

The Production of Marine Juniper (Juniperus oxycedrus subsp. macrocarpa) in the Network of Greenhouses of Andalusia

Antonio Sánchez Lancha
Director of the Network of Greenhouses of Andalusia
Department of Environment

Introduction

Coastal juniper fields are a typical plant community of the Andalusian Atlantic coastline, considered a "Priority Habitat" by Council Directive 92/43 EEC regarding the Conservation of Natural Habitats and of Wild Flora and Fauna. In Andalusia its critical conservation status has led the Department of Environment to include marine juniper (*Juniperus oxycedrus* L. subsp. *macrocarpa* (Sibth & SM.) Ball.) in the *Andalusian Catalogue of Threatened Species (Law 8/2003 of the Wild Flora and Fauna of Andalusia)*, as a species **in danger of extinction**.

Recognition of this category of threat led the Department of Environment to carry out a detailed assessment of the risks and disruptive agents for the species and its community, as well as a diagnosis of the state of its populations. It also established the fundamental objectives of guaranteeing the protection and conservation of the existing populations minimising the factors of threat, and favouring their growth and occupation of their potential area. The main threat is development of the coastline, which provokes irreversible destruction of the populations and fragmentation into very small groups.

Attainment of these objectives has materialised in the **Coastal Juniper Fields Conservation Programme (2002-2006)** which has included various restoration actions of the habitat of this species and a complementary line of monitoring, research, dissemination and environmental education tasks.

An important part of these recovery actions has been the restitution using marine juniper produced in the **Network of Greenhouses of the Department of Environment**. In this case the objective was to reduce the isolation and progressive reduction in size of the current populations.

In order to deal with this demand propagation of this species has been fundamental, a task that has been done since 2001 at the Network of Greenhouses of the Department of Environment.

Distribution of Marine Juniper in Andalusia

In Andalusia the current populations of marine juniper are distributed discontinuously along a narrow coastal strip some 225 km long, between El Rompido (Huelva) and Tarifa (Cádiz). They are distributed through the **Cádiz-Huelva-Algarve sector**. It is estimated that the Andalusian population of this species currently comprises some 24,245 individuals of all ages, although in small populations the majority are of a medium to large size, young plants being scarce as a result of their low natural regeneration. The older Andalusian juniper field populations are in protected natural areas.

The **habitat** for marine juniper is typically in areas close to the sea, normally on sandy soil, although it can also live on rocks or cliffs as in the La Breña Nature Reserve and Barbate Marshes. With the exception of the latter, the small marine juniper forests often appear in sandy areas near beaches, on mobile or fixed dune systems, both fossil and more recent, indistinctly occupying the dune peaks and slacks between successive lines of dunes (known locally as “corrales”).

Production of Marine Juniper

COLLECTION AND CLEANING

The **fruit** of the marine juniper is a 12-15 (-25) mm round or somewhat ovoid fleshy cone known as “galbula”, which is light green when unripe and purple-brown when ripe. The **seeds** are triangular, hard and do not have wings. Each fruit has between 2 and 3 seeds, although as few as 1 and as many as 7 (-9) may be found.

Fruiting is from March to May, and the galbulas ripen in the second year.

They are **harvested** between August and October. The fruit is harvested manually before they are completely ripe, which is shown by their yellowy-green colour. The harvest is done from the ground. Care must be taken as the fruit does not ripen until the second year, so first-year fruit must not be harvested (distinguishable by their smaller size and green colour).

Marine juniper is **dioecious**, which must be borne in mind during the harvest as only the female plants will have fruit.

The following table shows the quantities of fruit and number of towns where Marine Juniper has been harvested by the Network of Greenhouses of Andalusia between 2002-2007:

Year	Kg fruit gathered	Number of towns
2002	4.808	10
2003	130,8	2
2004	42	2
2005	4.980,8	4
2006	804,9	7
2007	16	1
TOTAL	10.782,5	

The fruit is soaked **clean**, the seeds are separated by mechanically removing the pulp and rinsing until the seeds are completely clean; they are air-dried until they reach the optimum humidity content for their conservation and later they are subjected to fanning which will remove any remaining traces of dry pulp and skin.

Once clean they are stored at 3-4°C in a refrigerated chamber until they are due to be sown. In batches stored for two years in these conditions no decrease in the percentage of germination has been detected.

Juniper seeds have **orthodox behaviour**, that is, they are able to remain viable after being dried to less than 5-10 % of their humidity content.

The data shown in the following table has been taken from populations of *Juniperus*

oxycedrus subsp. *macrocarpa* in the territory of Andalusia and are based on the experience of the Network of Greenhouses:

Average weight 100 seeds (g)	Seeds/kg	g. seeds/ Kg fruit	Purity
6,119	16.342	168,3	98%

For every kg of fruit harvested an average of 168.3g of seeds are obtained, in other words, an approximate yield of 16.8%. With the cleaning methods used a 98% batch purity is obtained. One kg of marine juniper seeds contains an average of 16,000.

SEEDBED SOURCES

The **seedbed sources** comprise "trees located within a fruit and seed harvest area, with a surface area containing one or more groups of well-distributed trees and in a sufficient number and density to ensure adequate interpollination". They are one of the two kinds of basic materials accepted for producing reproduction material for the **identified category**.

The **seedbed sources** are basic materials that are approved for the purpose of providing seed to reforestation programmes with species of medium or low economic value, and where they look to ensure local seed supply from those where the origin is known and, therefore, there is an assumption that it is perfectly adapted to the ecological conditions of the area.

In the *Order of 10 July 2003, which approves the list of basic materials for the production of identified forestry reproduction materials* (BOJA nº 145) three **seedbed sources** are included for *J. oxycedrus* subsp. *macrocarpa* in Andalusia:

Region of origin	Province	Code	Municipality	Forest name
43. Southern Andalusian Coast	Huelva	E-43	Almonte	Arenas Gordas
43. Southern Andalusian Coast	Huelva	E-43	Punta Umbría	La Bota y El Portil
43. Southern Andalusian Coast	Cádiz	E-43	Conil de la Frontera	Playa del puerco

The seedbed sources are included in the **National Catalogue of Basic Materials for the production of Identified FRM** (BOE nº 234, of 28 September 2004).

Since **seed certification** has started, five batches of Marine Juniper have been certified, all for the production by the Network of Greenhouses itself, four batches from 2006 and one from the 2007 harvest:

FS-237/43/21/002	Punta Umbria	8,9 Kg	22 and 23/08/2006	Network of Greenhouses.CMA	E-AN/0006/06
FS-237/43/21/001	Almonte	36 Kg	17/08/2006	Network of Greenhouses.CMA	E-AN/0007/07
FS-237/43/21/001	Almonte	37 Kg	16/08/2006	Network of Greenhouses.CMA	E-AN/0012/07
FS-237/43/11/001	Conil de la Frontera	63 Kg	14/08/2006-17/08/2006	Network of Greenhouses.CMA	E-AN/0013/07
FS-237/43/11/001	Conil de la Frontera	16 Kg	08/08/2007	Network of Greenhouses.CMA	E-AN/0025/07

PROPAGATION

Sowing must be done in autumn (October), the seeds are first soaked in water for 348 hours, removing any that float (empty seeds) and rinsing several times.

This species accepts transplanting well, sowing is done in seedbed boxes using peat moss and vermiculite in a proportion of 9:1, covering the seed with vermiculite 1.5 times the largest size. Perlite and fertilised coir have also begun to be used in a proportion of 1:1 for the seedbed boxes, giving quite satisfactory results.

Germination occurs between 3-5 weeks (40 days), when the seedlings begin to germinate they are protected from extreme temperatures, in greenhouses or under plastic, so that the ambient temperature of the seedlings is 20-21°C. For this reason the ventilation is monitored to obtain temperatures as close as possible to these values, as the plants are very delicate during the first stages. 40% germinate.

This species accepts transplanting well, when the seedlings have 2 or 3 needles they are transplanted to a plug tray or flowerpot (400cc cavities are recommended), the soil used should drain more so the mix used is 90% peat moss and 10% river sand, but always maintaining a certain humidity. Experiments are also being done for the production with another soil formed by fertilised coir and perlite in a proportion of 9:1.

One-year-old plants can grow to 50cm tall, and can remain in the same recipient for 2 years, later needing to be transplanted to larger flowerpots or tray cavities. The survival rate during the first year is approximately 90%.

Periodic preventative treatments must be done during production with broad-spectrum **fungicides**. It is also advisable to apply **soil insecticide** to seedbeds on a monthly basis to control the appearance of nematodes.

This species is mainly produced in the Greenhouses of La Alcaidesa (Cádiz) and San Jerónimo (Seville), which are the greenhouses that belong to the network that have the most similar conditions to the natural distribution of marine juniper. Although a part has also been produced in the Greenhouse of Las Tobas y Alberquillas (Huelva).

In total 71,684 feet of coastal juniper have been planted in the field within the framework of the juniper fields Project using **1-year-old plants**, planting has been done in two successive stages (2003/04 and 2004/05), in the provinces of Huelva and Cádiz. The following tables show the areas of action:

Municipality	Forest	Year of planting		Total planted
		2003	2004	
Palos de la Frontera	Dunas del Odiel		1.720	1.720
Punta Umbría	Campo Común de Abajo	740		740
Huelva	Ganchos de la Laguna Marítima	1.000	4.120	5.120
	Llanos de Bacuta	640		640
Lepe	Flecha del Rompido	1.620	15.240	16.860
Isla Cristina	Dunas de Isla Cristina	845	7.440	8.285
Total:				33.365

Municipality	Forest	Year of planting	Total planted
Tarifa	Dunas de Tarifa-Punta Paloma	2003	1.300
	Dunas de Tarifa-Punta Camarinal	2003	1.485
	Betis	2004	6.600
Barbate	Breñas Alta y Baja	2003	15.567
	Dunas de Barbate	2004	1.660
Conil de la Frontera	Rosan	2004	2.600
	Dehesa de Roche	2004	4.014
Puerto de Sta. María	Dunas de San Antón	2004	2.063
Rota	Pinar de Rota	2004	2.750
Sanlúcar de Barrameda	Pinar de la Algaida	2004	280
Total:			38.319

Finally, a series of dissemination campaigns, biodiversity and social participation training have been developed, particularly aimed at the populations of the area occupied by marine juniper fields. These tasks have comprised the creation of abundant dissemination material and the start of several sub-programmes, including various plantings using volunteers.

The **total number of juniper plants** that have left the Network of Greenhouses during this time is 80,470, as well as supplying its own Juniper Fields Conservation project for the different actions such as reinforcement of populations and environmental education campaigns, the rest of the plants have mainly been sent to different Councils in the province of Cádiz, as well as to environmental education campaigns, Botanical

Gardens or habitat restoration projects. The following table shows the final destination of the plants:

DESTINATION	PROJECT
Barracks of Bolonia (Tarifa)	CÁDIZ ENVIRONMENTAL EDUCATION
Environment Agent	CÁDIZ ENVIRONMENTAL EDUCATION
Facinas Neighbourhood Association	CÁDIZ ENVIRONMENTAL EDUCATION
Algeciras Town Council	CÁDIZ TOWN COUNCILS
Chiclana Town Council	CÁDIZ TOWN COUNCILS
Rota Town Council	CÁDIZ TOWN COUNCILS
Puerto Real Town Council	CÁDIZ TOWN COUNCILS
Town Council	CÁDIZ TOWN COUNCILS
Cádiz Town Council	CÁDIZ TOWN COUNCILS
C.C.T.A DE MÁLAGA - ALGARROBO-COSTA	MÁLAGA ENVIRONMENTAL EDUCATION
SAN FELIPE DE LA LINEA Primary School	CÁDIZ ENVIRONMENTAL EDUCATION
TARTESOS DE ALGECIRAS Primary School	CÁDIZ ENVIRONMENTAL EDUCATION
Nª Sra del Rosario Guazamara Primary School	ALMERÍA ENVIRONMENTAL EDUCATION
Campo de Gibraltar employment training centre	CÁDIZ ENVIRONMENTAL EDUCATION
MONTECALPE DE ALGECIRAS SCHOOL	CÁDIZ ENVIRONMENTAL EDUCATION
EGMASA Cádiz Coastal Habitats Conservation	CÁDIZ PROJECT
EGMASA Cádiz Coastal Habitats Conservation	CÁDIZ PROJECT
Cádiz Environmental Education	CÁDIZ ENVIRONMENTAL EDUCATION
El Boticario	ALMERÍA WORKS
Goyca - El Odiel Marshland	HUELVA WORKS
HOSPITAL PUNTA EUROPA DE ALGECIRAS	CÁDIZ ENVIRONMENTAL EDUCATION
Huelva Goyca	HUELVA TOWN COUNCILS
Almadraba de Tarifa Secondary School	CÁDIZ ENVIRONMENTAL EDUCATION
BAELO CLAUDIA-TARIFA Secondary School	CÁDIZ ENVIRONMENTAL EDUCATION
PUERTO REAL COUNCIL BOTANICAL GARDEN	CÁDIZ ENVIRONMENTAL EDUCATION
GIBRALTAR BOTANICAL GARDEN	CÁDIZ ENVIRONMENTAL EDUCATION
Dunas del Odiel Botanical Garden	HUELVA WORKS
LAS TRES CULTURAS BOTANICAL GARDEN	CÁDIZ ENVIRONMENTAL EDUCATION
El Odiel-Palos de la Frontera lagoon public forest	HUELVA WORKS
Huelva works	HUELVA WORKS
Parador de Mazagon	HUELVA WORKS
Exotic species control project TRAGASA	CÁDIZ PROJECT
Rep. Cádiz forests SEMISUR	CÁDIZ PROJECT
Rep. Huerta Grande	CÁDIZ WORKS
Rep. Public Forests of Cádiz	CÁDIZ PROJECT
Restoration of wetlands of La Janda Region	CÁDIZ PROJECT
Landscape restoration - Carril Bicol	HUELVA WORKS
Landscape restoration of Punta Umbría - Huelva	HUELVA WORKS
Astur salt marshes	HUELVA WORKS
Plant health	SEVILLE WORKS
Pinar del Rey-San Roque Council employment workshop	CÁDIZ ENVIRONMENTAL EDUCATION
Archaeological site, Bolonia	CÁDIZ PROJECT

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