



LIFE DUNAS
LIFE19 CCA/PT/001178

Lotus sp. in the consolidation of a reconstructed dune in Porto Santo (Madeira)

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Secretaria Regional
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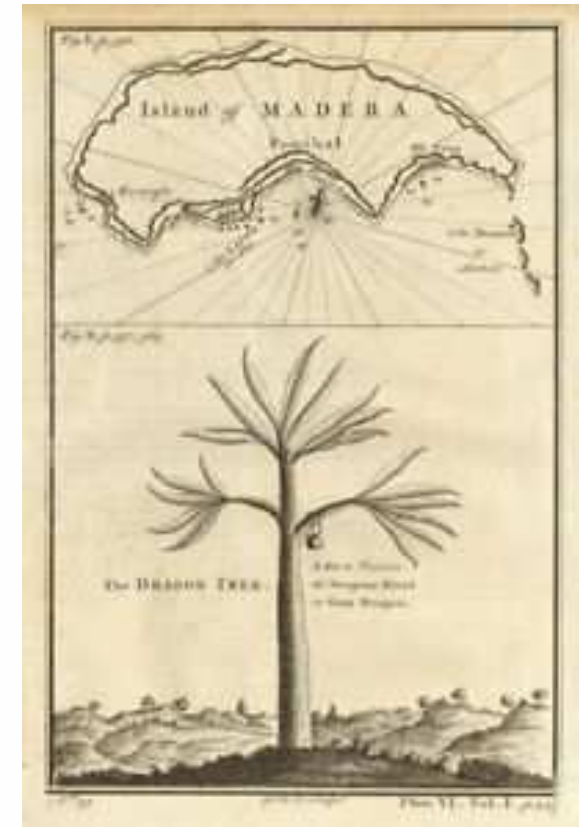
Porto Santo island belongs to Madeiran archipelago that was officially discovered by the Portuguese Gonçalves Zarco and Tristão Vaz Teixeira around 1418, during the period of Portuguese discoveries and exploration of the West African coast.



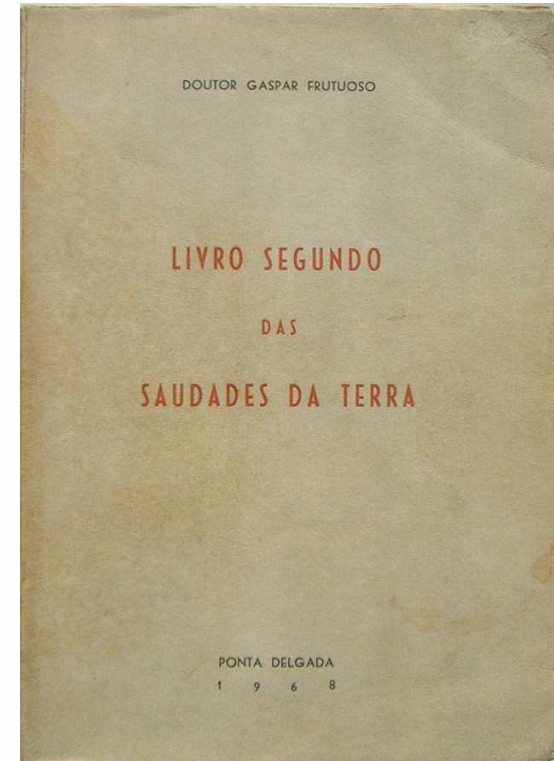
The accounts of Luiz de Cadamosto who visited the island of Porto Santo in 1445 are the first known records on the original flora of Porto Santo and key elements in the landscape (Bowdich, 1825) and were fully published only in 1867 by the Royal Portuguese Academy of Sciences (Cadamosto, 1867).

Cadamosto mentions the presence of trees from which dragon's blood (the sap of *Dracaena draco* L.) is extracted and the yellow fruits eaten.

Bowdich, TE. 1825. Excursions in Madeira and Porto Santo. George B. Whittaker, London.
Cadamosto, L. 1867. Navegações de Luiz de Cadamosto: Da Ilha de Porto Santo aonde abordei. In: Collecção de Notícias para a Historia e Geografia das Nações Ultramarinas que vivem nos Domínios Portuguezes. Tomo 2. pp. 7. Segunda Edição. Academia Real das Sciencias. Typographia da Academia. Lisboa.



Porto Santo “was all covered with dragon trees and junipers and other trees up to the sea” (Frutuoso, 2007)



Frutuoso, G. 2007. As Saudades da Terra. Fac-Símile. Coleção “Funchal 500 anos”. Empresa Municipal “Funchal 500 anos”. Funchal. Cap. II. pp. 10.



At present dragon tree species no longer exists in natural conditions in Porto Santo and is "preserved" only in the coat of arms of the city, and only three *Juniperus* plants remain on the cliffs of Pico Branco.



The introduction of the rabbit at the beginning of colonization also potentiated the destruction of natural ecosystems. Regarding the introduction of rabbits in Porto Santo, a recent facsimile edition Silva & Menezes (1940) states that Bartolomeu Perestrelo, the first “capitão donatário” of Porto Santo, released “*his mother and offspring, but within a short time these animals multiplied in such a way, that he could not sow or plant anything that was not immediately devoured or spoiled by them*”.



Silva FA, Menezes CA. 1984. Elucidário Madeirense. Edição Fac-Símile da edição de 1946. Volume primeiro. Junta Geral do Distrito Autónomo do Funchal.

Foto: funchalnoticias.net/





Elaeagnus angustifolia

1780

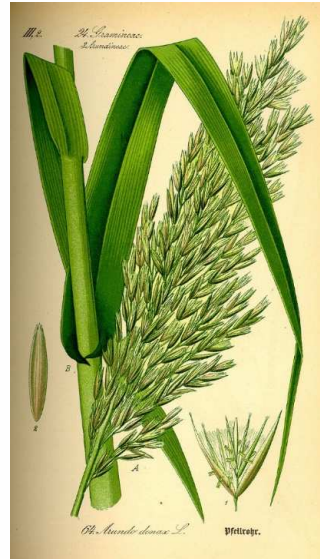
Elaeagnus angustifolia

The tree-of-paradise and *Lycium europaeum* were introduced in Porto Santo (Pereira 1989).

1783

Arundo donax

Branco (1987) reports the failure of experiments with vines to prevent sands from invading agricultural land. Thus, in 1783, the then Governor of Madeira ordered the planting of new vines to stop the progress of the sands as well as planting cane in the sand, delimiting the agricultural lands.



http://www.plantillustrations.org/illustration.php?id_illustration=141310

1834

Tamarix gallica

Pereira 1989, refers to tamargueira as well as having been introduced in 1834 as a resource for fuel and for vineyards.

1834

Carpobrotus edulis

Lowe (1864), using the name *Mesembryanthemum edule*, claims that it was introduced in Porto Santo around 1834 by JA Pedroso and a few years later, "... it had already in 1855 overspread in vast beds the whole sandy region at the back of the beach about the town and chiefly to the eastward".



www.lizzieharper.co.uk

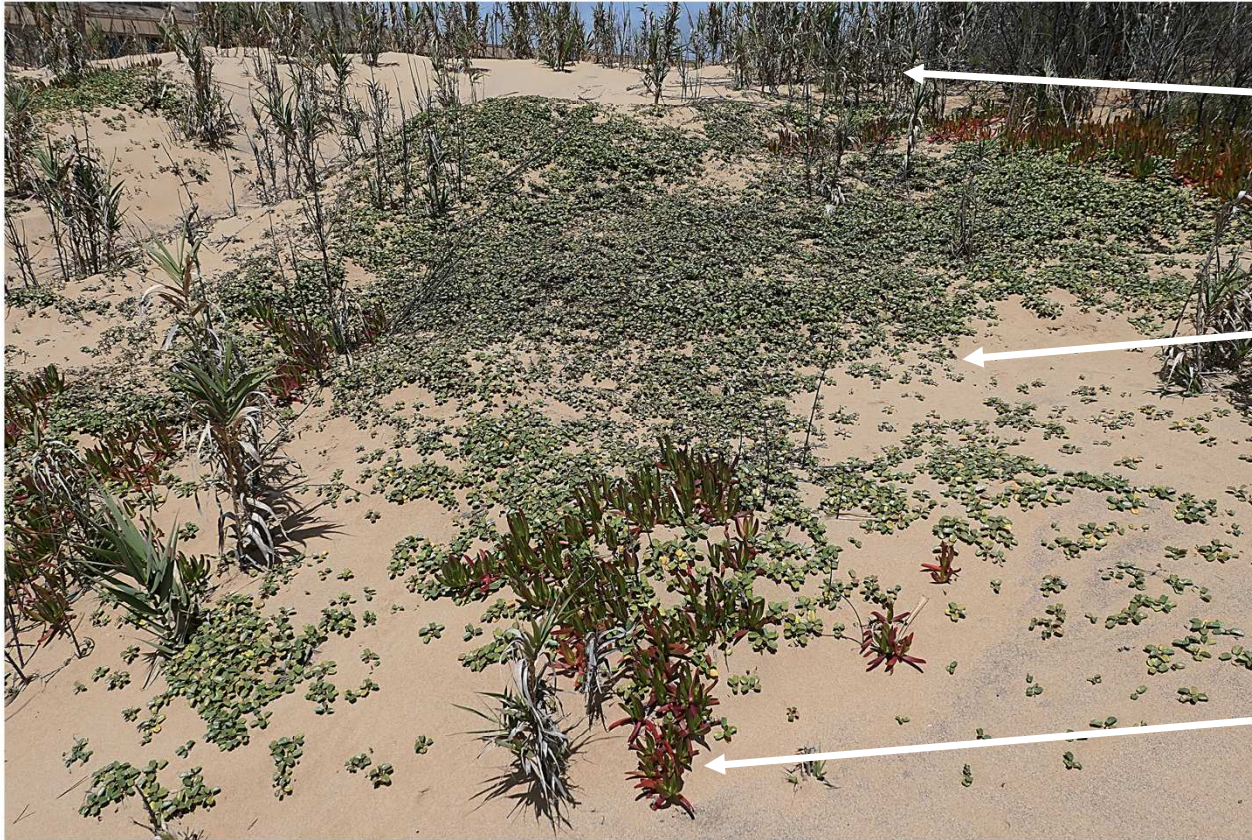
Pereira, ECN. 1989. Ilhas de Zargo. Volume 1 - 4ª Edição. Câmara Municipal do Funchal.

Lowe, RT. 1857-72. A Manual Flora of Madeira and the adjacent Islands of Porto Santo and the Desertas. Vol. I, part. 1, 1857, XII 1- 106; part. 2, 1862, 107-262; part. 3, 1864, 263-377; part. 4, 1868, 379-522; part. 5, 1868, 523-582 + Addenda et Corrigenda; Index 583-618; Vol. II, part. 1, 1872, 1-113.

Branco, JF. 1987. Camponeses da Madeira-As bases materiais do quotidiano no arquipélago (1750-1900). Publicações Dom Quixote. Lisboa, pp. 38.



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Arundo donax

Calystegia soldanella

Carpobrotus edulis



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LIFE DUNAS (LIFE19 CCA/PT/001178) - Increasing resilience to climate change

BENEFICIARIES:

- Secretaria Regional de Ambiente, Recursos Naturais e Alterações Climáticas - coordinating beneficiary
- Município do Porto Santo - associated beneficiary
- Faculdade de Ciências da Universidade de Lisboa - associated beneficiary
- Instituto das Florestas e Conservação da Natureza, IP-RAM - associated beneficiary
- Secretaria Regional de Agricultura e Desenvolvimento Rural - associated beneficiary
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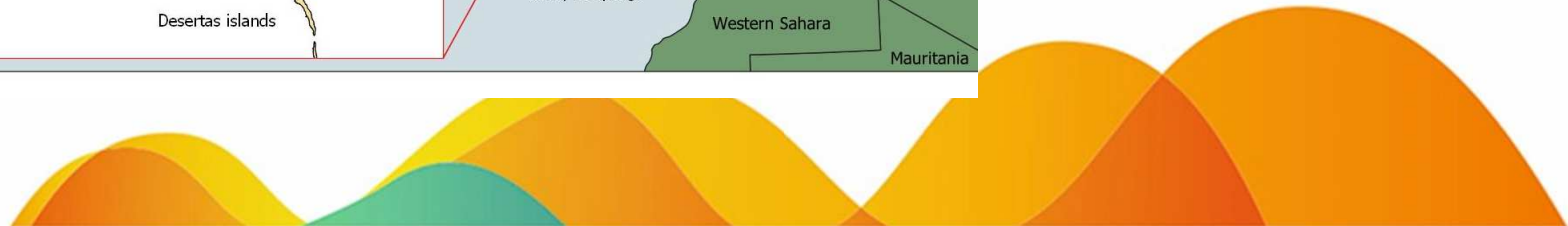
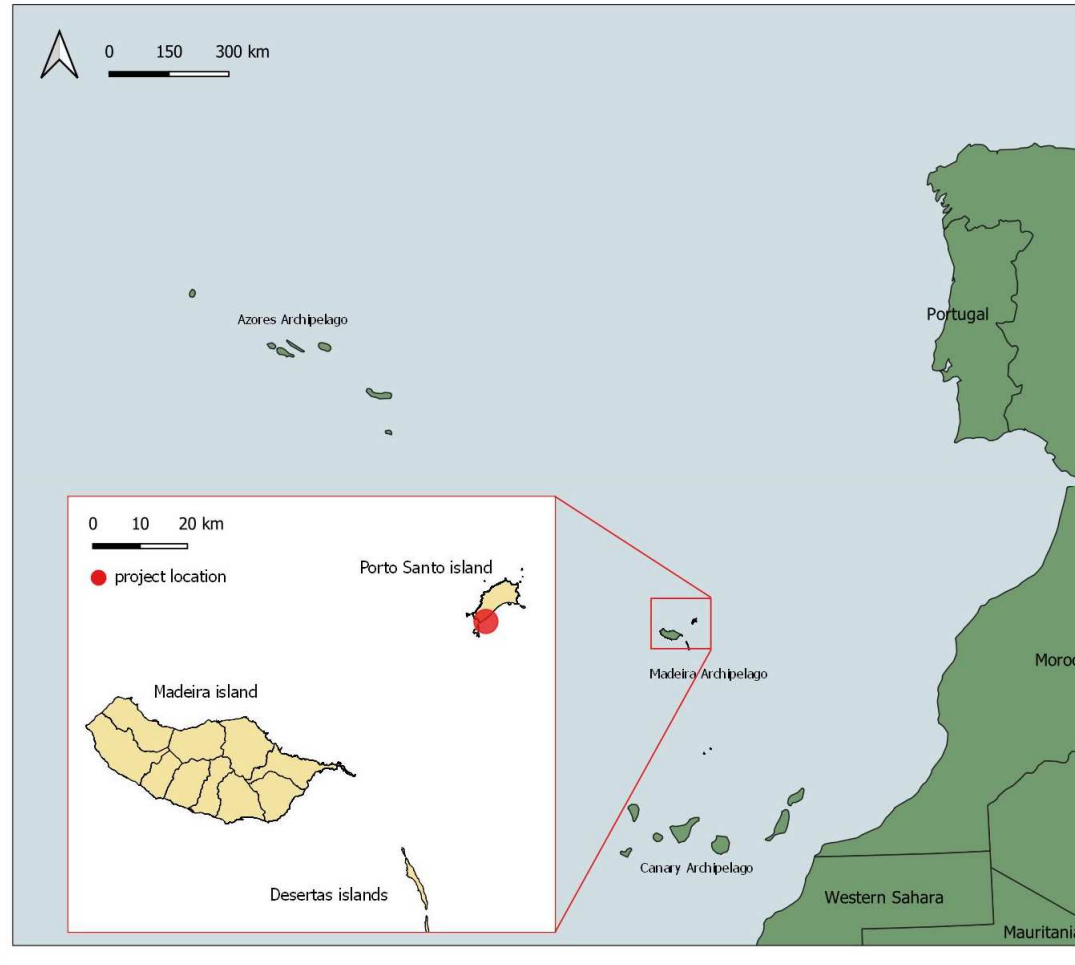
Start date: 01/10/2020

Expected end date: 30/09/2025



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LIFE DUNAS (LIFE19 CCA/PT/001178) - Increasing resilience to climate change



Main operational objectives (LIFE DUNAS):

- Restoration of a dune area, that was depleted in nineteen fifties. This action includes two fases. The first, includes geomorphological works using about 90,000 m³ of sand dredged from “near shore sand banks” without compromising regular coastal dynamics. The second, aims **ecosystem restoration based on plants of native flora and control of Invasive Alien Species on a wider buffer area;**
- (re)use of pre-dune for agriculture, with production methods and practices to improve dune resilience, by reducing losses of wind erosion and “devolution” of sand to the dunes;
- improving awareness-raising in the local population and users of the sand dunes.



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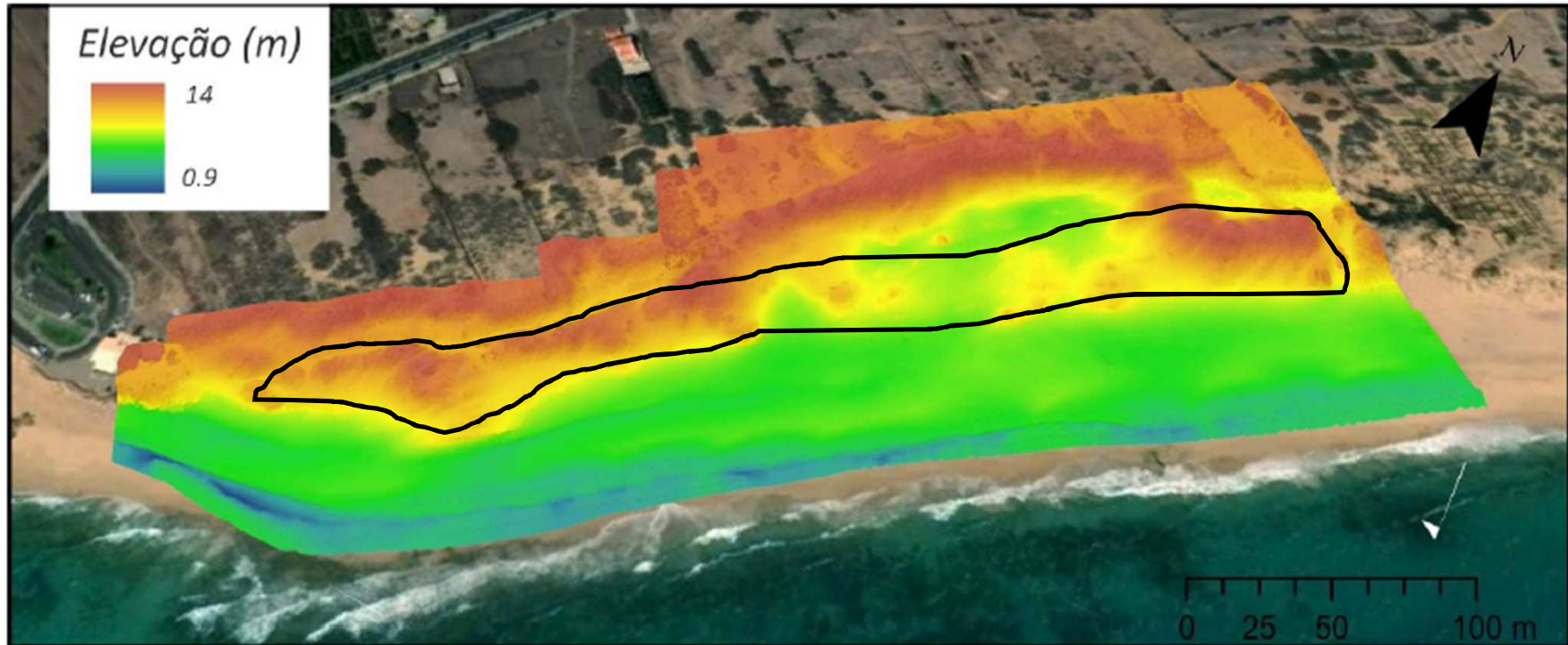
Extraction of sand for civil construction, namely from Porto Santo airport in the 1950s creating a dune depression



Foto de Pedro Menezes

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Faculdade de Ciências Universidade de Lisboa



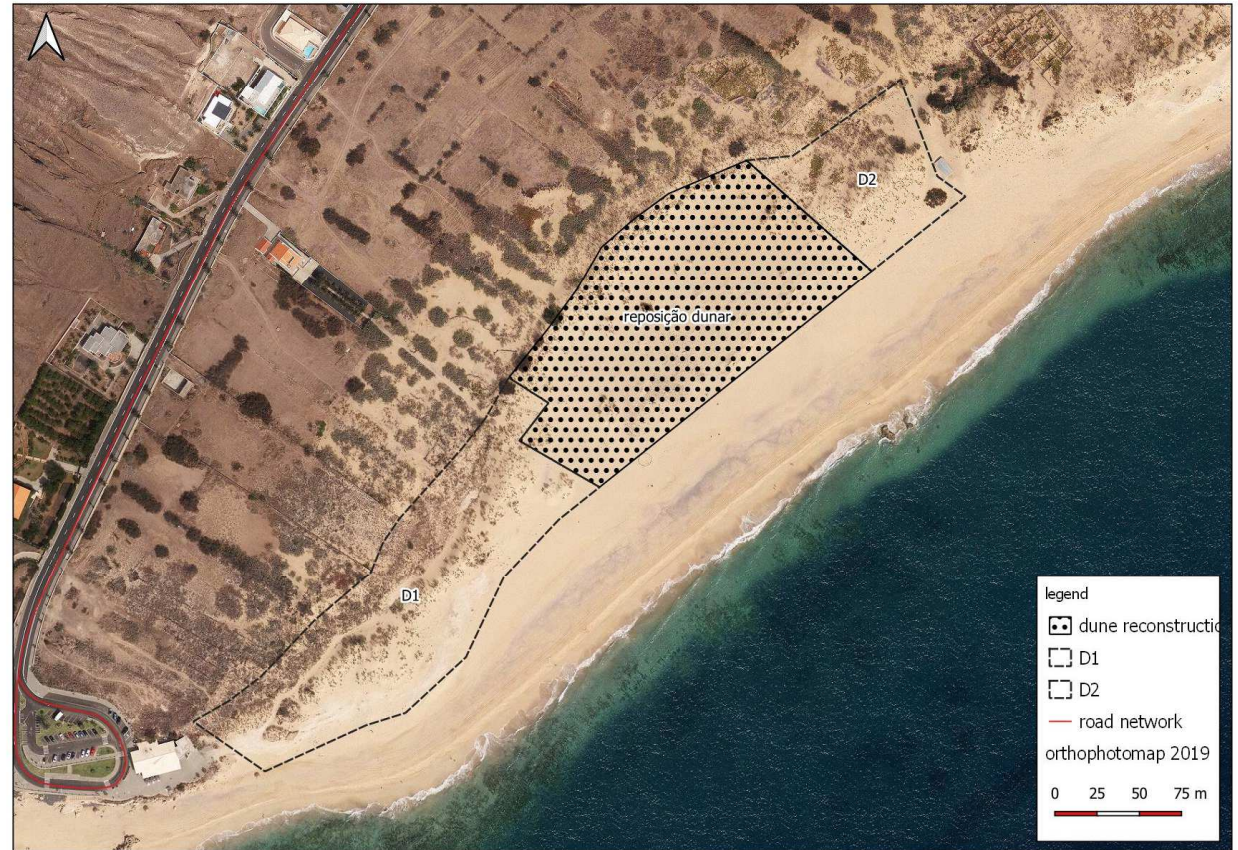
Morphological characterization of the dune to be rebuilt – 3D



A.1: Preparatory actions of LIFE DUNAS

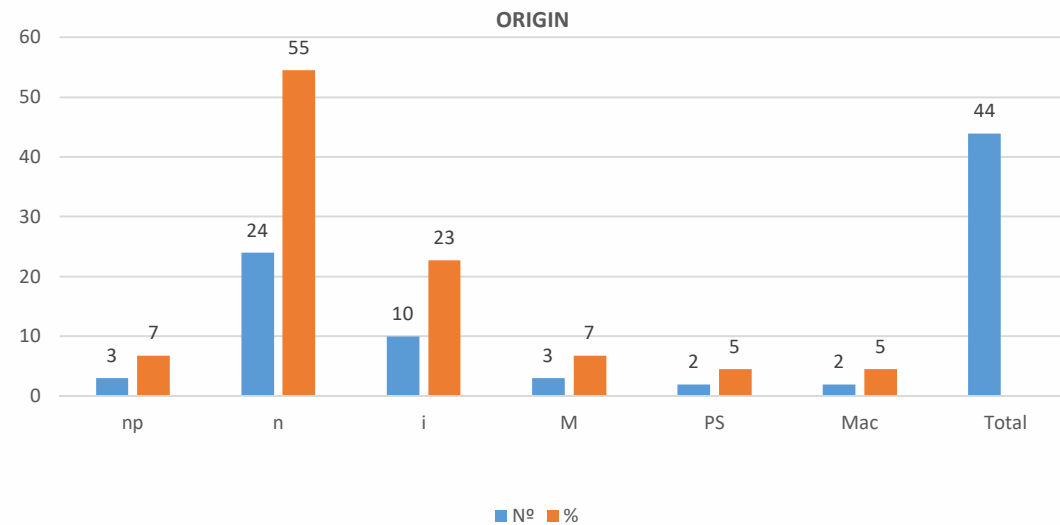
Update of the ecological cover of the project intervention area, allowing to update distribution maps of **Invasive Alien Species of flora (IAS)** and **Native flora** in the buffer area (D1 and D2).

These will be used to prepare the **Operational Plan for Control of IAS** and the **Operational Plan for Habitat Restoration** (including native flora propagation).



A.1: Preparatory actions of LIFE DUNAS

Update of the flora cover of the project intervention area



PS - Endemic to Porto Santo; M - Endemic to Porto Santo and present in the archipelago of Madeira and / or Selvagens; Mac - Endemic to the archipelago of Madeira and Selvagens and at least one other Macaronesian archipelago; n - native (occurs naturally in the archipelagos Madeira and Selvagens); i - introduced by man (non native); np - probable native



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A.1: Preparatory actions of LIFE DUNAS

Species cover

Methodology:

Based on the centroids of the squares, an inventory of the flora covered by the circles with a radius of 10m was made. Coordinates of the centroids will be used for future monitoring so that we can assess the evolution of flora and vegetation.

For each species the Braun-Blanquet (1932) abundance-dominance scale was determined:

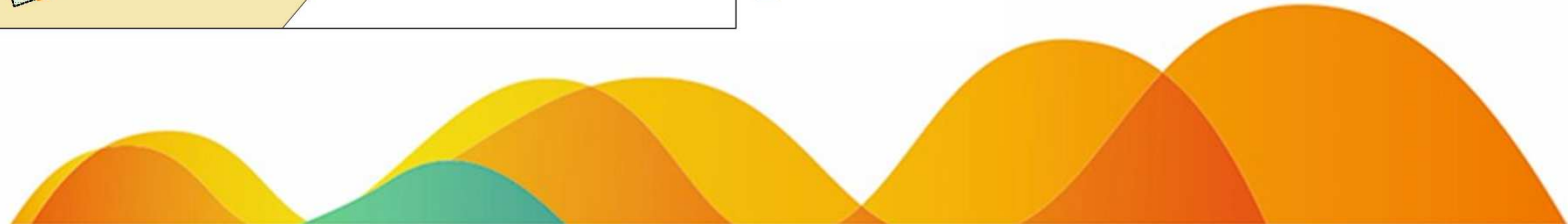
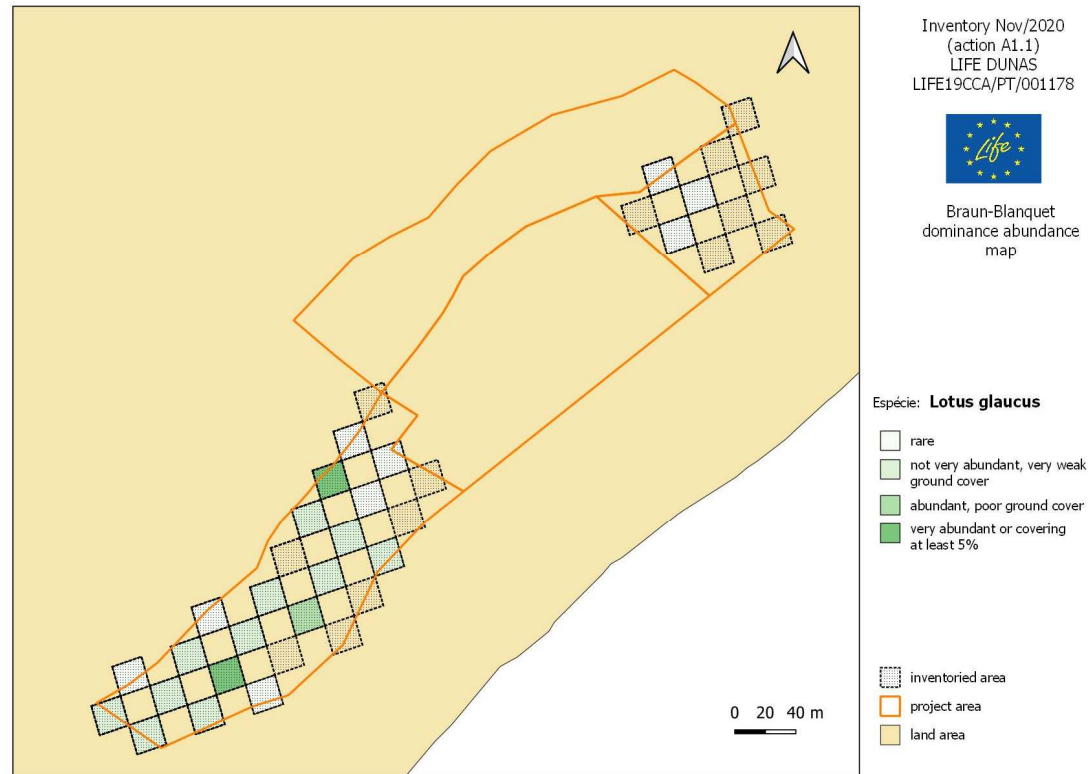
- r - Rare or isolated individuals;
- + - Individuals not very abundant, with very low coverage;
- 1 - Very abundant individuals, but with poor coverage;
- 2 - Individuals very abundant or covering at least 5% of the minimum area;
- 3 - Any number of individuals covering 25 to 50% of the minimum area;
- 4 - Any number of individuals covering 50 to 75% of the minimum area;
- 5 - Any number of individuals covering 75% to 100% of the minimum area

Braun-Blanquet, J. 1932. Plant Sociology. McGraw-Hill, Londres.



A.1: Preparatory actions of LIFE DUNAS

Inventory of the flora (*Lotus glaucus* subsp. *floridus*) cover of the project intervention area



A.1: Preparatory actions of LIFE DUNAS

Update of the vegetation cover of the project intervention area

1. *Polygono maritimae-Euphorbietum paraliae* Jardim, Sequeira, Capelo, Aguiar, J.C. Costa, Espírito-Santo & Lousã 2003 - Association of primary dunes of Porto Santo dominated by *Euphorbia paralias*, *Polygonum maritimum* and *Calystegia soldanella*.

2. *Euphorbio paraliae – Lotetum floridi* Jardim, Sequeira, Capelo, Aguiar, J.C. Costa, Espírito-Santo & Lousã 2003 - Fixed dune community dominated by *Lotus glaucus* subsp. *floridus* and *Euphorbia paralias*.

3. *Salsolo kali-Cakiletum maritimae* Costa & Mansanet 1981 nom. mut.

4. *Tamarix galica* community

5. *Arundo donax* community

Capelo, J., Menezes De Sequeira, M., Jardim, R., & Costa, J.C. 2004. Guia da excursão geobotânica dos V Encontros ALFA 2004 a ilha da Madeira. In Capelo, J.A, Paisagem Vegetal da Ilha da Madeira. pp, 5-45. Quercetea 6: 3-200.

Costa, J.C., Neto C., Aguiar C., Capelo J., Espírito Santo M.D., Honrado J., Pinto-Gomes C., Monteiro_Henriques T., Sequeira M. & Lousã M. 2012. Vascular Plant Communities in Portugal (Continental, the Azores and Madeira). Global Geobotany 2: 1-180.



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ACTION C.2: Habitat Restoration and Nature-Based Solutions to promote dune cover and reduce wind erosion

a) Collection of seeds from native species of flora formerly identified as being part of the local habitats and adaptation of Native Flora Nursery

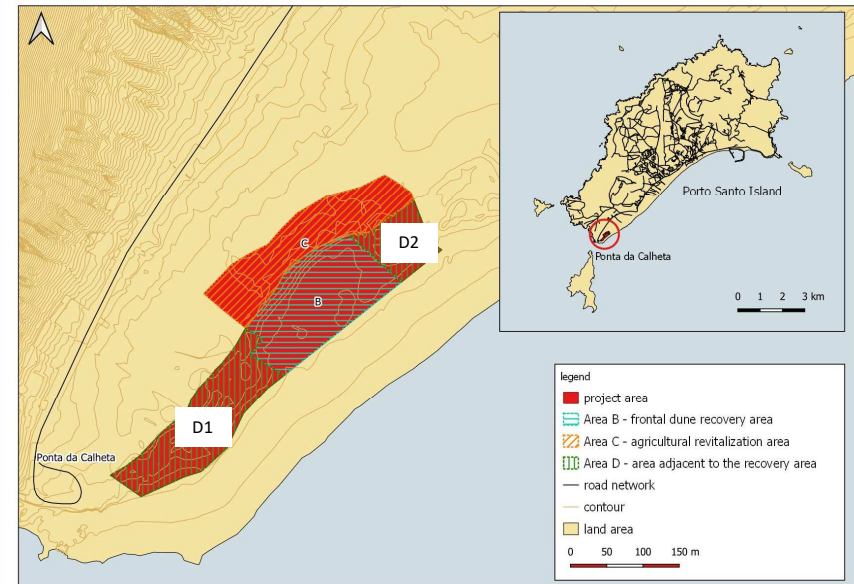
- Seed and cutting harvest along Porto Santo dunes maximizing genetic variation.
- Adaptation of the facilities of the existing native flora nursery for sowing and vegetative propagation. Sand and peat will be used, in order to avoid the introduction of invasive species in the plantation area.



ACTION C.2: Habitat Restoration and Nature-Based Solutions to promote dune cover and reduce wind erosion

b) Control of IAS (Invasive Alien Species)

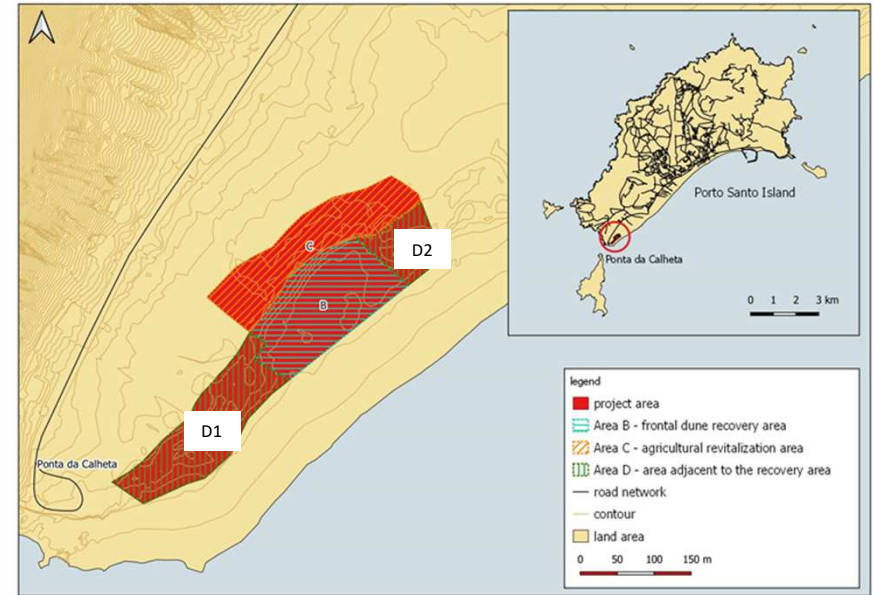
- The control of ***Arundo donax*** in area D1, will be done through successive cuts with the use of brush cutter next to the rhizome. Cuts must be made whenever necessary so that the shoots do not exceed an average height of 0,3 m. (1)
- Remaining area of D1 will be used with ***Arundo donax*** control tests, namely:
 - Shading by geosynthetic screen
 - Sodium chloride after cutting
 - Linseed oil after cutting
- The area D2 will be used with ***Arundo donax*** control tests, namely shading by burlap fabric (*serapilheira*) that must be completely covered with sand with a height of at least 0,1 m. (2)



ACTION C.2: Habitat Restoration and Nature-Based Solutions to promote dune cover and reduce wind erosion

b) Control of IAS (Invasive Alien Species)

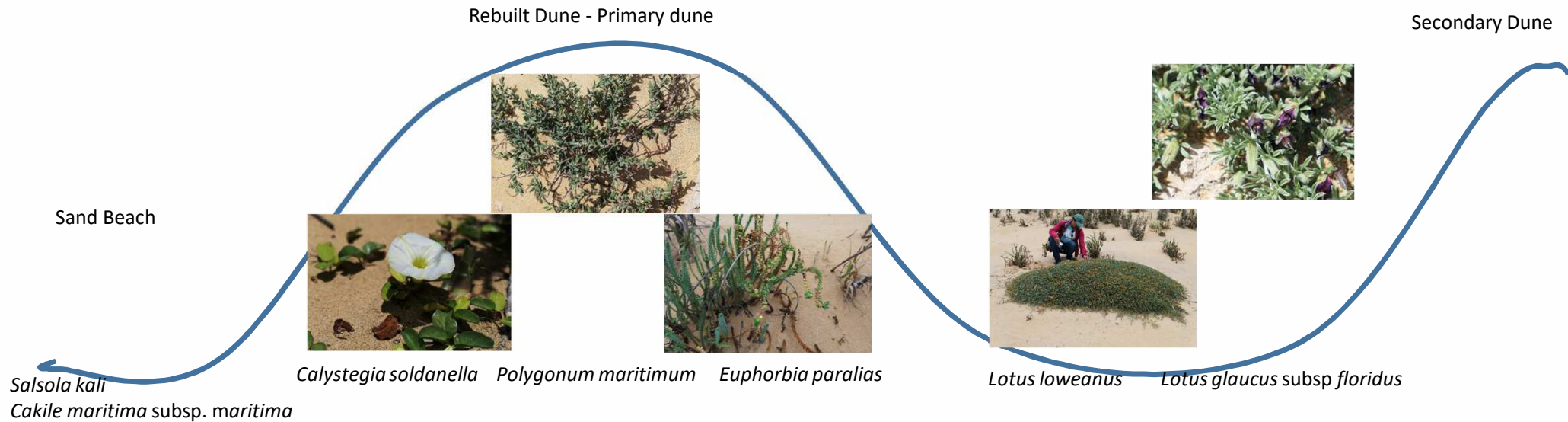
Areas D - control applied to *Carpobrotus edulis*



ACTION C.2: Habitat Restoration and Nature-Based Solutions to promote dune cover and reduce wind erosion

c) Habitat Restoration and Mitigation/Prevention of Wind Erosion

. Restore the native habitats of Porto Santo dunes by planting the herbaceous plants outcoming from the nursery protected by wind-break palisades.



Capelo, J., Menezes De Sequeira, M., Jardim, R., & Costa, J.C. 2004. Guia da excursão geobotânica dos V Encontros ALFA 2004 a ilha da Madeira. In Capelo, J.A, Paisagem Vegetal da Ilha da Madeira. pp, 5 -45. Quercetea 6: 3-200.

Costa, J.C., Neto C., Aguiar C., Capelo J., Espírito Santo M.D., Honrado J., Pinto-Gomes C., Monteiro_Henriques T., Sequeira M. & Lousã M. 2012. Vascular Plant Communities in Portugal (Continental, the Azores and Madeira). Global Geobotany 2: 1-180.



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Lotus glaucus subsp. *floridus* -
Endemic from Porto Santo



Lotus lowenus – Endemic from Porto Santo



ACTION C.2: Habitat Restoration and Nature-Based Solutions to promote dune cover and reduce wind erosion

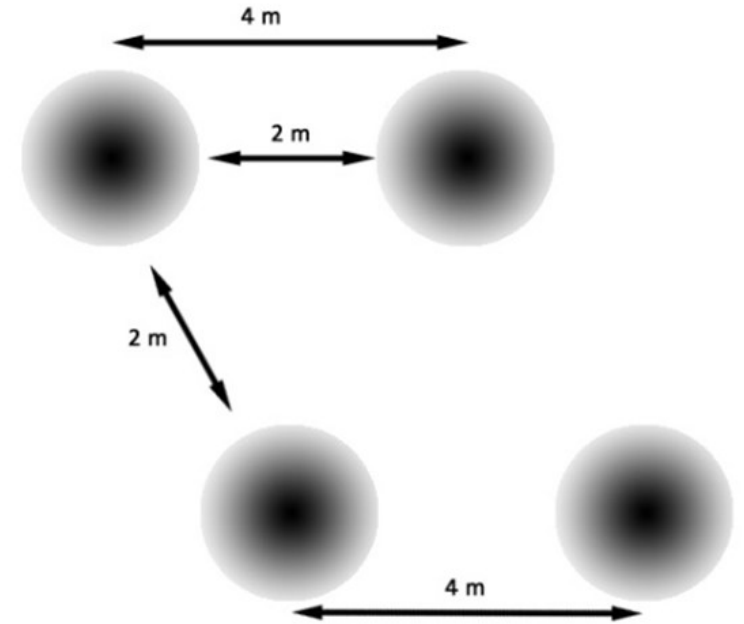
c) Habitat Restoration and Mitigation/Prevention of Wind Erosion

Primary dune (dune to be rebuilt) - MIX 1: *Euphorbia paralias*, *Polygonum maritimum*, *Calystegia soldanella* (plants and seeds will be used).

Inter dune and secondary dune - MIX 2: *Lotus loweanus*, *Lotus glaucus* subsp. *floridus*, *Euphorbia paralias*, *Senecio incrassatus*, *Euphorbia terracina*, *Polygonum maritimum* (plants and seeds will be used).

Base of the primary dune (dune to be rebuilt) - MIX 3: *Salsola kali*, *Cakile maritima* subsp. *maritime* (only seeds will be used).

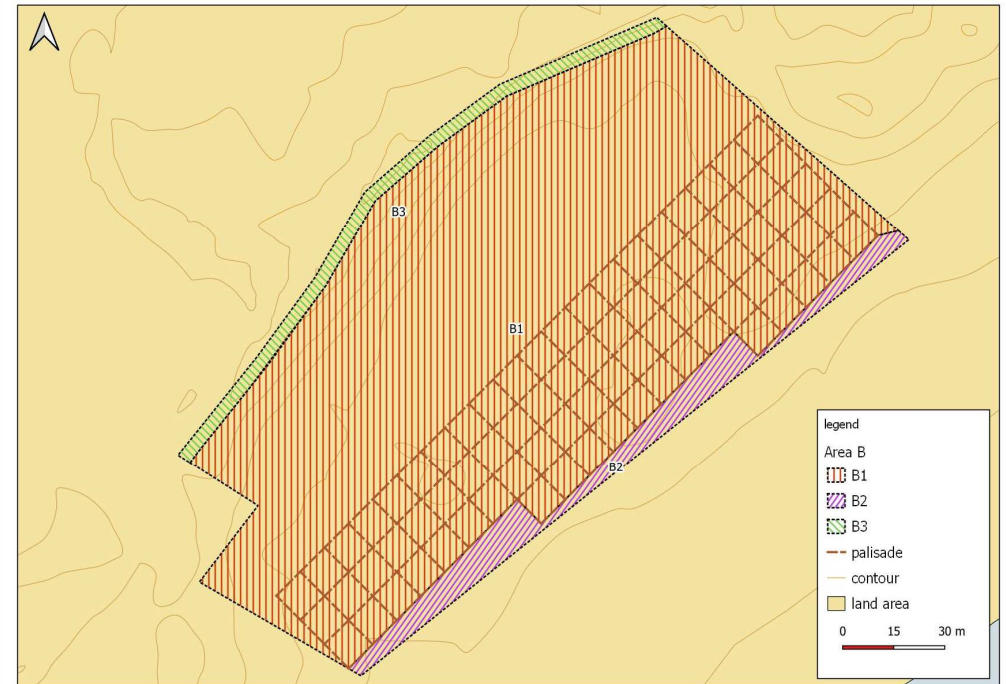
Transition to agricultural land - *Phagnalon lowei* (only seeds will be used).



ACTION C.2: Habitat Restoration and Nature-Based Solutions to promote dune cover and reduce wind erosion

c) Habitat Restoration and Mitigation/Prevention of Wind Erosion

Restore the native habitats of Porto Santo dunes by planting the herbaceous plants outcoming from the nursery, protected by wind-break palisades.





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Thank you for your attention

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