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The scientific community accepts marram grass to be non-invasive in dune stabilisation in the Cape

Significance:

For more than three decades, botanists and dune ecologists in the Department of Botany at Rhodes University have spent over 20 000 people-hours researching marram grass. Because of the invasive nature of the plant in Australasia and North America, the plant was long thought to be invasive in the Cape. It has been concluded that the species is non-invasive so long as the variety present in the Cape is used and no new material is introduced. Despite this evidence, the authorities list marram grass as a Category 2 species of weed which may only be grown under permitted conditions in demarcated areas. In order to obtain a permit to use the grass in a large stabilisation project at Hout Bay, a detailed study was reinitiated on the distribution of marram grass 20 years after the original studies on its distribution had been completed. These results confirmed results of the previous studies that the grass was non-invasive. These findings were ratified in a peer-reviewed research paper published recently in a special issue on 'Dynamics and Stability of Plant Communities in Coastal Sand Dunes' of the open access journal *Plants* (Lubke; *Plants* 2022;11(17), Art. #2260). Finally, marram grass, as it occurs on our Cape dunes, may be accepted as a useful pioneer and dune stabiliser. No indigenous species are capable of performing the same process.

Imagine having purchased a beach house along the Cape coast on a fine summer day to spend family holidays relaxing and enjoying South Africa's marvellous coastal environment. Then, on a visit to the beach house in the winter, when a strong southeasterly wind is blowing, you find that the dunes that naturally migrate along the shore are approaching your house at a rapid rate. When you approach a local environmental consultant, they assure you that, with permission from the authorities, you can stabilise the dune system and divert those sands away from your property.



Figure 1: A property at Witsand on the southern Cape coast.

Thanks to our team of researchers at Rhodes University's Department of Botany, the process is clearly explained in the information pamphlet 'Stabilization and management of coastal sand dunes'¹. We have also researched the use of marram grass (*Ammophila arenaria* (L.) Link.), and established that it is the best dune stabiliser in very mobile sands. This information was codified into a recent paper² that categorically establishes marram grass as a non-invader, thus making it available to use in the challenging task of stabilising dunes, although currently its use still requires a permit.

In Europe, marram grass (Figure 2) is the primary dune stabiliser of mobile dunes and is used extensively in many coastal parts to establish barriers to the sea in low-lying areas.³ Consequently, in the 1880s, with the Cape's connection with European countries, marram grass was chosen to stabilise the drift sands on the Cape Flats.⁴

However, marram grass is aggressively invasive in some countries.^{5,6} When a colleague, Al Wiedemann, pointed out the problems of marram grass invasion on the west coast of the USA⁶, a team at Rhodes University led by Prof. Roy Lubke, some 25 years ago, initiated a large European Union funded study (*INVASS*) on potentially invasive grass species with colleagues in Botswana, the UK, and the Netherlands.

Dr Ted Avis, a local Eastern Cape PhD student, now the CEO of a large environmental company (CES), conducted a survey of the coastal zone of the Eastern Cape in the 1980s.⁷ He established that marram had been planted

in numerous regions, sometimes over >100 ha in extent, by the then Department of Forestry as part of an extensive stabilisation programme of mobile dune systems.⁸ These stabilisation programmes were often inappropriate as dune studies at Rhodes University and the Coastal Research Unit at Nelson Mandela University only later showed. At this time, Roy Lubke and Ted Avis published their illustrated pamphlet.¹



Figure 2: *Ammophila arenaria* (marram grass) at Oyster Bay being replaced by shrubs with coastal scrub in the distance.

Dr Ursula Higgins (née Hertling), a PhD student from Germany, now head of the Research Support Division at the University of Bayreuth, did an extensive survey of the eastern, southern and western Cape coasts in the mid-1990s, and this provided reliable baseline data on the previous extent of marram grass plantings.³ These data were used by Roy Lubke in the 2017 survey to extract information about where marram grass was recorded. In addition, the sites of historical information on the plantings of marram were noted from other studies.^{8,9} In the 2017 survey, Lubke, if he found marram to be present, looked in adjacent sites up to 1 km away for other sites where marram could occur in order to record these sites as well.²

Dr Irma Knevel, a PhD student from the Netherlands, now following a career in Research and Student Development at Groningen University, studied numerous aspects of the biology of marram grass and indigenous

species.⁹ Her studies revealed that marram grass, as originally introduced, was non-invasive as it produced little or no seedlings from the parent plants and the plants never became established. Moreover, there was no conclusive evidence that marram grass rhizomes could be transported by sea currents. Knevel also looked at the viability of the use of other pioneers as stabilising agents, but none emerged as being satisfactory.¹⁰

Deon van Eeden, a past MSc student at Rhodes University, and practitioner of dune stabilisation for his company Vula Environmental Services in the Western Cape, has many years of experience in using marram grass as a stabiliser of mobile sands.¹¹ He has contributed to the techniques of dune stabilisation using indigenous species and has also worked out mechanised methods of planting marram.

Professor Roy Lubke, leader of the *INVASS* Project, and now a retired lecturer and Research Associate in the Department of Botany, Rhodes University, and founder of CES with Ted Avis, put together the paper², as is summarised in the graphic abstract (Figure 3).

Our quantitative study included 64 species on 36 plots sampled on the young dunes; these were divided into two communities:

- Early dune pioneer communities (25 plots)
- Early coastal scrub communities (11 plots)

Overall, we found that:

- Marram grass disappeared from four sites (the reason for which could not be established), and in others, it disappeared due to dune erosion. In still other sites where it had been planted, its disappearance was due to its inability to compete with other pioneers without a continuous sand supply.
- Of the 64 species sampled, we identified the average number of pioneers as 2, with the highest number of pioneer species (7) recorded at Kleinemonde (4 grass species, 1 herb, 1 creeper and 1 shrub). Marram grass was often one of the dune pioneers at many sites and fitted naturally into the dune system.
- In no cases where marram grass had been planted was the grass found in adjacent sites. In other words, marram may persist at some sites but there is no evidence of it having moved from these sites to adjacent favourable sites.

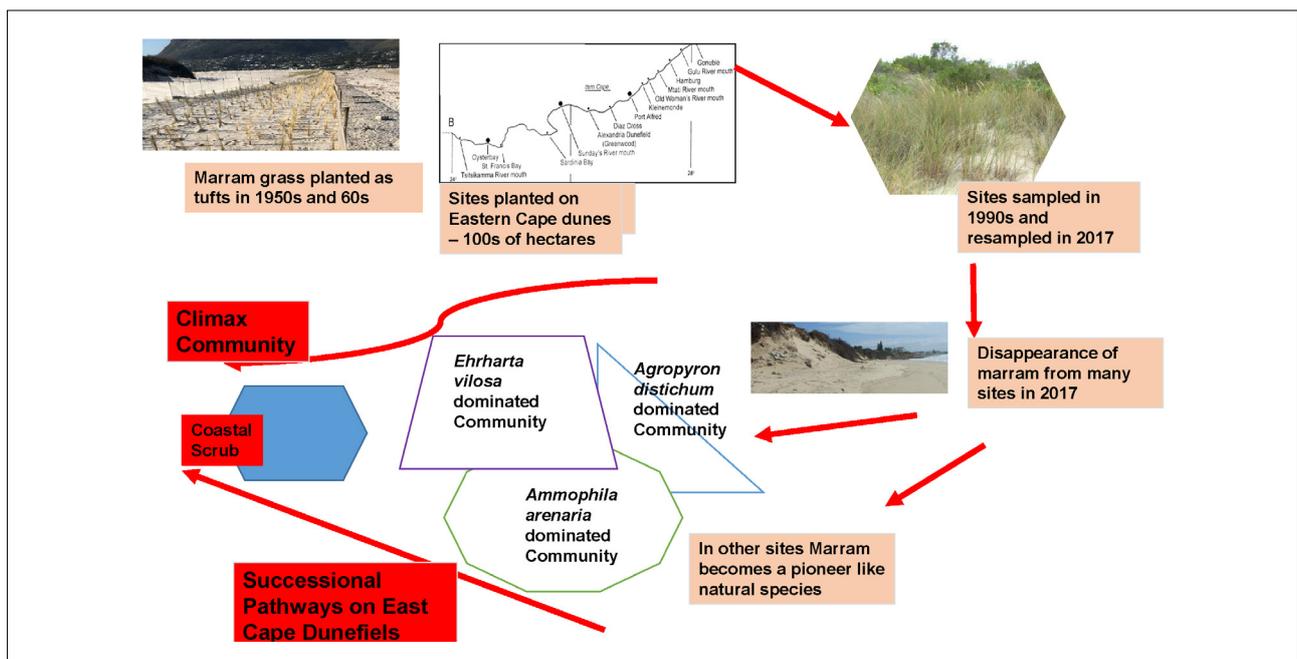


Figure 3: Graphic abstract that summarises the study.²



Thus, we concluded:

- In the Cape dune systems, marram grass does not persist in the climax vegetation.
- If it occurs, it is present along with other pioneer species.
- In many cases, marram just disappears, as stabilised sand is unfavourable for the grass to persist.

Thanks to our research, marram grass was shown to be a non-invasive species that can be successfully used in dune stabilisation. Moreover, we established that marram grass behaves identically to the indigenous species as a dune pioneer species. These results are highly significant for future stabilisation and dune management in the Cape, as for example, where dune sands invade roads or car parks.

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