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# THE TRUE BUGS (HETEROPTERA) OF TENTSMUIR POINT, FIFE

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## INTRODUCTION

Coastal sand dunes have long been recognised as important sites for plants and animals which often exhibit peculiarities confined to this type of formation. Insects have received much attention, although little ecological work has been attempted. Important papers include those by van Heerdt and Morzer Bruyns (1960) and Cotton (1967) who studied the insect fauna in relation to the stages of succession, comparing the mobile dunes with the more fixed dunes inland. More comprehensive ecological analyses have been done on the spider fauna of sand dunes by Duffy (1968) and Almquist (1973) who studied the habitat preferences of spiders over the whole range

of habitats found on dune systems. One of Duffy's study areas was Tentsmuir Point.

This paper gives the results of a study of the habitat preferences of one particular group of insects, the true bugs (Heteroptera), at Tentsmuir Point NNR (National Nature Reserve) during the summer of 1978. These insects feed on the sap of plants, and are closely related to Homopteran bugs (aphids and frog-hoppers). A few species have developed a predatory habit. Both groups belong to the order Hemiptera.

Tentsmuir Point is situated in the north-east corner of Fife, bounded on the north side by the Firth of Tay, and on the west by a mature pine plantation. The Reserve comprises a coastal strip two km long and up to 0.75 km wide, providing a fine example of a relatively undisturbed, actively growing, dune system. The climate of Tentsmuir is mild and the area is one of the sunniest in Scotland, although suffering periods of heavy rain. The average annual rainfall is 75 cms (30 inches). The Tentsmuir sand has a low lime content and as a result an acid flora has developed on the stable dunes inland. Previous collections of insects at Tentsmuir have shown the Reserve to have considerable entomological interest. Of particular relevance is a collection of true bugs, which is discussed later, made by Malcolm Smith (unpublished) between 1963 and 1967.

## CLASSIFICATION OF THE ANIMAL HABITATS

The landward part of Tentsmuir Point NNR comprises approximately 52 ha (130 acres) yet within this small area there is a remarkable diversity of plants which provide a wide range of habitats for bugs. Several attempts at classifying the vegetation have been made, e.g. Fairley (1977) and Duffy (1968), however none of these classifications were found to be suitable for bugs, which are often confined to one food plant with a very patchy distribution.

For the purposes of this study the Reserve was split up into 13 broad habitat types, briefly described below, and shown in Figures 1 and 2. The dominant plants found in each habitat are given in Table 1, in which English names are from Dony, Perring and Rob (1974).

A Drift Line. This is composed of an accumulation of flotsam, jetsam and dead organic material deposited by spring high tides. No growing vegetation is present.

B Embryo Dune. These dunes form an extensive area at the north of the reserve and consist of unstable low-lying dunes colonised sparsely by grasses.

C Marram Grass Dune. The highest and most prominent of the semi-stable dunes are colonised by marram grass with few other plants present.

D Lyme-Grass Dune. The semi-stable dunes are lower in the north-east and here lyme-grass takes over from marram grass. In July a number of herbaceous plants grow up amongst the lyme-grass.

E Marram Transition. On the landward side of the semi-stable dunes the marram grass begins to lose vigour and is less often found growing in tussocks. There is more bare ground but many other plants may be found amongst the marram grass. This is a more open habitat than the two preceding ones.

F Dune Slack (1): Grass/Sedge Type. The larger and more northern part of the main slack is dominated by grasses and sedges, together with some rushes.

G Dune Slack (2): Creeping Willow/Birdsfoot Trefoil Type. The southern half of the main slack is dominated by creeping willow and birdsfoot trefoil.

All the dune slacks on the Reserve are often flooded with fresh water during the winter and spring, and in summer support a rich profusion of flowering plants.

H Dune Heath (1): Lichen/Moss Type. Dune Heath covers a large area of the Reserve on the inland side of the slacks. Scots pines have been allowed to grow over a large part of this habitat, splitting it into two. Now areas of true Dune Heath are found in the north and south of the reserve, with a large section of young pine woodland in the centre.

I Dune Heath (2): Heather Type. This is a small area in the most northerly part of the Reserve where heather is dominant.

J Alder Line. The Alder Line was formed by alder colonising a dune slack and it now consists of a narrow strip of woodland running parallel to the shoreline across most of the Reserve.

K Birch/Willow Scrub. Small areas of silver birch and willow are present in several moist localities.

L Pine/Birch Woodland. This covers a large area in the centre of the Reserve where Scots pine has colonised the Dune Heath to the exclusion of many plants common in the latter habitat.

M Marshy Slack. The Marshy Slack is situated in the southern half of the Reserve along the western boundary and has typical marsh plants.

N Aquatic. The only permanently aquatic habitat on the Reserve is a 200 m Forestry Commission drainage ditch which flows slowly along the southern edge of the Reserve.

Table 1 Dominant Plants found in each habitat

A Drift Line

No growing vegetation

B Embryo Dune

Sand Couch Grass
Lyme-Grass

C Marram Dune

Marram Grass

D Lyme-Grass Dune

Lyme-grass
Spear Thistle
Rosebay Willowherb
Common Ragwort

E Marram Transition

Marram Grass
Mosses
Rosebay Willowherb
Spear Thistle
Ragwort

F Dune Slack (1)

Creeping Bent Grass
Sedges
Grass-of-Parnassus
Northern Marsh Orchid
Silver Birch
Seaside Centaury
Yellow Rattle

G Dune Slack (2)

Creeping Willow
Birdsfoot Trefoil
Silver Birch

H Dune Heath (1)

Lichens
Mosses
Lady's Bedstraw
Sweet Briar
Broom
Gorse

I Dune Heath (2)

Heather
Sweet Briar
Broom
Gorse

J Alder Line

Alder
Silver Birch
Yorkshire-fog
Skullcap

K Birch/Willow Scrub

Silver Birch
Grey Willow
Cross-leaved Heath
Heather
Mosses

L Pine/Birch Woodland

Scots pine

N Aquatic

Common Water-crowfoot
Marsh-marigold

M Marshy Slack

Common Sedge
Reed Sweet Grass
Soft Rush
Meadowsweet
Skullcap
Silverweed

## METHODS

Systematic collecting began on 7 July 1978 and continued for six weeks. Standard entomological collecting methods were used including sweeping and beating vegetation and searching on the ground in litter and moss. Several hours were spent collecting in each habitat and every major plant was sampled. Most habitats were sampled twice during the study period. Generally collecting was not attempted on days when the vegetation was very wet or temperatures were low.

Specimens were identified using Southwood and Leston (1959) and Macan (1965). Representative specimens were checked against reference material in the Royal Scottish Museum or Dundee Museum. A small number of specimens were identified by Alan Stubbs (Nature Conservancy Council) and Rodger Waterston (Royal Scottish Museum). Nomenclature of bugs follow Kloet and Hincks (1964).

## RESULTS

Sixty-two species were collected in the present study bringing the total number of species recorded for the reserve to 90, a large number for such a small area in northern Britain. Table 2 gives the number of species collected from each habitat type. The complete list of species collected is given in Table 3, together with an indication of their abundance. Aquatic bugs are given separately in Table 4.

Table 2 Total number of species in each habitat

| | Drift Line | Embryo Dune | Marram Dune | Lyme-grass Dune | Marram Transition | Dune Slack (1) | Dune Slack (2) | Dune Heath (1) | Dune Heath (2) | Alder Line | Birch/Willow Scrub | Pine/Birch Woodland | Marshy Slack | Aquatic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HABITAT | A | B | C | D | E | F | G | H | I | J | K | L | M | N |
| Number of Species | 0 | 4 | 5 | 11 | 4 | 13 | 10 | 22 | 11 | 18 | 12 | 20 | 17 | 6 |

## DISCUSSION

As expected, the number of Heteropteran bugs increases as one passes inland from the Embryo Dunes to the Dune Heath (Table 2). This may be due to the corresponding increase in plant diversity, but other contributing factors may include the physical instability and exposure of the seaward habitats.

Several bugs were ubiquitous, taken from a variety of plants throughout the reserve. For example, *Anthocoris nemoralis, A. nemorum, Plagiognathus chrysanthemi, Plesiocoris rugicollis, Calocoris norvegicus,* and *Leptoterna ferrugata* were abundant in seven or more habitats. Similarly, the shore bug *Saldula saltatoria* was found in seven habitats, although the absence of other saldids is puzzling. Some bugs are restricted to uncommon food plants, e.g. *Dicythus annulatus* was taken from restharrow, and *Orthops rubricatus* from a single sitka spruce tree.

On habitats A–E, which cover the mobile and semi-fixed dunes of the Reserve, few bugs were collected, probably due to low plant diversity. The Embryo Dunes, perhaps the most exposed terrestrial habitat on the reserve, supported little insect life including very few bugs. Of the bugs collected, *Trigonotylus psammaecolor* was the most noteworthy, all individuals being taken on the landward side of the Embryo Dunes. This is a bug which is only found on coastal sand dunes and so it may be classed as a 'psammophile' (van Heerdt and Morzer Bruyns 1960). It was taken from sand couch and marram grass during July. The Marram Dunes, on the other hand, have been shown to contain a wide variety of invertebrate life (Cotton 1967, Duffy 1968), and this is reflected in the larger number of bugs found here, and the presence of the predatory bugs *Anthocoris nemoralis* and *Saldula saltatoria*. Two other species, *Trigonotylus ruficornis* and *Leptoterna ferrugata* regularly feed on marram grass and were taken from this plant wherever it occurred on the Reserve. The Marram Transition habitat, although containing a few more plants, supported a similar fauna to that of the Marram Dunes. The Lyme-grass Dunes supported a much larger bug fauna than the previous two because of the large numbers of thistles and ragwort which grew up there in July.

The Dune Slacks contained two of the most interesting and important bugs on the Reserve. These are *Coranus subapterus* and *Systellonotus triguttatus,* and for both Tentsmuir Point is one of very few Scottish locations. *C. subapterus,* the Heath Assassin bug, is a large predatory bug feeding on a variety of small invertebrates. It was found on bare ground near creeping willow; both macropterus (long wing) and brachypterous (short wing) forms were taken, the former being rare in Southern England. *S. triguttatus* is normally found

TABLE 3 Estimates of abundance of each species in each habitat except 'Drift Line' (all zero) and 'Aquatic'.

A = Abundant C = Common R = Rare L = Local, i.e. taken from a locally distributed plant within the habitat

| SPECIES | Embryo Dune B | Marram Dune C | Lyme-grass Dune D | Marram Transition E | Dune Slack (1) F | Dune Slack (2) G | Dune Heath (1) H | Dune Heath (2) I | Alder Line J | Birch/Willow Scrub K | Pine/Birch Woodland L | Marshy Slack M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Elasmostethus interstinctus* | | | | | | | | | C | C | | |
| *Elasmucha grisea* | | | | | | | | | | R | | |
| *Pentatoma rufipes* | | | | | | C | | | A | A | | A |
| *Nysius thymi* | | | | C | C | | | | C | | | |
| *Stygnocoris pedestris* | | | | | | | | | | | | C |
| *Drymus brunneus* | | | | | | | | | | C | | |
| *Scolopostethus decoratus* | | | | | | | | | | | | R |
| *S. thomsoni* | | | | | | | | | RL | | | |
| *Coranus subapterus* | | | | | | C | | | | | | |
| *Anthocoris nemoralis* | | C | | | | | A | C | C | C | C | A |
| **A. nemorum* | | | | | | A | A | A | A | A | A | A |
| *A. sarothamni* | | | | | | | | RL | | | | |
| *Acompocoris pygmaeus* | | | | | | | | | | | C | |
| *Nabis ferus* | | | R | | | | | | | | | |
| *Monalocoris filicis* | | | | | | | CL | | | | R | |
| **Psallus ambiguus* | | | | | | | | | R | | | |
| *Psallus betuleti* | | | | | C | A | | | | A | | R |
| *P. roseus* | | | | | | | | | | | C | |
| **Phoenicocoris obscurellus* | | | | | | | | | | | C | |
| *Attractotomus magnicornis* | | | | | | | | | | | CL | |
| **Plagiognathus arbustorum* | | | A | | | | A | | R | | A | A |
| *P. chrysanthemi* | | | A | | A | A | A | A | A | A | | A |
| *Asciodema obsoletum* | | | | | | | CL | CL | | | | |
| *Systellonotus triguttatus* | | | | | C | C | | | | | | |
| *Dicyphus annulatus* | | | | | | | CL | | | | | |
| *Pachytomella parallela* | | | | | A | | | | | | | |
| *Heterocordylus genistae* | | | | | A | | | | | | | |

TABLE 3 (Continued)

A = Abundant C = Common R = Rare L = Local, i.e. taken from a locally distributed plant within the habitat

| SPECIES | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *H. tibialis* | | | | | C | | | CL | | | | |
| *Blepharidopterus angulatus* | | | | | | | | | C | | | |
| *Orthotylus adenocarpi* | | | | | | | | RL | | | | |
| *O. ericetorum* | | | | | | | C | C | | | | |
| *O. virescens* | | | | | | | CL | CL | | | | |
| **Mecomma albulans* | | | | | | | | | C | C | C | C |
| **Pithanus maerkeli* | | | | | C | | C | | C | | C | C |
| *Lygus maritimus* | | | C | | | | C | | | | | |
| *L. rugulipennis* | | | | | | | C | | | | C | |
| **L. wagneri* | | | | | | | | | | | | |
| *Orthops cervinus* | | | | | | | | | RL | | | |
| *O. rubricatus* | | | | | | | | | | | CL | |
| *Lygocoris pabulinus* | | C | C | | | | A | | A | | A | A |
| *L. contaminatus* | | | | | A | A | | | A | A | A | |
| **L. viridis* | | | C | | | | | | | C | | |
| *Camptozygum pinastri* | | | | | | | | | | | A | |
| **Plesiocoris rugicollis* | | | C | | | A | C | | A | A | A | A |
| *Dichrooscytus rufipennis* | | | | | | | | | | | C | |
| *Miris striatus* | | | | | | | | | R | | | |
| *Calocoris norvegicus* | R | | A | A | A | | A | A | | | A | A |
| *Adelphocoris lineolatus* | | | | | | | | | | | | |
| *Phytocoris pini* | | | | | | | | | | | C | |
| *P. tiliae* | | | | | | | | | R | | | |
| *Stenodema holsatum* | | | | | | | | | | | | R |
| *Trigonotylus psammaecolor* | C | C | | | | | | | | | | |
| *T. ruficornis* | A | | A | A | A | | A | | | | | |
| **Leptoterna dolobrata* | | | C | | | | C | | | | | C |
| *L. ferrugata* | A | A | A | A | A | A | A | C | | | | A |
| **Saldula saltatoria* | | C | | | A | A | A | A | | | A | A |

*The identification of those species marked with an asterisk has been checked by A. Stubbs (Nature Conservancy Council) or A. R. Waterston (Royal Scottish Museum).

south of a line from Lincoln to Carmarthen. It is usually found in open sandy heaths in association with ants, and at Tentsmuir Point it was found in the Dune Slacks where ants are common. The female is an ant mimic. Apart from these two species, the bug fauna of the slacks consist of common species normally associated with damp grassy situations in Scotland.

The Dune Heath has the most diverse vegetation in the Reserve and this was reflected by the large number of bug species found there. Among the more interesting were *Dicythus annulatus, Adelphocoris lineolatus,* both found on restharrow, and *Lygus wagneri* on tansy. Few bugs were taken from nettles, and the single trees of juniper and rowan had no bugs. Lichens and mosses dominate the ground vegetation and no bugs were collected there.

The Heather area at the north end of the reserve was much poorer in bugs and surprisingly only one heather-feeding species was collected, *Orthotylus ericetorum.* The few broom brushes, however, revealed an interesting fauna including *Anthocoris sarothamni, Orthotylus adenocarpi* and *O. virescens.* Very few bugs were found on the numerous rose bushes.

The Pine/Birch Woodland was also rich in bugs, although several of these were confined to Scots Pine, e.g. *Phytocoris pini, Phoenicocoris obscurellus, Camptozygum pinastri* and *Dichrooscytus rufipennis.* Scots pine appears to be a rich food plant for bugs on the reserve. One sitka spruce tree was sampled in mid-August and this revealed two additional species, *Attractotomus magnicornis* and *Orthops rubricatus.* The latter species is confined to spruces.

It is interesting to compare the Dune Heath fauna with that of the Pine/Birch Woodland, for the latter habitat may be considered as a development of the former, although an unnatural one following the regeneration of Scots pine from the mature plantation bordering the Reserve. From Table 3 it is apparent that ten species are common to both habitats and it is noticeable that all are common bugs found in most parts of the Reserve. In the case of the Pine/Birch Woodland, these bugs were all taken from common plants (e.g. grasses, ragwort) in small clearings in the wood. Of the remaining ten species collected from this habitat, all are associated with conifers, with the exception of *Psallus roseus* which was found on creeping willow near the edge of the wood. Hence the majority of bugs associated with the Dune Heath are absent from the Pine/Birch Woodland. This study suggests therefore that the result of the encroachment of the Scots pines has been the gradual extinction of those bugs feeding on heather, gorse, broom and restharrow and the invasion and spread of pine-feeding species over the last ten years or so. Reserve management policy aims at excluding Scots pines from all Dune Heath areas, and this was

extended in late 1978 to include the Marshy Slack and Pine/Birch Woodland. It is expected that all conifer species will be gradually removed from these areas in the future.

The Alder Line also supported a large number of species, all typical of deciduous trees. The northern half of the Alder Line was found to support more species than the southern half probably due to the lush vegetation growing beneath the trees: the predatory bug *Miris striatus,* was found there. As expected, the Birch/Willow Scrub had a similar fauna to that of the Alder Line. *Elasmucha grisea,* a shield bug, was taken from birch, and the damp ground vegetation revealed *Drymus brunneus,* a ground bug feeding on mosses.

The Marshy Slack, although small in area, supported a large number of bugs. All of the 17 species, however, are common and normally associated with wet marshy habitats. Meadowsweet, when it grew up in August, was found to be very rich in bugs; five species were collected from it on one occasion.

The Aquatic habitat was sampled on two occasions: for such a short stretch of water, a large number of species was collected. All are typical of slow-moving lowland streams.

## COMPARISON WITH OTHER COLLECTIONS

Various entomological collections have been made at Tentsmuir Point, the most important being a collection of Coleoptera and Heteroptera made by Malcolm Smith in 1963-67 while employed as Reserve Warden. Details of the Heteropteran bugs collected by M. Smith are given in Table 5 (pers. comm.). In addition, E. C. Pelham-Clinton collected the following species on visits in 1970; *Rhacognathus punctatus,* swept from creeping willow, and *Chartoscirta cincta,* smoked from lyme-grass (pers. comm.). Also R. A. Crowson collected *Ceratocombus coleoptratus* in 1972 (Crowson 1972).

An examination of the above lists reveals that my collections added fourteen new species to the Reserve but I did not find twenty-six species previously recorded. These discrepancies require some comment.

Many of those in the first category feed on trees and M. Smith has suggested that he missed them because he only sampled with a sweep net (pers. comm.). Furthermore, I sampled the aquatic habitat more extensively and this alone accounts for four new species.

The absence of the twenty-six species in the second category may be attributed to a number of factors. First of all, it should be noted that M. Smith made his collections over a period of five years,

TABLE 4 Water Bugs collected from Aquatic Habitat

*Gerris thoracicus
Notonecta Glauca
Sigara dorsalis
Corixa punctata
Callicorixa praeusta
*Hesperocorixa salbergi

*Checked by A. Stubbs or A. R. Waterston

TABLE 5 Heteropteran Bugs collected by M. Smith, at Tentsmuir Point NNR, 1963-67

Pentatoma rufipes
Piezodorus lituratus
Picromerus bidens
Nysius thymi
Kleidocerys truncatulus
Stygnocoris pedestris
S. rusticus
Drymus brunneus
Scolopostethus affinis
S. decoratus
S. thomsoni
Gastrodes grossipes
Piesma quadratum
Acalypta nigrina
A. parvula
Derephysia foliacea
Tingis cardui
Nabis ferus
N. flavomarginatus
Dolichonobis limbatus
Anthocoris confusus
A. nemoralis
A. nemorum
A. sarothamni
Acompocoris pygmaeus
Monalocoris filicis
Bothynotis pilosus
Conostethus brevis
Psallus ambiguus
P. betuleti
P. roseus
Atractot omus magnicornis
Plagiognathus arbustonum
P. chrysanthemi
Asciodema absoletum
Hallodapus rufescens
Systellonotus triguttatus
Dicyphus annulatus
Packytomella parallela
Heterocordylus tibialis
Blepharidopterus angulatus
Orthotylus ericetorum
Mecomma albulans
Pithanus maerkeli
Lygus maritimus
L. rugulipennis
L. wagneri
Orthops cervinus
Liocoris tripustulatus
Lygocoris contaminatus
L. pabulinus
L. viridis
Plesiocoris rugicollis
Camptozygum pinastri
Polymerus unifasciatus
Dichrooscytus rufipennis
Callocoris norvegicus
C. roseomaculatus
Adelphocoris lineolatus
Capsus ater
Stenodema calcaratum
S. holsatum
Trigonotylus psammaecolor
T. ruficornis
Leptopterna dolobrata
L. ferrugata
Ceratocombus coleoptratus
Saldula orthochila
S. saltatoria
Velia caprai
Gerris lateralis
Notonecta glauca
Corixa punctata
Sigara nigrolineata

whereas I collected for only six weeks of one summer. Some species may have been missed because they emerged earlier or later than the study period. This may account for *Stygnocoris rusticus, Nabis ferus, Stenodema calcaratum, Liocoris tripustulatus,* and *Ceratocombus coleoptratus* not being found in the present survey.

Another important factor may be the effect of habitat changes since M. Smith made his collection. Firstly, it is several years since the Dune Slacks were regularly flooded with seawater at spring high tides. This may account for the absence of *Piesma quodratum* and *Conostethus brevis* which feed on Halophytes, presumably more common on the Reserve at that time. Secondly, M. Smith collected three species of ground bugs (Lygaeidae) from nettles, *Scolopostethus affinis, S. thomsoni, Liocoris tripustulatus.* Of these only one was taken by the present author and it was rare. Nettles appear to have decreased on the Reserve recently and this may account for the apparent absence of the other two species. Thirdly, a succession of wet winters and springs has resulted in prolonged flooding in the area of the Marshy Slack during the last few years. Many bugs are susceptible to attack by fungi when overwintering, and this may affect their survival under wet conditions. In 1978, the luxuriant plant growth normally associated with this habitat did not grow up until September, after collecting had ceased. There is also a possibility that my collecting in this habitat may not have been intensive enough. Any or all these factors may account for the absence of species such as *Acalypta nigrina, A. parvula, Derephysia foliacea, Bothynotus pilosus,* and *Ceratocombus coleoptratus.*

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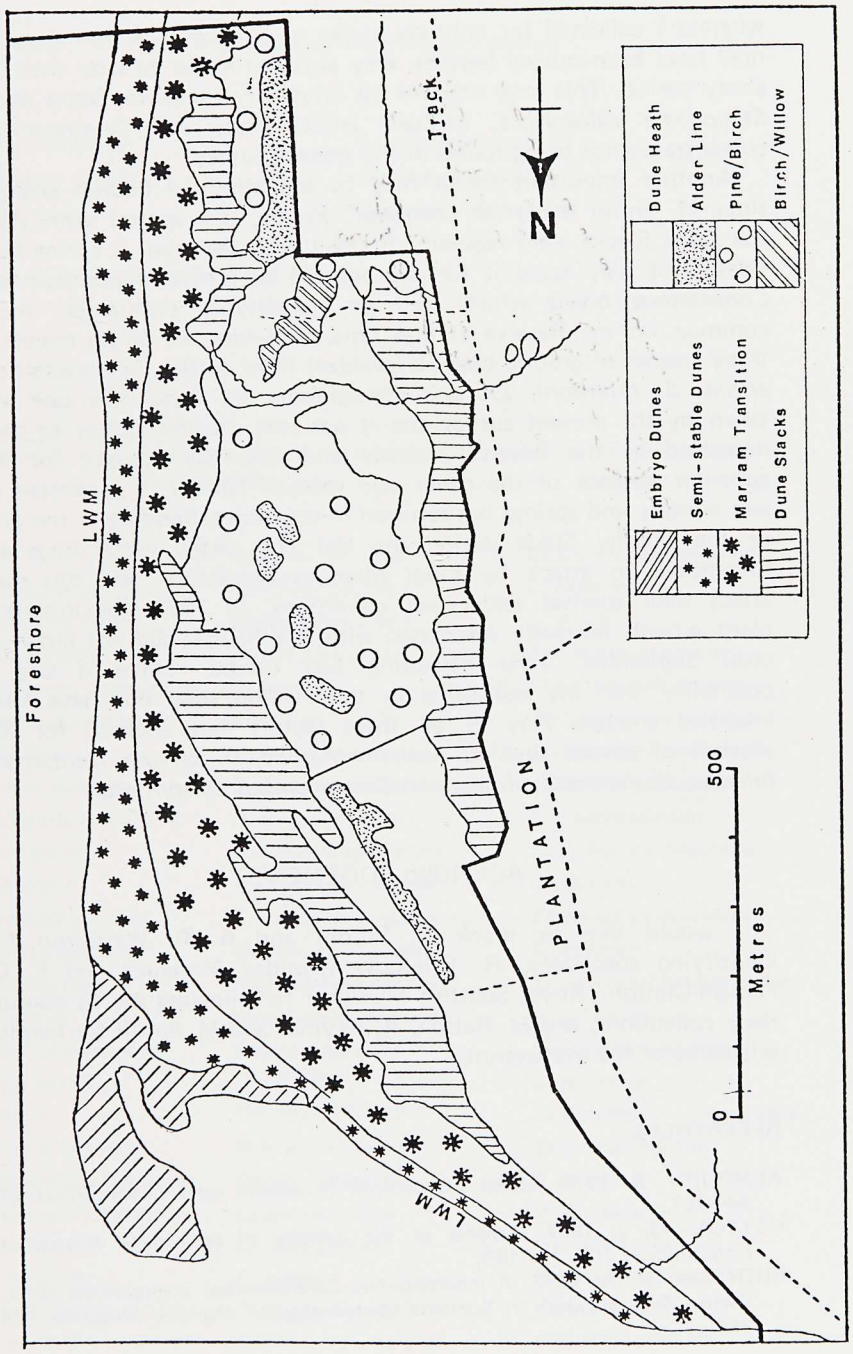


Figure 1 Vegetation map of Tentsmuir Point NNR

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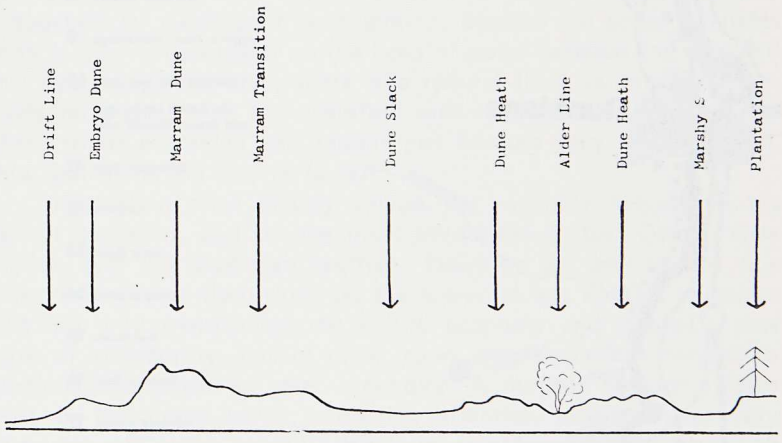


Figure 2 Diagrammatic representation of habitats at Tentsmuir Point along a hypothetical cross-section