, pedunculate oak (*Quercus robur*) and pine (*Pinus* sp.) have also been found in the scrub patches. Bramble is abundant in the more open scrub and patches of common nettle indicate nutrient-enriched soil. Where the scrub is open enough to allow light to penetrate to the ground layer, a range of more typical woodland species such as ivy and, much more rarely, stinking iris (*Iris foetidissima*) can be found. Madder is quite common under some of the scrub, vestiges of the pre-scrub vegetation are still present as well and bracken is well mixed with a significant number of patches.
- 2.37 Many patches of scrub proved to be impenetrable on the whole, thus further species growing beneath the woody species or within the shrub mixture may have been missed, although binoculars were used as far as possible. Some of the scrub patches are large, meaning that species may have been missed more in these than associated with the smaller patches.

H - Wet Rush-grass/Wetland Vegetation

- 2.38 The key area of this wet plant community occurred in 1983 in the valley west of La Moye Golf Course. It extended between the incipient willow woodland and the point at which the water sinks into the sand upstream from the woodland. The species present were those typical of damp grassland or marshes. Hard rush (*Juncus inflexus*) was locally abundant and sharp-flowered rush (*J. acutiflorus*) covered patches of the ground by the stream. There were also stands of water mint (*Mentha aquatica*), common fleabane (*Pulicaria dysenterica*), hemp-agrimony (*Eupatorium cannabinum*) and purple-loosestrife (*Lythrum salicaria*). Further upstream, in the two areas where the springs issued from the golf course, the marshy vegetation changed to one dominated by tussocks of purple moor-grass (*Molinia caerulea*) and a scattering of marsh pennywort (*Hydrocotyle vulgaris*) - now a Jersey BAP species. Amongst these, several orchids were found, probably of southern marsh-orchid (*Dactylorhiza praetermissa*).
- 2.39 In 2005, there were few vestiges of this wetland community, although the more vigorous hemp-agrimony community remained. By 2014, the *Molinia* community had been subsumed by the willow woodland and had all but disappeared. However, just prior to the 2014 season, some of the scrub at the bottom of the valley had been cleared and a new wetland is establishing on either side of a patch of remaining trees. An abundance of ragwort (*Senecio jacobaea*) and

common nettle shows the effects of recent disturbance, but a good number of wetland species are present and will hopefully spread – common fleabane, hemlock water dropwort (*Oenanthe crocata*), chamomile (*Chamaemelum nobile*), rushes and water mint. Monitoring of the spread of these species and the invasion of others would reveal the degree of success of this management over time. It would also be worthwhile removing more of the willows 'upstream' of the recent works to see if the *Molinia* strip could be re-established as well, provided sufficient clean water can be assured from the golf course above.

- 2.40 A new wetland has developed associated with the La Carrière car park, which had a fringe of common spike-rush (*Eleocharis palustris*), rushes (*Juncus* species) and water mint in 2005. This has changed in 2014 to parrot feather (*Myriophyllum aquaticum*), which needs to be removed, and white water lily (*Nymphaea alba*). A small strip of wet grassland/marsh had developed around this pond by 2014, with species including yellow bartsia (*Parentucellia viscosa*), which is an uncommon species in Britain.
- 2.41 The 2014 survey included a large area of woodland at the eastern end of Bosdet, which includes a new wetland that seems mostly to be a reed bed. This was inaccessible apart from the southern edges. Common reed (*Phragmites australis*) formed a significant patch, with other tall and smaller wetland species around the southern edge.

I - Bracken Dominant or Co-dominant

- 2.42 Bracken tends to be more abundant on and below the sand-covered granite slope below La Moye Golf Course, and near the housing on Le Mont a la Brune. On the whole, it can appear in dense stands mixed with scrub on the slopes below the golf course, or in areas where recent sand-blow is being stabilised by marram (as around La Carrière Quarry and on the frontal dunes) or in short grassy areas. The other species in these communities are those characteristic of scrub, open marram, rose or short, species-rich turf (Plate 8). The bracken does not grow strongly on the lime-rich sand and seems to suffer in such situations from drought and nutrient deficiencies (as evident in the foreground of Plate 5 on Bosdet).

J - Burnet Rose Dominant

- 2.43 For the most part, burnet rose occurs as a co-dominant species in the grassland variants (particularly with B communities (see para. 2.10), or at the edge of the scrub. However, in the vicinity of many of the paths, especially on the low dunes below the golf course, burnet rose is the main species of an open community into which few other species have spread (Plate 9). Walker (1980) attributes this dominance to the recent burial of the underlying turf by blown sand from nearby paths or tracks. The burnet rose can grow up through a small amount of accumulating sand, but many of the other species previously associated with it in the blanketed turf fail to survive. Exceptions are lady's bedstraw and wild thyme which are often associated with this burnet rose community. Other species such as early hair-grass, rough star-thistle, mouse-ear species (*Cerastium* sp.), crested hair-grass, field wood-rush, restharrow, ribwort plantain and common milkwort (*Polygala vulgaris*) are also regular to occasional companions.
- 2.44 Burnet rose tends to form mixtures with the B species-rich grasslands in particular, as explained in para 2.10 above.

K - Woodland

- 2.45 As might be expected so close to the salt-laden winds off the sea, woodland is scarce on Les Blanchés Banques. Only a few areas can be defined as woodland, where the canopy is high enough to permit entry, and the light levels sufficient to allow a ground flora to develop. These areas are strongly contrastive. One is a small willow (*Salix*) patch on the southern border of the area, straddling the seasonal stream issuing from the golf course. Hawthorn, evergreen oak

and blackthorn are the other trees, and the ground flora consists of patches of common nettle which are indicative of nutrient enrichment (no doubt off the golf course). Ivy is also widespread, especially under the denser parts of the canopy.

- 2.46 A second much larger area of woodland lies on the north-eastern boundary and extends into two long arms north-east from Bosdet, much of which has not been surveyed before as part of the dunes. Some of this is also an area of long-established scrub which has developed into woodland. However, here the canopy trees are pedunculate oak and sycamore (*Acer pseudoplatanus*). Evergreen oak, hawthorn and elder are also present, and the ground flora includes abundant ivy and common nettle. Brambles are common. In the wetter woodland at the foot of this slope, there is a group of poplar (*Populus* sp.) and crack-willow trees (*Salix fragilis*), with a ground flora of wetland species including water mint and fool's-water-cress (*Apium nodiflorum*).
- 2.47 Woodland is now developing in small patches, or in mixtures with other vegetation types. The pine and evergreen oak canopies where isolated trees occur have been separated out as individuals in the analysis (e.g. Plate 5).

L - Heathland

- 2.48 Amongst the gorse and bracken on the slopes below La Moye Golf Course in particular, are patches of heathland where mostly bell heather (*Erica cinerea*) is mixed with a burnet rose/grass vegetation. The presence of the ericaceous species indicates acidic soils and is probably related to the proximity of the granite to the surface sand, and the stronger leaching on the north-facing slope. Only a few patches of bell heather were found anywhere else on the dunes, mostly on the Southern Dunes unit and towards the back of the dune plain on acidic, grass covered soils (Plate 10). The main accompanying species are bird's-foot trefoil, lady's bedstraw and some of the species associated with the granite cliffs like madder, bramble and common sorrel. The rare species shaggy mouse-ear hawkweed (*Pilosella peleteriana*) was found in heathland on the granite cliffs as well.

Invasive Species

- 2.49 Cape cudweed (*Gnaphalium undulatum*) has disappeared from the heathland sites but has appeared, in mostly small amounts, in most of the other vegetation types, suggesting gradual invasion. This is an alien species that is not a feature of the dunes and may need to be controlled. Ragwort is a native species that has to be controlled where invasive. It appeared in 2014 in the closed marram community, not having been recorded there before, but was occasional in many of the other vegetation types, particularly the grasslands, as it had been in previous years. Another invasive species is white stonecrop (*Sedum album*), which may have been wrongly identified at times in the past. This is quite abundant in some parts of the dune plain and edge of the escarpment in particular. It could be very difficult to control since each fragment remaining develops into a new mat of vegetation. However, its further invasion requires some control.
- 2.50 Parrot feather, an invasive wetland species occurs in the pond (first recorded there in 2014) in La Carrière car park and needs to be removed safely.
- 2.51 Russian vine (*Fallopia* species) forms a significant patch close to the house gardens off Mont a la Brune (Plate 7). This needs to be removed to prevent further spread. It seems to spread readily in Jersey's climate and has probably escaped from a neighbouring garden.
- 2.52 Tall nightshade (*Solanum chenopodioides*) was found mixed in some of the gorse and the scrub on Le Mont Tcheurdron, and on the high dunes for the first time. This is probably a garden escape, is not native and its spread needs to be monitored. If invasive, it should be

removed before it spreads further. Shrubby orache (*Atriplex halimus*) is a non-native shrub species found mostly near the coastal road on the dunes. It does not seem to be invasive here.

- 2.53 In the woodland at the north-eastern end of the site there is abundant winter heliotrope (*Petasites fragrans*), which is not native and is obviously rather invasive. However, this species has invaded other sites in Jersey and it may be too late to control it effectively now. This needs to be reviewed by the Environment Department in the context of the ease of control.

The GIS Mapping

- 2.54 Habitat survey data for the Les Blanchés Banques dune system were transferred into GIS format, using the ESRI ArcGIS 10 GIS and the latest editor on-screen digitising tools. Scanned A3 field survey maps were ortho-rectified and used as the base for digitising. This technique offers high levels of spatial accuracy and an ease of use relative to other methods.
- 2.55 The survey data were digitised directly into an existing 2005 GIS vegetation dataset (which was also used as a base for the field survey). The 2005 polygon survey boundary has been extended to match the Les Blanchés Banques SSI survey boundary and now covers a larger area.
- 2.56 After the initial data capture, a verification process was undertaken in which an experienced ecological surveyor reviewed the GIS dataset and air photography together, in order to identify any discrepancies. These were then corrected/amended as necessary. This has been undertaken twice to ensure corrections were completed accurately and other errors were not missed. The resulting GIS polygon layer holds over 4000 habitat patches each with an id code, vegetation code, area in meters squared and hectares, a general habitat class and whether it is a mosaic of several habitats. An additional GIS point layer was created to collect target notes, the locations of which are shown in Figure 1.
- 2.57 Once the habitat layer was completed in GIS format, the data were ready for manipulation and analysis to show the changes and habitats present on Les Blanchés Banques in 2014 and the new extensions which form the complete SSI.
- 2.58 The 2014 dataset was clipped to cover an identical geographical area to the 2005 survey for comparison purposes and to form an analysis boundary for the various tables presented in the report. The statistics used in these summaries and analysis were produced from these two layers: the 2005 dataset and 2014 dataset clipped to the same area. The only notable difference between these two layers was that in 2005 several of the northern car parks were included but they were excluded from the new 2014 SSI boundary. This was not considered a significant issue as the car parks fall within the habitat type 'bare ground' which is not a significant habitat. They could be excluded from the 2005 data set if required.

Some Limitations of the Surveys

- 2.59 There are a number of factors that will affect the confidence levels of the resulting mapping and the degree of certainty when comparing the vegetation between the two years. The main factors relate to:
- consistency of definition of vegetation types;
 - accuracy of mapping in the field;
 - accuracy of GIS transference, which has been a different process in the two years.

Consistency of Definition of Vegetation Types

- 2.60 One of the surveyors has been the same for all four surveys, which assists in ensuring consistency, but the other surveyors in 2014 had not been part of the 2005 mapping team. On-site training, so that all surveyors agreed on definitions, was undertaken in 2014. All surveyors are good botanists, so identification of species should be relatively consistent. However, there are so many variations in the vegetation that it is difficult to maintain agreement and consistency and there will be a degree of subjectivity based on experience. The most difficult vegetation communities to differentiate are the mixtures and the differences between the species-rich B group. In general, the rule was followed that for a mixture to be recorded, the two or three vegetation types had to be in equal proportions. However, where intimate integration of communities occurs, this can be difficult to judge. There were also difficulties in deciding when open marram became closed marram, and when closed marram could be sharing space with other communities.
- 2.61 Some vegetation types were more easily defined and there was, therefore, greater confidence in their discrete mapping. These include the different scrub categories, individual evergreen oak trees (except where buried within dense scrub or woodland making them difficult to detect), bare sand, and where bracken was present (usually in mixtures as an invasive species in other communities). When comparing the vegetation categories between years, the major changes have been interpreted as the key ones that would appear to be more robust in the light of the consistency of vegetation definition, rather than the myriad of minor ones, sometimes only affecting less than 100m². This has meant a degree of combining vegetation communities to provide a useful commentary.

Accuracy of Field Mapping

- 2.62 There was a much higher degree of mapping detail in 2005 and 2014 owing to the large scale of the photographs. This has resulted in more definition of vegetation patches, with patch boundaries being more precise than was possible in the 1994 survey. This is clearly illustrated by the fact that 2,618 separate patches of vegetation were identified in the field in 1994, 3,509 in 2005 and 4,025 in 2014 within the same 2005 mapping area. In many respects this will relate to the separation of individual gorse bushes, other scrub and evergreen oak trees, and these disparities need to be borne in mind when making comparisons.
- 2.63 The main differences between 2005 and 2014 have been explored more than the previous changes, but the whole set is useful context in identifying trends.

Accuracy of GIS Mapping

- 2.64 The process of converting field data into useable GIS data may result in the addition of systematic inaccuracies of classification and position. However, positional inaccuracies were minimised by using a consistently precise and correct method of digitising directly from the scanned field maps and, therefore, can be assumed to be of negligible importance in this project. Classification inaccuracies are potentially more important and an extensive review of the GIS data was conducted by each individual surveyor to identify and amend any errors of classification and again later by the author to double check the outcome.
- 2.65 The employment of a GIS-based methodology has enabled the data to be stored in a consistent, detailed and well structured format, with rapidity and ease of use for manipulation and analysis purposes, and a highly satisfactory level of output in terms of statistical results and mapping.

3. THE 2014 VEGETATION MAP

- 3.1 The following provides an overview of the mapping results for 2014 over the whole area covered in the field. The map itself is provided digitally, but is too complex to be included in this report, because of the large number of community mixtures. In order to facilitate a synopsis of the current vegetation types, each is described but they have been grouped to match the main division of the communities into yellow and grey dunes, scrub and woodland as is being adopted in the condition assessment. Maps of the key vegetation types are included to show their pattern and distribution. Target note locations are shown on Figure 1 and listed in Appendix 2.
- 3.2 As the frontal dunes, the additional section in La Moye Golf Course and Bosdet have not been mapped before and there is no other baseline with which to compare them, the data from these areas cannot be used to show any changes or trends. These areas are described separately before the overlapping mapping survey area is presented and compared with previous years.

The Distribution and Character of the Vegetation Communities

The Frontal Dunes

- 3.3 This area comprises a long, narrow strip of dunes, the Foredues, stretching between the slip road and car park by Le Braye south nearly to the hotel at La Pulente and some 100-150m wide. It consists of a series of bare sand dunes set within a matrix mostly of grey dunes, consisting of both dense marram (community D) and open marram (community C). The dense marram is particularly noticeable along the land-facing side of the blowouts. One new blowout developed or more sand blow in others was evident as a result of the 2013-4 winter storms and the strandline and sand on the beach below is reported to have been washed away at the same time. Sand couch is locally abundant in the dense marram close to the sea wall in places, which is not seen widely elsewhere on the dunes. The open marram vegetation is quite rich in species, approaching an open B community in places, although with more sand owing to its proximity to the effects of wind near the sea and to the regular recreational use along this stretch.
- 3.4 Along part of the sea wall in the central part of the site there is a very narrow fringe of strandline vegetation – too small to map, but comprising an abundance of sea bindweed (*Calystegia soldanella*) and marram, interspersed with rock samphire (*Crithmum maritimum*), sea rocket (*Cakile maritima*) and sea beet (*Beta vulgaris*) (Plate 6, TN3).
- 3.5 There are more limited patches of species-rich grassland (B, Bi and B mixed with burnet rose (J)), mostly on the eastern side of the strip where they are less affected by wind erosion. Rabbit activity along the frontal dunes is regular and its effects conspicuous in determining the extent of more species-rich patches. At one location (TN2), 23 pyramidal orchids (Plate 11), two of which were white flowered, were found. A number of the special dune species were found associated with the richer grassland, with 20 stems of childing pink at TN4 and abundant small hare's ear and some early sand grass on the east side of Le Braye car park beside the coast road (TN23, TN24).
- 3.6 Rank grassland (E) is more abundant at the far southern end of the frontal dunes, but nowhere extensive here. However, there is an abundance of the glaucous form of fescue near La Pulente along with one plant of pyramidal orchid (TN1).
- 3.7 In the central section, there is much more bracken invasion associated with the extension of granite from the eastern escarpment to La Tête du Nièr Côte where there are remains of gun

emplacements and associated activity. There is a granite surfaced patch alongside the sea wall in the central part of the unit.

- 3.8 There is some scrub consisting mostly of brambles, tree lupin (*Lavatera arborea*) or shrubby orache. The southern boundary is marked by a large Monterey pine (*Pinus radiata*) with an associated fig tree (*Ficus carica*). Evergreen oak occurs sporadically, although none are large in size yet.
- 3.9 Green lizards (*Lacerta viridis*) were seen in this coastal dune strip.

Bosdet

- 3.10 Bosdet is, in total contrast to the frontal dunes, at the back of the dune system at the far north-west edge, extending from Le Mont a la Brune and Le Mont Tcheurdron eastwards following a deep valley, ending in extensive woodland at La Ville de Quennevais. The area largely faces west, south or south-west, apart from the limited slopes of Le Mont Tcheurdron which lead down to Mont a la Brune. Narrow, deep valleys stretch around a developed area, with mature woodland in each, tying in with the woodland that stretches east to Les Quennevais. The boundary of the mapping area passes through various vegetation patches, mostly scrub below Bosdet Golf Course, and forms no distinctive edge (Plate 8).
- 3.11 The main vegetation type is scrub, often in very extensive patches on the upper valley slopes, frequently mixed with bracken (Plate 8). Much of the scrub is impenetrable and has been viewed only from paths or more open vegetation patches. Privet, hawthorn and blackthorn are the main species with some dog rose (*Rosa canina*), the odd conifer and some evergreen oak. Gorse is mixed with many of the scrub patches and forms extensive areas on its own as well, sometimes in association with rank grassland kept open by some rabbit grazing. There is one large patch of Russian vine near the houses off Mont a la Brune (TN16). Tall nightshade was noted mixed in some of the gorse and the scrub on Le Mont Tcheurdron, but rarely. Its spread here needs to be monitored and controlled if it proves to be invasive.
- 3.12 Woodland dominates at the eastern end of this unit. The strip in the western of the two arms was inaccessible and could only be surveyed from distant views. Access was only gained to the main part of the wood and the eastern arm. The main wood is dominated by mature pedunculate oak with frequent elder and hawthorn and locally dominant mature sycamore. There is localised hazel (*Corylus avellana*), although this may have been planted, and a locally dense thicket of elm (*Ulmus* spp). A few ancient ash (*Fraxinus excelsior*) occur at the upper edge and one veteran oak (TN17) is located near the small stream crossing point. There are a few other more minor woody components of the wood including grey willow (*Salix cinerea*), holly (*Ilex aquifolium*), and hybrid poplars (*Populus x canadensis*).
- 3.13 The woodland ground flora is quite varied with a number of typical woodland species such as ground-ivy (*Glechoma hederacea*), herb-Robert (*Geum robertianum*), wood speedwell (*Veronica montana*), red campion (*Silene dioica*), stinking iris and butcher's broom. Ivy, however, is overwhelming dominant, including up some of the trees, over much of the wood, and there are other invasive species like winter heliotrope and common nettle. A number of ferns occur occasionally throughout the wood, including hart's-tongue (*Phyllitis scolopendrium*) and male-fern (*Dryopteris filix-mas*).
- 3.14 There is also a reed bed with willow scrub in the main valley along a minor water course. Access was only to the edges of this, and its full extent could not be mapped accurately. The main species apart from common reed around the southern edge were hemlock water-dropwort, great willow-herb (*Epilobium hirsuta*), fool's water-cress and hemp agrimony. Drier ground species like common nettle and hogweed were also frequent around the edges. This is

one of the few wet areas on the dunes. The drainage from the reed bed passes into drains that feed into the large, seasonal pool that lies within the dune valley just to the west of the wood.

- 3.15 Some limited areas of species-rich grassland (B) occur at the foot of the slope alongside the main west to east dune path through this patch. Open marram is sometimes mixed with this and bracken is sparse in some of these more open areas. Two pyramidal orchids were found (TN19) close to the same path. Some more rank grassland (E) also occurs, although this tends to show greater acidity reflected in the abundance of common bent here compared with the more base-rich grassland species on the dune plain. The abundance of burnet rose in these grassland patches places gives them an affinity with the E community rather than a new acid grassland category.

The High Dunes Extension

- 3.16 A small area extending into La Moye Golf Course has been included in the 2014 survey. This is principally of mixed scrub and gorse in separate patches or mixed vegetation, extensive bracken cover, scattered evergreen oak and a small area of woodland. There are some smaller patches of rank grassland (E) as well as areas of acidic dune grassland dominated by common bent with abundant burnet rose along the top edge next to the functional golf course. This is also the area where disturbance has resulted in the new tall herb community dominated by common nettle described above. A significant man-made, deep pond is included on the edge of the golf course, but this does not support any significant vegetation community.

The Target Notes

- 3.17 The main function of the target notes was to record the location of the rare species on the dunes, although additional notes were made for areas not previously mapped (as presented above). Appendix 2 shows that of all the special species that were being recorded when seen, the chief ones during an early July survey after drought conditions are pyramidal orchid – found in 12 different locations with over 177 flowering spikes - and small hare's ear. The latter was found in seven locations. There were two records for sea stock (*Matthiola sinuata*), both near a blow-out on the high dunes, whereas this species has only been seen on the frontal dunes previously by one surveyor, but not found there in 2014. There were also three records for heath speedwell (*Veronica officinalis*), mostly associated with the granite ridge above La Carrière car park. This is a rare species in Jersey.
- 3.18 There are also records for early sand-grass, Nottingham catchfly and four-leaved allseed, (*Polycarpon tetraphyllum*).

The 2014 Survey Area

- 3.19 The following paragraphs set out the character of the overall vegetation mapping for 2014, focusing on the more important communities that tie in with the condition monitoring, thus the habitats are not considered entirely in alphabetical order. The total area of this mapping is 130.36ha. Because of the complexity of mapping mixtures of communities and, therefore, of many of these falling within different key vegetation types, many mixed patches occur in more than one of the following tables. The totals cannot, therefore, be summed to produce a vegetation synopsis of what occurs on the dunes. In addition, some of the small patches comprising three communities are omitted from the tables to avoid allocating them to a particular community type. These data, however, are not used for the comparison between the survey periods (see Section 4).

B - Species-rich Vegetation

- 3.20 The species-rich B grassland communities along with the rank grassland (E) and burnet rose (J) constitute the grey dunes as far as the condition assessment is concerned. They are, therefore, treated together in this account.
- 3.21 The B vegetation is the most important vegetation on the dunes as it is species-rich. Figure 2 shows its distribution, from which the concentration on the dune plain and adjacent low dunes is clear. The amount of each vegetation type is shown in Table 1 below and, in total, together form a significant component of the dune vegetation, signifying a high quality system as these are the richer vegetation types where more of the special species can be found.

Table 1 The Extent of Species-Rich Vegetation in 2014

Community	No of Patches	Hectares	% of Total Area
Species-rich plus lichens and mosses (B and mixtures with B)	681	23.32	17.88
Species-rich, less open (Bi and its mixtures)	682	20.50	15.72
Trampled, species-rich (Bii and its mixtures)	256	4.86	3.73
Totals	1619	48.68	37.33

- 3.22 The B vegetation, (the species-rich, open community with plenty of small scrapings by rabbits, and with many lichens and mosses), without any mixtures is mostly found on the dune plain, over the low dunes below the La Moye Golf Course slope, and in the upper areas near Les Quennevais (Figure 2). There are some patches on the frontal dunes and Bosdet and a few on the southern dunes.
- 3.23 The pure B vegetation covers 305 patches and 9.38ha, which is just under half of the total B and B mixtures area. The areas where the B and Bi communities share dominance comprise 53 patches and 3.51ha.
- 3.24 The Bi areas are also species-rich, but present a more continuous vegetation with less bare ground, mosses and lichens. They tend to be shorter than the rank grass plots, and with more species, especially focusing on a fescue sward. The Bi and mixtures with it cover 682 patches and 20.50ha, or some 15.7% of the site. With pure B, Bi and B or Bi mixtures, the total area of species-rich grassland is 43.88ha, which is some 34% of the 130.36ha of dunes that have been surveyed. This is a significant proportion, and a major contribution to the high nature conservation value of the site. If only the communities with B of some kind in them (B, Bi, Bii plus or minus sand are considered as they are open communities (i.e. not mixtures with other community types), the total cover is 25.71ha, which is still a significant area (20%). The species lists (Appendix 1) show that the generic B communities are richer than the others on the dunes and contribute many of the species of nature conservation interest as well.
- 3.25 The mixtures of B and Bi with other vegetation types mostly occur with open marram (C), closed marram (D), burnet rose (J), sand (S) and bracken (I) and the main ones have been separated out on Figure 2. Most of these patches occur on the low and high dunes rather than on the plain (Figure 2). The mixtures of all B types of community with rank grassland (E) are

located mostly on the dune plain (Figure 2), whilst any B community mixed with burnet rose are mostly on the high and low dunes. This is quite a striking contrast and could be related to the hypothesis that the dominance of the rose is related to sand blow which is greater on the high dunes than the dune plain. Thus the soils on the plain are likely to be more mature and stable compared with the high dunes. The effect of wind blowing sand is more likely to be significant on the high dunes since they offer more of a barrier to the wind than the flatter dune plain.

- 3.26 The Bii communities are those that are basically a trampled version of the species-rich ones. They tend to be short because they are trampled and have lost some of their richness as a result. The areas of this community are distinctly related to paths and the junctions of several paths where rabbits probably help to keep the sward short. The lines and patches on Figure 2 show this vegetation to be concentrated on the dune plain and the southern dunes on flatter areas and in more stable soils, with smaller areas towards the back of the Les Quennevais, where the access from the housing east of the golf course lies, and on the frontal dunes. Although it appears to be fairly extensive, the patches (including a few mixtures with sand and burnet rose) total only 4.86ha, but are well spread out.

E - Rank Grassland

- 3.27 The rank grassland is tall and usually dominated by a mixture of grasses, especially hairy oat grass (*Helictotrichon pubescens*), cock's-foot and sweet vernal-grass, with more common bent in the more stable, leached areas, particularly on Bosdet. Yorkshire fog is a feature in places, and burnet rose a constant companion. The communities are listed in Table 2, but note that the communities mixed with B have already been included in the totals for that community type in Table 1 and a very small number of minor patches of E with more than two other communities have been omitted.

Table 2 The Rank Grassland Communities

Community	No of Patches	Hectares	% of Total Area
Rank Grassland (E)	143	2.90	2.22
Rank grass/ gorse or scrub (E/F, E/G)	29	1.78	1.36
Rank grass/bracken and +/- scrub	58	1.89	1.45
E mixed with C or D (marram) (includes with bracken as well)	104	6.03	4.63
E mixed with all Bs	114	4.50	3.45
Other mixtures (E/A, E/I, E/J, E/L, E/S)	37	0.81	0.62
All rank grassland and mixtures	485	17.91	13.73

- 3.28 Figures 3 and 4 show the distribution of all the rank grass and its mixtures. Rank grass alone covers only 2.9ha, with mixtures including all other communities totalling 15.0ha. In total, rank grass with or without mixtures covers 13.73% of the dunes as surveyed in 2014. The most extensive of the shared communities is with the open or closed marram C or D (Figure 4) followed by the species-rich communities shown on Figure 3 (Bs). This reflects the position of the rank grass in succession on the dunes – developing from the species-rich communities

where there is insufficient rabbit grazing or developing from or with marram where again there is not enough rabbit grazing and the community becomes more rank rather than a richer B type of grassland.

- 3.29 The combination with marram (C or D) as shown on Figure 4 is mostly confined to the dune plain and southern dunes rather than the high plain, with a significant stretch along the as well west and south of Le Braye car park.
- 3.30 The other mixtures are mostly with bracken or scrub invasion, which could be a result of these invading the rank grassland. It is clear that most of the rank grass not combined with other communities lies on the dune plain, in parts of Bosdet, or small patches on the frontal dunes with very little associated with the high or low dunes (a little at the far west end and on the golf course). Where it is mixed with any of the B communities (4.50ha in 114 patches, 101 of which are Bi/E), it is concentrated on the dune plain (Figure 2) and is largely absent from the low or high dunes except where it occurs close to Les Quennevais. This area may have fewer rabbits and this may be the main determining factor. There are more rabbits associated with a more rolling topography towards the middle of the plain, even though this is still close to a car park and, therefore, people and dogs that could disturb the rabbits.
- 3.31 As with the species-rich grassland, the prime area for the mixed rank grass/burnet rose community is on the high and low dunes at the south or east end of the site, with only minor amounts associated with the southern unit.

J – Burnet Rose Dominant

- 3.32 The most dominating areas of burnet rose are about 20-30cms high with fresh growth which appears to respond to being covered by sand by growing upwards through it. There are fewer species with this type of rose community and more bare ground. In other areas the rose is thinner, shorter, less dense and there is a wider range of other species, reminiscent of B or Bi vegetation.

Table 3 Burnet Rose Communities

Community	No of Patches	Hectares	% of Total Area
Burnet rose dominant (J)	204	4.95	5.03
Rose/species rich (all Bs/J)	124	5.32	4.08
Rose/sand	99	1.58	1.22
Rose/other communities	263	3.60	2.76
Total	690	15.45	11.85

- 3.33 Table 3 shows that there are 204 patches where rose is the dominant species covering 4.95ha, or 5% of the dunes. Figure 3 shows the rose-dominant areas to be primarily amongst the higher dunes on the eastern half of the site, but also on the low dunes below La Moye Golf Course and at the back end of the plain. They are typically on the lower land between former blowouts, or on the flatter areas amongst smaller blowouts.
- 3.34 The mixtures with burnet rose occur in 486 patches, occupying 10.5ha, or 6.82% of the site (this includes mixtures with different types of grasslands already described). These are

generally related to the same distribution pattern as the dominant rose vegetation. The main companion communities are the B and Bi species-rich grasslands (5.32ha) and open marram, all on the low dunes below La Moye Golf Course, or on the higher plateau dunes as described above. Only very small areas show a mixed rank grass and rose, and few are mixed with any kind of scrub (ten patches covering 0.42 are mixed with scrub, only two tiny patches mixed with gorse). A larger group of patches are where rose shares the community with bare sand, indicating possible current sand blow areas. These patches total 1.58ha in 99 patches.

C - Open Tussock Marram Grass

- 3.35 The C and D communities are those of the yellow dunes. The open marram category can be quite varied. It can be sparse, non-vigorous marram where it is associated with paths and trampling. There tends to be considerable bare sand associated with this as well. Where there is less trampling there are more mosses, in particular, as well as other species, and the vegetation seems to be moving towards an open species-rich (B) community. The totals are provided in Table 4 omitting those already given in tables above and with small areas where three communities co-exist left out.

Table 4 The Open and Closed Marram Communities

Community	No of Patches	Hectares	% of Total Area
Open Marram (C)	203	6.96	5.33
Closed Marram (D)	64	3.76	2.88
Open Marram/all species-rich Bs (C/Bs)	184	4.71	3.61
Open Marram C mixtures (not Bs or E)	200	5.47	4.20
Closed Marram D mixtures with any B	94	3.48	2.67
Closed Marram D mixtures (not Bs or E)	116	0.86	0.66

- 3.36 The totals are not given as they effectively double count the Bs and E vegetation communities which are already included in tables above. Mixtures of open and closed marram are also additional, with five patches totalling a minor 0.11ha.
- 3.37 Figure 4 shows the C communities (mixed and pure) are closely associated with the dunes rather than the plain, with large areas on some of the former large blow-outs that are now revegetating and a high concentration associated with the frontal dunes.
- 3.38 Altogether there are 203 patches where the open marram is the main vegetation type, covering 6.96ha (5.33% of the dunes). This vegetation is associated with the blowouts, both large and small, that occur throughout the higher and frontal dunes. At Les Quennevais end, there are many small patches associated with small-scale blowouts often beside the paths. Larger areas are found close to other bare sand and blowouts in the central area of the high dunes areas. Although the marram is sometimes quite dense in these areas, the many paths and areas of disturbance ensure that the vegetation remains open. There are also a large number of patches associated with the edges of the plain where this starts to rise into the blown sand zone. Not all of these are associated with paths.

- 3.39 The next most widespread open marram mixture is with the other community types, of which open marram and bracken is the main contributor. This is mostly associated with the eastern end of the dunes and the granite slopes below La Moye Golf Course. The mixtures with the B communities is roughly equally of B or Bi and lies mostly on the edges of the high dunes at the south and east end of the dune plain. This relates to where there is more disturbance and bare sand.
- 3.40 This vegetation is an integral part of any dune system, and illustrates a degree of dynamicism which is advantageous for the species that can colonise. The C community also supports specialists species, especially grey hair-grass (an RDB near threatened species), although this also occurs in other communities as well (see Appendix 1).

D - Closed Marram

- 3.41 This is marram that is closed, thick, tall and dense, but often also contains a wide range of other species that are also found in the species-rich (B) and rank grassland (E) communities. There are 64 patches of closed marram on its own, mostly occurring on the and on the north side of the dune plain (Figure 4). The D community in mixtures with all the species-rich B vegetation covers only 3.48ha, while those with other vegetation types cover a larger 4.61ha. Bracken plays a prominent role in the latter. The mixed areas can be seen on Figure 4. More of this community is in a mixture with rank grassland than any other community type, mostly fringing the plain along the roads and at the eastern edge in particular. This relates to where the rank grassland type is along with enough sand movement to support the dense marram vegetation.

F - Gorse Scrub

- 3.42 The cover of gorse and gorse scrub mixed with other communities is shown on Figure 5. F is gorse dominated or co-dominant vegetation, but other species like wild privet and blackthorn have often colonised and there is often also much burnet rose.
- 3.43 The predominant type in terms of the number of patches is pure gorse – this is a product of the clarity and large scale of the air photographs which permitted all the discrete patches of gorse to be identified. The total area covered (2.37ha, Table 5) is not excessive compared to the other vegetation types. The larger patches of gorse occur at the back of the dunes on or close to Bosdet, on the slopes below La Moye Golf Course and at the foot of the high dunes. Many smaller patches are found on the dune plain.

Table 5 The Total Areas of Gorse and Gorse Mixtures

Vegetation	No of Patches	Hectares	% of Total Area
Gorse dominant (F)	429	2.37	1.82
Gorse/scrub (F/G)	69	2.51	1.93
Gorse/scrub/bracken (F/G/I)	13	1.55	1.19
Gorse /other vegetation	31	1.53	1.18
Total	546	8.05	6.18

- 3.44 Gorse mixed with other scrub occurs in a smaller number of patches but which are on average larger than the gorse alone patches and cover more than the area of just gorse (Figure 5). These tend to be on the granite escarpment below La Moye Golf Course, close to Les Quennevais and with large patches on Bosdet.

G – Mixed Shrubs

- 3.45 The scrub is variously dominated by shrubs other than gorse (although there may be remnants of this surviving where the patch changes from gorse to mixed scrub). Most of the scrub is not mixed with other vegetation types (313 patches occupying 10.92ha), except where growing with bracken (59 patches covering 3.92ha, mostly on Bosdet). Apart from these, scrub mixed with rose, woodland, heath and sand covers 65 patches covering 1.3ha. Altogether, scrub and its mixtures (including mixed with gorse – see Table 5) covers about 14.32% of the dunes as surveyed in 2014.

Table 6 Mixed Scrub Communities

Vegetation	No of Patches	Hectares	% of Total Area
Scrub (G)	313	10.92	8.38
Scrub/Bracken (G/I)	59	3.92	3.01
Scrub and other communities (not Gorse or bracken)	65	1.30	1.00

- 3.46 Figure 5 shows the scrub as predominantly lying along the north-facing slopes in the eastern end of the dunes, on Bosdet, below La Moye Golf Course on the south side of the site, in small patches round the front slopes of the higher dunes and, occasionally, in the section of the site close to the sport's ground.

K - Woodland

- 3.47 The areas of woodland are still fairly restricted (Figure 5). The main area is at the far eastern end of the dunes at the head of the main west-east valley. Smaller patches occur elsewhere marked by increasingly mature trees that have formed a canopy. Altogether there are 13 patches 3.20ha, with only scrub mixed with woodland on eight sites on 1.02ha, representing very small polygons. The second largest area of woodland persists in the valley running west off La Moye Golf Course south of La Carrière car park. However, the mapping also identified individual and clusters of pines (Pi) and evergreen oak (Qi). In addition, there are 154 individual evergreen oaks that have been mapped (smaller ones will not be visible on the aerial photographs, so would be missed). Their canopy covers altogether 0.95ha. Some of these trees lie within scrub areas as shown on Figure 5, but many are dotted around the dune plain.

I - Bracken Dominant or Co-dominant

- 3.48 This can be tall, dense, rank bracken, usually on deeper soils, or very scattered thin bracken, usually co-dominant then with another vegetation type such as B or C. The extent is shown on Figure 5. Bracken patches and those mixed with vegetation other than scrub and gorse are prominent below La Moye Golf Course above the low dunes and the southern unit, as well as

on Bosdet. They overflow from the southern unit onto the frontal dunes – an indication of the extent of the granite cliffs under the sand in this area. The mixed bracken and scrub or gorse patches are mostly in the same areas.

- 3.49 There are in total 149 patches covering 8.05ha, or 6.17% of the site where bracken is the main vegetation. There is a further 14.37ha of bracken mixed with other vegetation types, in 403 patches, giving a total coverage of mixed or pure bracken of 17.2%, which is quite high. Unlike most of the other communities, there are more patches of mixed than of bracken-dominant areas. Bracken seems to be able to invade any of the vegetation types, and is fairly equally mixed with different grasslands, marram, scrub and gorse. There are also 33 patches over 0.6ha of bracken mixed only with sand. These are on the slopes below the southern end of La Moye Golf Course and above La Carrière car park.
- 3.50 Figure 5 shows the very distinctive character of the bracken distribution across the dunes, with it all concentrated on the north-eastern edge extending into the larger belts of scrub and the granite slopes below the golf course.

H - Wet Rush-grass Vegetation

- 3.51 There are three main wet areas on the dunes, excluding the large area where sand has been extracted, which sometimes holds water (see Figure 6). Although the pond in La Carrière car park was present in 2005, a new wetland has developed around it, which contains a good mixture of wetland plants. This takes the runoff from the car park. A new wetland consists of a small reed bed at the edge of the main block of woodland at the eastern end of the Bosdet section. A third wetland is the small slither down the valley running west from La Moye Golf Course on the south side of the headland, and the expanded wet area downslope of this which has recently been cleared. These total five separate patches, one of which is co-dominant with bracken. These total only 0.11ha altogether: a very small fraction of the dunes, but enlarged by a patch of wetland mixed with bracken (0.064ha), also in the valley passing west from La Moye Golf Course. Indeed, Les Blanchés Banques as an internationally important sand dune site is remarkable in the dearth of wetland areas compared with other sites, which is either a natural phenomenon, or/and the result of interference with the water table in terms of the effects of water abstraction. There is no indication in Le Sueur (1984) for previous wetland species from the dunes that have now been lost, suggesting that the dryness is a natural feature on this site.

L - Heathland

- 3.52 The heathland areas where heath species have been determined as dominating occur on 13 patches covering 0.14ha plus a further 31 most of which have already been included in habitat mixes, totalling 0.63ha. They are shown on Figure 6 in two main areas: on the slopes above La Carrière car park and those to the south of it. Only a very small area survives on the dune plain. Most of the mixtures are grassland, but there are some with scrub and gorse as well as bracken and marram.

A - The Disturbed, Tall Herb Community

- 3.53 There is very little of this vegetation type. It is recorded in 18 separate patches covering 0.16ha and as 37 other small patches associated with other community types, but all totalling only 0.8ha. These are concentrated around the upper Le Mont a la Brune car park, and close to this road, but further east (see Figure 6). The community is a more open bare ground vegetation, but there are also mixtures with rank grass (A/E) or with gorse scrub (A/F) or mixed shrubs (A/G). The cause of disturbance creating this vegetation seems to relate to rabbit warren excavations, works on the adjacent road and possibly to recreational disturbance.

S and BG - Sand/Bare Ground

- 3.54 Bare sand is largely associated with the blowouts on the higher dune plateau, on the frontal dunes, and in small areas associated with the lower edges of these dunes and with paths. The extent of bare sand is very limited on the dune plain and the dense scrub-covered granite and dune slopes (Figure 6). Altogether there are 266 patches of bare sand covering 4.1ha of the dunes (3.14%). In addition, there are a mix of sites, mostly bracken and grasslands that also hold bare sand totalling 6.03ha across 247 patches (showing how small the patches are on average) constituting 4.63% of the dunes.
- 3.55 Some of the path network in the higher dunes consists mostly of bare sand in contrast with that on the dune plain where the trampled Bii community predominates instead. This reflects the greater sensitivity and reduced carrying capacity of the less stabilised vegetation on the dune slopes to trampling wear. These are particularly conspicuous close to La Carrière car park reflecting their regular use by dog walkers.
- 3.56 Most of the mixed sand communities are with open marram (with 33 patches across 1.66ha) and burnet rose (99 patches, totalling 1.58ha) which Figure 3 shows are spread out on the dune plain as well as the higher dunes, mostly close to the footpath network and small blowouts. There is also a sweep of species-rich grassland (B) mixed with sand (45 patches on 1.18ha) mostly on the higher dune plateau area.
- 3.57 Areas of bare ground that are not significant to the dunes are the areas in the car parks, also areas of concrete from the old gun emplacements, and the steps up onto the viewpoint above La Carrière quarry. Rock is also mapped where it outcrops in sufficiently large patches, or appears in mixed vegetation. One final miscellaneous category is for garden habitat which has crept out in a minor way into the dunes (only taking about 29m²) at La Pulente at the southern end of the southern dunes– through the spread of garden shrubs rather than any annexing.

4. CHANGES IN THE VEGETATION OF THE DUNES

Introduction

- 4.1 A comparison follows between the vegetation communities, their distribution and extent recorded in 2005, and that found in 2014. Reference will also be made to the 1994 vegetation map of the dune vegetation where changes have been noticeable, but the area of survey was slightly less in that year which will affect some of the comparative numbers. Figure 7 shows the extent of the overlap of the areas mapped in the two years, which totals 106.04ha. This boundary is also shown on the subsequent maps detailing changes in the different communities. The area excludes the large areas on the frontal dunes and Bosdet, and the smaller area on La Moye Golf Course that cannot be compared with the more limited 2005 and earlier data. The totals will, therefore, be different (usually less than) those given in Section 3 above.
- 4.2 The method of comparison has been reviewed and changed compared with the 2005 report. In the latter, the total areas of the pure vegetation type plus all the areas mixed with other communities were summarised together. This meant that there was significant double counting where communities were mixed, with each of the component counted as part of their 'parent' vegetation types. This was useful in showing the direction of change, but hid the detail. In order to remove the double counting for this assessment, any mixed vegetation type has been allocated to its community proportionally. Thus a B/E mixture has been allocated as 50% B and 50% E, or a B/Bi/E community has been divided equally into the three communities. This is based on the assumption that the mixtures are roughly proportionate (i.e. a B/E patch is 50:50 of each), but this is reasonable since it reflects the criteria used for determining mixtures in the mapping methodology. This new method allows more precise comparison between years. This conversion has been used for the 2005 and 2014 dataset, but not for the 1994 data, so trends only can be discerned regarding the full sequence of mapping. The 1983 data could not be digitised, so less dependency can be ascribed to it.
- 4.3 The most useful way of examining the changes is to discuss each vegetation type in turn in the same order as above, but with reference to a new set of maps that show the changes. The database for the comparison is provided digitally. The full data sheets are not reproduced in this report, but smaller subsets are drawn from them to illustrate the changes found.
- 4.4 The main changes for the community types are summarised in Table 7. These figures are based on the allocation process described above and cover a smaller area than that surveyed in 2014, so the totals differ from those given in Section 3 above. In addition, the pure-unmixed vegetation types from the 1994 data set are also compared. This uses the unmixed vegetation communities as set out in the 2005 report (PAA 2006) and the total hectareage will not add up to the same as those in Table 7. The grey dunes (communities B, E and J) are considered first, with the marram vegetation (communities B and D) that constitute the yellow dunes presented second. The other vegetation types then follow, grouped to reflect their ecological affinities where relevant. The totals for bare ground and 'other' features are not included. Bare ground includes car parks, gun emplacements etc, and is not relevant. The 'other' features include individual trees which are mentioned in the section on woodland.

Table 7 The Overall Differences in the Vegetation between 2005 and 2014

Community	2005	2014	Ha Change	% Change
A - ruderal	0.11	0.56	0.45	80.61
B - species-rich	10.95	14.90	3.96	26.56
Bi - species-rich, less open	16.28	15.31	-0.97	-6.33
Bii - trampled	3.38	4.26	0.89	20.78
C - open marram	13.01	10.21	-2.80	-27.42
D - closed marram	5.72	5.87	0.15	2.57
E - rank grass	10.92	7.92	-3.00	-37.90
F - gorse scrub	4.60	3.88	-0.72	-18.60
G - other scrub	9.03	11.47	2.44	21.24
H - wet	0.02	0.09	0.07	74.74
I - bracken	11.81	11.54	-0.27	-2.32
J - burnet rose	11.18	9.97	-1.21	-12.11
K - woodland	0.90	1.52	0.62	40.61
L - heath	0.58	0.42	-0.16	-37.77
S - bare sand	5.70	6.66	0.96	14.37

B - Species-rich Vegetation

- 4.5 In 2005, there was a reduction since 1994 of just over a third of the species-rich, moss/lichen-rich B vegetation (non-mixtures only – Table 8), and an increase of over double the extent of the denser, but still relatively species-rich Bi community. Most of the B community had changed to Bi, or to a mixture of B and rose. The indication was that there had been inadequate grazing by rabbits to maintain some of the species-rich grassland in its previous state, and that there had been a gradual closing in of the sward to form the still rich but closed Bi sward, with some moving onto rank grassland as well.

Table 8 Trends in the Diverse Unmixed B Vegetation

Vegetation Community	1994	2005	2014
B open diverse	11.13ha	7.19ha	8.35ha
Bi closed, diverse	4.00ha	9.74ha	7.41ha
Bii diverse trampled	5.03ha	3.30ha	3.47ha
E Rank grassland	3.77ha	6.35ha	1.44ha
J Burnet rose dominated	8.39ha	7.86ha	4.91ha

- 4.6 By 2014, these trends seem to have been reversed. There is a clear and substantial increase in the B, richer, more open community, and reduction in the denser, less diverse Bi. Similarly, there has been a substantial loss of the rank grassland E.
- 4.7 Between 1994 and 2005, there had been significant changes in the more closed fescue-dominated species-rich grassland, Bi, showing an increase by more than double the 1994 amount of pure Bi. By 2014, the total amount of pure Bi had declined again, although not to the low of 1994. The amount of unmixed B and Bi vegetation is a little more or less than half the total amount of the allocated mixtures, showing that the mixtures with other vegetation types are important. The more prominent mixtures in 2014 are those with burnet rose and with each other, showing the importance of the species-rich community overall.
- 4.8 These changes are similar when all the mixtures and unmixed B and Bi communities are considered together in the allocated dataset (Table 7). They tend to support the surmise above that there has been more rabbit grazing to expand the diverse grassland, including scrapes and digging to create the open sward of B, and that this has developed at the expense of the thicker, taller, denser swards composed of the more vigorous species.
- 4.9 These changes are shown between 2005 and 2014 on Figure 7 where the significant extent of the dunes that were B communities (of any kind) in 2005 and remained so in 2014 can be seen. This is particularly on the dune plain, the high dunes, the low dunes fringing the granite escarpment in the southern part of the site and in the southern area, with smaller patches towards the sports ground near St Brelade. There are also a cluster of patches that have changed, but remain some form of B (species-rich) vegetation. These are particularly on the low dunes north of to La Carrière car park and to the east of this. Only a few other changes within the B family of communities are shown scattered around the whole site.
- 4.10 There is also a large number of new B vegetation patches that had been a different non-B type in 2005. These are shown in blue or cream on Figure 7, and occur across the dune plain, the high dunes and low dunes. This is the group that will account most for the expansion in B vegetation in 2014. There are also areas that have changed from a B type of community to another of a completely different kind. These patches occur on the dune plain in larger patches, with smaller ones close to the south-east boundary of the site and a few scattered around the granite cliffs and on the southern unit.
- 4.11 It was clear viewing the dune plain, in particular, during the mapping exercise, that there had been a significant increase in rabbit grazing, reduction in the extent of rank grassland and increase in the more open, richer grassland since the last time the site was seen by the surveyor with most familiarity with the vegetation. A visual comparison with the 1983 map

(Anderson 1984) suggests that the rank grassland on the plain had been more extensive than in 2005, and that the extent of species-rich grassland is still greater than in 1983.

- 4.12 Table 8 shows a reduction in Bii unmixed trampled path-way vegetation between 1994 and 2005. This occurred both as mixed and non-mixed swards by about a quarter to a third. 2014 saw a slight increase in the pure vegetation community compared with 2005, which represented a 20% increase when all the mixtures containing Bii plus the unmixed community were considered. The Bii vegetation is clearly associated mostly with paths (as can be seen in the linear strips on Figure 2) and is defined as a trampling response in terms of the expansion of rye grass and loss of sensitive species. This vegetation does not develop as a response to rabbit grazing, although rabbits will utilise the shorter vegetation. The changes in extent, therefore, suggest more trampling and recreational pressure spreading across the dunes.

E - Rank Grassland

- 4.13 Table 8 shows a significant increase in the areas of rank grassland between 1994 and 2005. This might be expected as the effect of the 1990 gale that had destroyed much of the rank grassland that had been present on the dune plain and opened it up to colonisation by new plants after many died from the salt spray effect of the storm. This effectively rejuvenated the plain grasslands, creating new areas of species-rich grasslands which have been retained whilst there have been sufficient rabbits to manage them. By 2014, there has been a very substantial reduction in rank grassland again, to lower levels of unmixed habitat than in 1994. The total of all the types of rank grassland in the allocated dataset (Table 7) also shows a significant 38% decline since 2005. This finding compares with the report on dune condition, where the overall grey dune vegetation has not altered significantly since 2005. This shows that there is more dynamism between the rank and species-rich grasslands than between these and other dune categories (scrub types or yellow dune vegetation for example).
- 4.14 Figure 8 is remarkable in that there are very few of the previously mapped rank grassland (E) patches which have remained the same vegetation type, although more of the 2005 mixed E vegetation remains unchanged. This is mostly around the back of the dune plain, with smaller patches along the coast road and scattered elsewhere. There are also a number of sometimes quite extensive patches that have changed from rank grassland to a mixed community. Comparing Figures 7 and 8 shows that some of these have changed to a mixture with a B species-rich grassland, as was apparent when mapping the dunes.
- 4.15 There are only very small patches of new E grassland, either in mixtures or as plain E. These are scattered throughout with no particular pattern. Some of these are mixtures with different B communities as can be seen by comparing Figures 7 and 8.

J – Burnet Rose Dominant

- 4.16 Rose dominated areas seem to have declined, both in all its mixtures (Table 7) and in its pure form (Table 8) as a continuous trend since 1994. Overall, the comparison between 2005 and 2014 shows a 12% decline, but the decline in the pure community has been greater between 2005 and 2014 than across the previous decade. It is difficult to be consistent in allocating the burnet rose dominated and co-dominated vegetation across years and surveyors, despite clear criteria. The rose can be visually more dominating in some years than others which depends on the range and height of its accompanying species. It has also been reported that the gypsy moth had effectively defoliated burnet rose in places on the lower dunes a couple of years ago. This too could affect the vigour of the plant and its appearance in terms of dominance or co-dominance. Such moth outbreaks have been seen by the author previously on the dunes and are regarded as another cyclical variable in determining the extent of burnet rose from year to year. The rose seems to recover fairly rapidly to such defoliation.

- 4.17 Some of the quadrat data used for the condition assessments shows an increase in cover of burnet rose which is of note since it suggests that there could have been an increase in the rose without it pushing the vegetation into a new category. Such an explanation would fit the casual observation by staff that the abundance of rose seems to have increased, even though the mapping data shows a steady decline in overall cover as defined in this study.
- 4.18 Most of the burnet rose is mixed with species-rich B community and its appearance and degree of dominance will depend on the vigour and growth of the accompanying species, itself probably mostly determined by rabbit activity, which is obviously variable from year to year.
- 4.19 Bare sand is also a common mix with burnet rose. It is a feature of dunes that bare sand is exposed in different spots over a period of time, before vegetating through succession after disturbance. This can be derived from disparate sources including storms with strong winds, rabbit activity or human trampling effects. Each can interact with each other as well, with rabbit diggings or trampling effects exposing bare sand to wind blow. Whether rose colonises after such disturbance will depend mostly on whether it is in the disturbed community already or not. As it is very widespread across the dunes, except in the early marram colonisation stages, it can be seen as an opportunist, able to develop through small-scale sand blow (rather than large blowouts where marram is more effective) and become dominant or co-dominant with sand, at an early stage.
- 4.20 Figure 9 shows the dynamics of the burnet rose dominant and mixed vegetation. Areas in the high dunes in particular have remained rose-dominated, and further patches in the same general area have remained a mixed rose community. Others have been lost, some at the far south-eastern edge of the site, plus some fringing the escarpment and low dunes. There have also been gains, with new J mixes, some of which are with the species-rich B vegetation groups (compare Figures 7 and 9). Fewer patches have changed from a J mixture to straight J. The mapped data show that the rose communities are dynamic and change regularly around the dunes, although mostly on the high and low dunes rather than the dune plain. This is thought to be related to the greater instability of the dunes compared with the plain where there is less bare sand and sand blow.

C and D - Open or Closed Marram Grass

- 4.21 There was not a major change in the total extent of open marram in or not in mixtures between 1994 and 2005. However, by 2014, the amount of overall C vegetation had reduced by nearly 3ha (27% Table 7). This trend is matched in the unmixed vegetation as well (Table 9) where it has reduced significantly. The amount of unmixed dense marram shows a minor loss since 2005, although the total of the mixtures (Table 7) shows a slight overall increase. The overall amount of unmixed marram (open and closed) has reduced sharply across the latest period although the loss between for all yellow dune marram vegetation altogether has only reduced a little. There is a possibility of some inconsistent interpretation of these vegetation categories, but as many patches have changed in location, this does not seem likely to be an issue.

Table 9 Trends in the Unmixed Marram Communities

Vegetation Community	1994	2005	2014
C open marram	7.28ha	9.27ha	4.68ha
D closed marram	3.75ha	1.66ha	1.16ha

- 4.22 Since the areas of open marram are a natural stage in the stabilisation of dunes, their progressive development through natural succession might be expected over time. It is apparent that there is a considerable mobility of this vegetation type, and new areas form as others develop into other vegetation types. This is evident from Figure 10, which shows that there are only limited areas of the C or D communities not mixed with other vegetation types that have remained unchanged across the nine years. However, many more of the C and D mixtures with each other or other vegetation types are all still where they were in 2005 (the dark green-blue colour). These occur along the foothills of the low dunes and extensively in the high dunes as well as along the coastal road, with smaller patches in the southern dune area.
- 4.23 There have also been major changes from C or D (pure or mixed) to non-marram-based communities (the red and bright green patches on Figure 10). These are particularly on the high dunes around the former largest blowout, near the sport's field and in limited patches elsewhere. Again, comparing the figures shows that some of the losses of C or D vegetation or their mixtures has developed into species-rich B types, and a few appear to now be a rank grassland of some kind.
- 4.24 These changes and patterns illustrate the dynamism of these early colonising vegetation types which tie in with the changes in bare sand, trampling (to which marram is intolerant), and to natural succession. They might suggest a general stabilisation of the dunes with a reduction of overall marram area. Dunes are characteristically dynamic with new blowouts forming after storm conditions which are then vegetated by marram as a primary coloniser. However, many dune systems, as here, have been artificially stabilised through barriers like Jersey's sea wall, which have prevented significant fresh sand being blown into the system from the beach. The fact that the main other area of active dunes and blowouts is on the high and low dunes south and east of the dune plain also provides opportunities for storm damage to expose and move sand around. Thus, there are marram communities on these areas distant from the frontal dunes, which are not typical of other dune systems, but important in not then being as affected by the sea wall.
- 4.25 The area most affected by coastal processes is the frontal dunes and this is not part of the survey area common to all survey dates, yet it does support extensive areas of both open and dense marram vegetation. The dunes need to be seen as a whole system, so future comparisons will be more valid in terms of any concerns about the dune system becoming too stable. It is possible that the perturbations needed to develop large-scale blowouts are on a longer time scale than the ten-yearly vegetation re-surveys since they are dependent on natural weather processes and patterns. For the moment, it is the smaller scale exposure of fresh sand that is evident which will maintain some marram vegetation throughout the more mobile dunes on the site.

F - Gorse and Other Scrub

- 4.26 Table 10 provides the cover of scrub, woodland and bracken for the three survey times for the non-mixed vegetation types, with two figures for 2005 to reflect the slightly different areas used in the 1994/2005 comparison and that for the 2005/2014 comparison. The differences are not great.
- 4.27 The table shows that there was a considerable increase in the cover of gorse scrub between 1994 and 2005 (2.42ha against the former 0.63ha). This is still a very small proportion of the dunes (2.3%), but relates to only pure gorse patches not those where gorse occurs with other species. The 1990 gale had a severe impact on the gorse that had been present on the slopes below the main blowouts on the inland cliff and the spread since then probably reflects recovery to its former level of cover. However, this process does not seem to have continued until 2014 when a reduced area of unmixed gorse cover was recorded. The same loss of gorse is

presented in Table 7 where the overall gorse and mixed gorse communities are combined. The 3ha or 27% loss is significant.

- 4.28 The cover of mixed scrub declined 10-13% in mixtures or alone between 1994 and 2005. If combined with the gorse cover, then the total scrub cover of all mixtures increased by 1.72ha overall. This is still greater than the amount estimated to have developed over time between 1945 (around 10ha) and 1979 (about 14ha) as presented in the 15-year review (unpublished report by PAA to the Environmental Services Department 1999). The increase by 2005 was mostly associated with areas that were already covered with scrub on the main slope below La Moye Golf Course, and along the edges of the main area of existing scrub in the large west-east valley that stretches to the far eastern end of the dunes. This is the main block of scrub (and woodland) that has remained in the same place.
- 4.29 By 2014, the trend had reversed, with a 1.66ha expansion in non-mixed scrub. The overall mixture of scrub communities had increased by 2.44ha, some 21% of the total (Table 7).

Table 10 Trends in Unmixed Scrub, Woodland and Bracken Cover

Vegetation Type	1994	2005 1994/2005 Area and 2005/2014 Area	2014
Gorse scrub	0.63ha	2.42ha/2.47ha	1.92ha
Other scrub	7.08ha	6.32ha/6.67ha	8.33ha
Woodland	0.12ha	0.05ha/0.61ha	1.28ha
Bracken	1.32ha	7.18ha/7.34ha	6.79ha

- 4.30 Figure 11 shows the areas of gorse scrub, other scrub and woodland that have not changed since 2005. The largest patches are scrub rather than gorse along the main north-facing dune ridges in the central eastern part of the dunes (as shown on Figure 5). These have consolidated in places, but largely remain the same. Many of the gorse patches (Figure 5) on the dune plain have also remained intact since 2005. There are very few areas of scrub that have been lost since 2005 (red patches on Figure 11). Some has changed to bracken-dominated areas (see Figure 5), some to woodland as well as other non-scrub habitats. In general, once a patch of scrub has established, it seems to remain for a long time, whereas the gorse is more vulnerable to salt-laden winds in winter storms. Those that occurred in 2013-14 did not seem to affect the gorse on the dunes as it did in 1990, as there were few signs of dead or moribund gorse.

K - Woodland

- 4.31 Woodland is one of the main habitats affected by the difference in areas compared between 1994, 2005 and 2014 (Figure 11). There was an apparent reduction in the extent of woodland between 1994 and 2005, and a subsequent significant expansion by 2014 of woodland from 0.90ha to 1.52ha, a 40% increase in area. The change of all the different woodland communities shows that most of this is pure woodland without other vegetation mixtures. This is still a very small proportion of the dune vegetation, however, and not a significant cause for concern.
- 4.32 There could be a number of factors involved in these changes. Firstly, there is a better definition of woodland because of the ease of separation of different patches on the 2005 photographs

compared with 1994 black and white, smaller scale mapping. Secondly, it has been possible to exclude small areas of other dune types of grassland and marram from the woodland areas, thus appearing to result in a reduction of woodland cover between 1994 and 2005. Thirdly, some of the woodland and tree cover has extended and this can be seen clearly on the dune plain where the willow wood in the south side of the dunes, for example, has expanded considerably indicating an increase in canopy since the 2005 survey.

- 4.33 It is likely that some of the areas previously mapped as mixed shrubs have become tall enough to pass under, thus changing with time into young woodland. Thus, the overall cover of woodland and woodland mixtures is probably a realistic assessment of the increase in cover, but this is still less than 1% of the dune area, and not significant in extent. Figure 11 shows that some of the expansion is associated with the willow wood, with an expanded canopy, in the southern dunes, whilst there has been an expansion too of the main area of woodland at the north-east end of the dunes together with smaller patches close to the main scrub banks which will have developed out of the scrub.
- 4.34 The woodland total does not include the canopy of the larger Holm oak (*Quercus ilex*) and pines that are outside the woodland patches. These covered 0.8ha in 2005 and had only increased to 0.9ha by 2014. The total number of evergreen oak individual trees in 2005 was 168, with 153 recorded in 2014. The difference in numbers could relate to changes in recording their occurrence within scrub habitats plus the fact that some trees have been removed as part of dune management (although some of these may have been too small to register on the aerial photographs), but the area they cover probably reflects an increase in canopy extent over the intervening nine years (Figure 11).

I – Bracken

- 4.35 Bracken-dominated areas showed a marked increase from 1.32ha in 1994 to 7.18ha in 2005. Total bracken communities also increased overall by 26% to 14.66ha. These changes were observed to commence after the 1990 storm when bracken appeared to be taking the place of the previously extensive gorse scrub that was killed by the salt spray. The majority of bracken forms mixtures as it invades other communities, as described in Section 3.
- 4.36 By 2014, bracken in pure stands had declined marginally to 6.79ha, and the total bracken communities have declined similarly from 11.87ha to 11.54ha between 2005 and 2014, showing a small loss overall. This is reflected in Figure 12 where there are large areas of stable bracken or bracken mixtures around the granite cliffs below La Moye Golf Course and, to a lesser extent, along the back of the dunes below Bosdet. There is some interchange between vegetation types, with new patches of bracken or bracken mixtures shown below the golf course and a number of small patches that have changed to a different non-bracken community. These are mostly small fringes to larger patches, some of which were smothered by expanding woodland or scrub (see Figures 11 and 12). There are equally also new patches of bracken both below La Moye Golf Course and along the back of the dunes adjacent to the Bosdet extension.
- 4.37 Earlier investigations by the author on the dunes along several bracken fronts showed that bracken was sensitive to drought in the sandy soils of the dunes and retreated rather than advanced in such conditions. In wet springs/summers, the reverse might be expected. Winter storms that sprayed salt over the dunes have been seen to affect evergreen species like gorse, but bracken would not be affected whilst dormant. If such salt spray effects occurred in the growing season, the bracken would be more disadvantaged. The timing of events, therefore, has the potential to control bracken spread and density. There have been a number of spring and summer droughted periods during the last ten years which could have affected the advance and retreat of bracken. The locations of these will depend on the depth and water holding capacity of the soils along with their aspect.

H – Wetland Vegetation

- 4.38 The main wetlands in 1994 were the damp valley bottom running down from the south side of La Moye Golf Course and the large flooded sand pit at the north eastern end of the dunes. The latter was dry in 2005 and 2014 and has been mapped as bare sand. The wet area in the valley from the golf course has dried since 1994, and the purple moor-grass and marsh pennywort have disappeared. Instead the valley is marked by an abundance of hemp agrimony and other tall vigorous herbs, suggesting a recent significant increase in nutrients flowing off the golf course. In 2005, the main addition to the wetlands was the narrow marshy fringe to the pond in La Carrière car park (Figure 13) which is still present.
- 4.39 In 2014, the tall herb wetland in the valley in the southern unit from La Moye Golf Course was much expanded after significant scrub removal just before the mapping survey with a total of 0.09ha of wetland altogether, more than four times as much as in 2005, but still a very small area. Future monitoring will need to establish whether a good quality wetland develops from this clearance or whether ruderal herbs take over – this being dependent on how wet the soils are in the growing season.

L - Heathland

- 4.40 There have been significant changes in the cover of heathland over the 20 years of mapping, although the totals are very small, and constitute much less than 1% of the dunes. In 1994, only 0.008ha was mapped, but this had increased by 2005 to 0.35ha of unmixed heathland. By 2014, it had declined to 0.14ha of pure heathland habitat. The same trend of decline is shown on Table 7 where all the heathland communities are shown reducing from 0.58 to 0.42ha in total between 2005 and 2014. These figures show that most of the heathland cover is mixed with other communities.
- 4.41 Figure 13 also shows the changes in the heathland communities. The areas that have remained unchanged in location are mostly on the southern dune area and it is here that several new heathland patches have appeared as well, particularly on the slopes above La Carrière quarry. There are also some patches on the southern dunes granite slopes that have changed from heathland due to bracken (see Figure 12) or scrub invasion (Figure 11), while others have become more mixed with burnet rose or grasslands of different sorts.
- 4.42 The presence of heathland reflects both the close proximity of the granite cliffs to the surface, thus influencing the pH of the sand on this area, and the natural leaching of stable dune plain soils to produce conditions in which bell heather can invade. If conditions can maintain the dune plain vegetation of grassland or heathland (essentially through rabbit grazing) then the heathland should slowly expand as more soils are leached, but this will be a gradual process. On the granite/sand cliffs, the heathland seems to be more vulnerable to invasion by bracken or scrub/gorse, perhaps where rabbit grazing is not sufficient to prevent some of these successional changes.

A - The Disturbed, Tall Herb Community

- 4.43 The figures in Table 7 show that there has been a significant increase in area of the disturbed, tall herb community between 2005 and 2014 from 0.11 to 0.56ha. This is still a very small part of the dune grassland and not of significance. This contrasts with the sharp decline in cover of this community between 1994 and 2005, again with very small areas involved. The latter was mostly related to the maturation of the vegetation around the car parks which had been landscaped and edged with bare sand prior to 1994. By 2014, there seems to have been more disturbance around Le Mont a la Brune upper car park leading to the development of this vegetation type. Some is likely to be related to excessive activity around rabbit warrens

amongst the gorse and other scrub in this area. The old middens associated with the Prisoner of War camp are now classified as ruderal with scrub owing to the disturbance by rabbits. Minor disturbance had also been caused by works alongside the road near the car park.

- 4.44 The results show a distinct change in the nature of the ruderal community from one derived from mounding round car parks and associated works, to one associated more with rabbit activity under scrub. This ties in with the increase in species-rich B grasslands at the expense of the rank grassland which is predicted to be the result of increases in rabbits – their burrows are often associated with the scrub patches.

S - Sand

- 4.45 Between 1994 and 2005, there was a very small increase in bare sand, from 3.92ha to 4.00ha (with no partial vegetation cover), and this had hardly changed by 2014 (3.98ha). The amount of sand alone and with various vegetation types was 5.70ha in 2005 and shows a modest expansion to 6.66 (14.4% more) by 2014.
- 4.46 The spatial patterns of the changes between 1994 and 2005 (Figure 14) showed that little sand remained in the same areas between the years (1.37ha), the main ones being the sand pit that regularly floods, and a few of the larger blowouts. The new areas of bare sand, or sand mixed with vegetation occurred spread across the higher dunes. A similar pattern can be seen on Figure 14 in 2014. The main areas of sand that have remained in place are the large sand area that often floods in winter at the back of the dunes, and a large blowout west of this. There is a footpath network in the high and low dunes that has remained bare sand as well. Only very limited areas of mixed sand and vegetation have remained in place, with many more small patches appearing mostly on the high or low dunes rather than in the dune plain. There seems to be a number of small blowouts that have appeared, new footpaths that are now bare or where footpaths have ballooned out from their originally linear pattern.
- 4.47 Only very limited areas have changed from sand to non-sand-related vegetation types, and these small areas are spread across the high and low dunes as well as the slopes below La Moye Golf Course. The amount of sand on the dune plain and of changes to this are very limited. This pattern of changing sand is part of the dynamics of the dunes as explained in para. 4.19.

5. CONCLUSIONS

- 5.1 Just as in 2005, the changes described emphasise forcefully the dynamic nature of the dunes. In general terms, it has been found that even where small changes in overall totals of vegetation types are shown, there have frequently been significant spatial changes within and between the vegetation types. Those most likely to remain static are the longer lived ones such as scrub and woodland, but even these show changes. Some change could be due to inconsistencies in interpretation in the field and mapping methods. However, the fact that all the vegetation types seem to change significantly, and on an appreciable scale, must reflect natural change in the dunes.
- 5.2 The key findings are the switches between the grassland, rose and marram communities that occur, the possible recovery of heathland and gorse since the storm in 1990 and then their decline to 2014; the way in which the scrub tends to remain in the same areas all the time but consolidates and expands plus some new patches; the way bare sand cycles through different communities and the very confined nature of the bracken communities. The changes have also assisted in identifying the way that natural succession progresses, and the relationships between some of the vegetation types that could only be postulated previously.
- 5.3 Although many of the changes appear to be dramatic when one community changes to another, it has to be born in mind that many of the species are the same in each, and it is the preponderance of the main ones, and the extent to which they dominate that changes, either because these key species increase or decrease, or through changes in the abundance of the companion species that then result in greater dominance of the others.
- 5.4 The major losses in rank grassland and gains in species-rich communities is a major benefit for the dunes providing the chances of more species being found and developing large populations. As the dunes here support more dune annuals than most dunes in the British Isles, the open vegetation that provides the opportunities for annuals and other small species is critical. The re-appearance of several orchid species in the area recently is also a reflection of such changes which are more widespread than those on Les Blanchés Banques. Managing the dunes to promote rabbit grazing is not easy, but these animals are critical to the maintenance of the dune flora and its associated fauna.
- 5.5 The decline in marram communities overall should be noted but perhaps not with too much concern at the moment. The sea wall effectively cuts off new supplies of sand, so the system is inherently more stable than without the wall. Nevertheless, because the yellow dunes are largely on the scarp edges and high dunes rather than the dune plain and, therefore, more vulnerable to wind blow, and because the site is well used by rabbits and people which together produce different kinds of regular disturbance, sources of sand are evident, albeit generally on a small scale. There will be a different perspective for the marram communities on the dunes when the frontal dunes are included in the whole survey assessment in the future as this is closest to the sea and contains extensive marram-dominated vegetation.
- 5.6 It is suggested that major gales and storm effects on the dunes may be a once in a generation (or more) effect, the results of which would persist but slowly decline through succession for decades. It would be interesting, for example, to explore the origin of the main blowouts that were conspicuous in the earliest 1983 mapping on the high dunes, many of which have now stabilised with much less bare sand visible over the 30-year period. The ten-yearly site surveys are possibly, therefore, on too short a timescale to reflect this potential source of perturbation.
- 5.7 The spread of scrub (not gorse) is a cause perhaps of concern. This seems inexorable over the full time sequence of dune vegetation mapping. There is evidence that it has expanded in places into the heathland and species-rich grassland. Focus on removing it from such areas before it excludes the underlying vegetation would be advantageous. Gorse establishment

seems to be more readily controlled by strong salt-spray laden winds. Bracken invasion is probably less of a problem as it has declined on the dunes and, with climate change, may well suffer more through spring or summer droughts in the future. Nevertheless, some monitoring of its effects on heathland patches would be merited as this habitat is so restricted.

- 5.8 The expansion of woodland is substantial but not significant owing to the very limited area. Salt spray and strong winds are likely to contain and control extensive woodland development over time. However, as wetlands are at a premium, it would be useful to reduce the willow wood in the small valley from La Moye Golf Course in order to restore further wetlands along the line of the former *Molinia* strip.
- 5.9 The key findings of the 2014 survey are supported by the understanding of the dunes that has been acquired over 31 years of investigation and monitoring by PAA. That the storm in 1990 had a significant effect that took 11 or so years to restore is clear, but the system has moved on from this now and the way the dunes have responded relate to the detail of where rabbit grazing is adequate to maintain species-rich swards, where the trampling and disturbance effects are most felt and the effects of drought which could be containing bracken on the driest soils.
- 5.10 The dunes remain a key amenity site for Jersey people and visitors alike, and their effect is seen in the bare sandy paths and disturbance. This helps maintain the dynamics of the dunes when storms move the exposed sand around. Such movement also stimulates the dominance of burnet rose, which is also affected by moth outbreaks and competition with other species, themselves controlled by rabbit grazing.
- 5.11 The mapping exercise and the ability to use GIS to analyse the data have provided a further fascinating insight into the character and dynamics of the dunes in a way that was previously impossible. The extent of the constant 'churning' of vegetation communities was first exposed in 2005 after comparison with the 1994 data, and has now been found to have continued to 2014. This shows that the changes are part of long-term, ongoing perturbations. Some of the trends have been in a single direction (for example the decline in rose-dominant vegetation), although this may not continue. Others increase and decrease in line with various factors such as damaging salt winds, erosive winds producing bare sand and blowouts which rejuvenate the dunes and kick-start natural succession again, the intensity of rabbit grazing, or other site conditions. The changes ensure that the dunes incorporate sufficient instability to be able to support the full range of dune communities. This has important implications for assessing the nature conservation condition of the dunes and in ensuring that it is managed effectively in the future.

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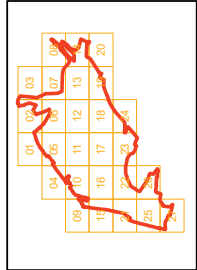
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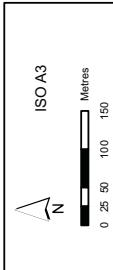
FIGURES



Legend

- 2014 survey boundary (130ha) ▭
- 2005 survey boundary (107ha) ▭
- 1994 survey boundary (105ha) ▭
- Dune areas ▭
- Target notes 1-48 ●
- Cafe ■
- Golf Course ■
- Quarry ■
- Car Park (CP) ■

Car Park Names:
 1= La Puente (Long stay CP)
 2 = La Carrière CP
 3 = Le Mont à la Bruine (Lower CP)
 4 = Le Mont à la Bruine (Upper CP)
 5 = Le Braye (CP)



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Project Name: Vegetation Mapping LBB 2014

Discipline: Ecology

**Survey Extent
 2014, 2005 and 1994**

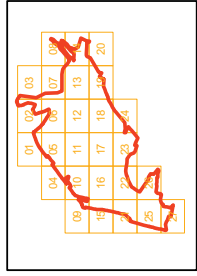
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Aerial photography States of Jersey 2013

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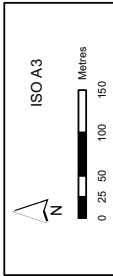


Legend

2014 survey boundary

Grassland Habitat Codes:

- B
- Bi
- Bii
- B mosaic e.g. B/Bi/Bii
- B mixtures with other habitats (exclu. E&J)
- Bs with E
- Bs with J



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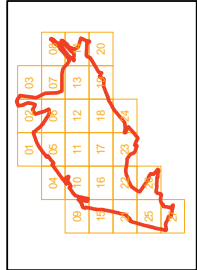
Title: **Grey Dunes - Fixed Dune Grassland Communities (B, Bi, Bii) and Mosaics 2014**

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PRARR\G_LBBD03\16_Environment_LBB14Map			Date
Figure: JAR030104\FY0301			Revision
			B



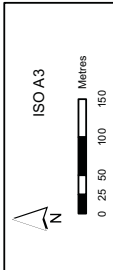
Grey Dunes – Fixed dune grassland :

Rank Grassland = E,
Short Species-rich Vegetation with Moss and Lichens = B,
Variable Short Turf Species-rich Community = Bi,
Trampled, Species-rich Community = Bii,
Burnet Rose Dominant = J.



Legend

- 2014 survey boundary
- E Rank grassland
- E with other (no B's)
- E/J
- J
- J with B
- J mosaic
- C/E mosaics
- D/E
- D/E mosaic with A or B or Bi or I



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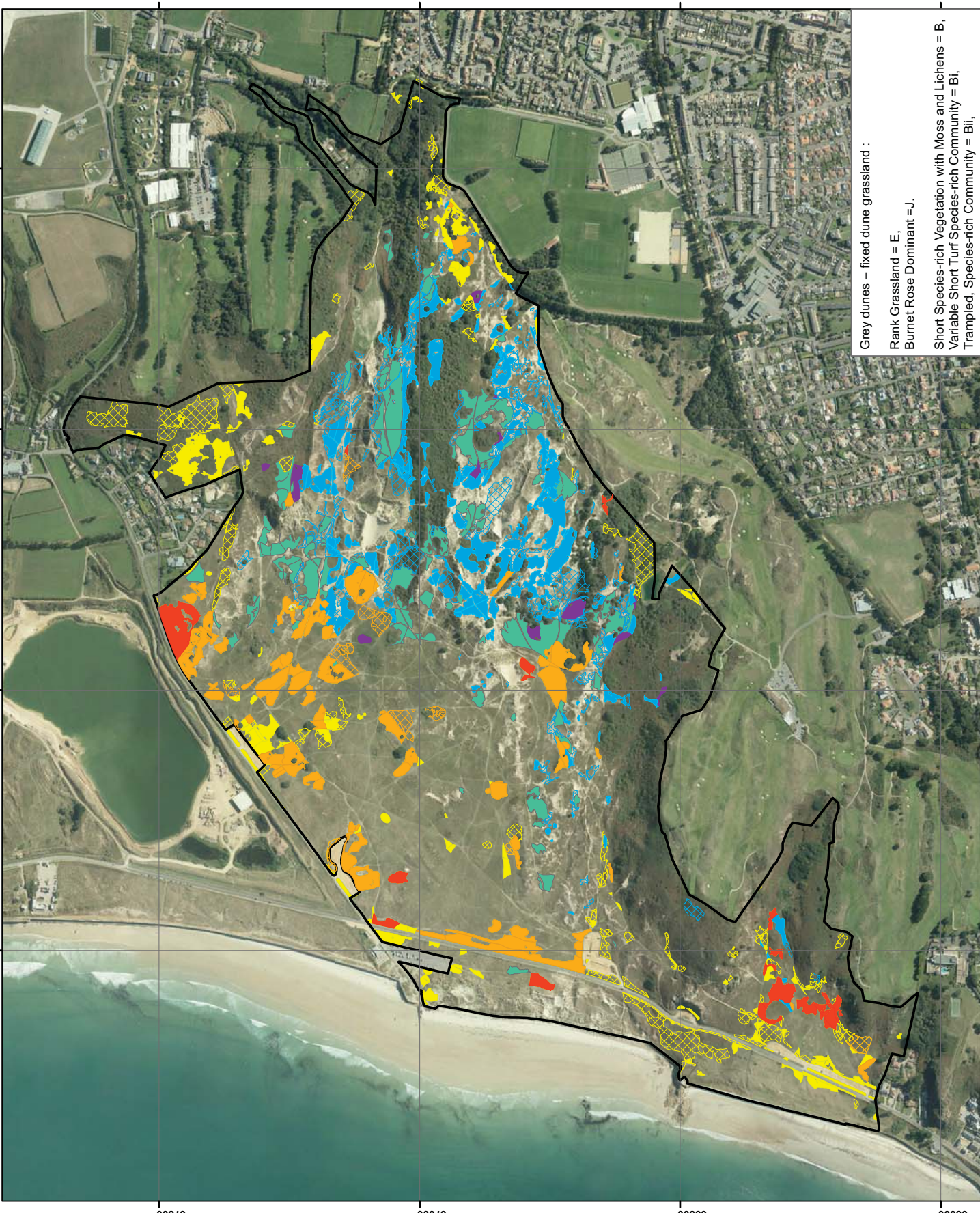
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Project Name: Vegetation Mapping LBB 2014

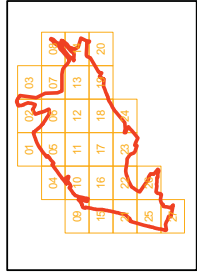
Discipline: Ecology

**Grey Dunes
 Fixed Dune Grasslands
 (E&J) and Mosaics
 2014**

Scale	1:7,000	Drawing No.	Figure 3
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Project No.	TRAR/03/0000/31/Revised/2014/Map Revision	Date	MAR 2015
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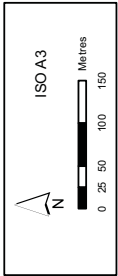


Grey dunes – fixed dune grassland :
 Rank Grassland = E,
 Burnet Rose Dominant = J,
 Short, Species-rich Vegetation with Moss and Lichens = B,
 Variable Short Turf Species-rich Community = Bi,
 Trampled, Species-rich Community = Bli,



Legend

- 2014 survey boundary
- C
- D
- C/D
- D mosaic with other habitat
- C mosaic with other habitat
- C/E
- D/E
- C/E/B mosaic
- D/E mosaic with A or B or Bi or I



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Project Name: Vegetation Mapping LBB 2014

Discipline: Ecology

**Yellow Dunes-
 Marram Communities (C,D)
 and Mosaics 2014**

Scale	1:6,250	Drawing No.	Figure 4
Drawn By	JL	Original	KL
PRARR\GLO\CD\31_Environment\JPM\Map Revision		Date	MAR 2015
		Revision	B



Aerial photography: States of Jersey 2013