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A P. menziesii var. menziesii (=viridis) (Schwerin) Franco stand description dataset: a case study of Pavari's experimental Plot 412 ninety years after plantation.

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Keywords:	forest management, forest ecology, Douglas fir

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Abstract

This paper describes a dataset containing the historical series of dendrometric data from a *P. menziesii* var. *menziesii* (=*viridis*) (Schwerin) Franco plantation. Implemented in 1932, the plantation is located in "Rio di Mercurella" place, in the Tyrrhenian coastal mountain range of Calabria region (Southern Italy). The experimental plot has been identified as Plot 412 and is characterized by trees with a relevant role for forest community biodiversity.

The monitoring started in 1940. The dataset reported five of all the inventories Until 2013, inventories have been carried out by Istituto Sperimentale di Selvicoltura and Unità di Ricerca per la Selvicoltura in Ambiente Mediterraneo, now CREA Forestry and Wood research centre which has taken over the last two.

The following data have been collected: position, number, diameter at breast heigh (DBH) of all the trees and total height (Ht) of a trees sample. Collected data are an important historical source and testimony the first experimental test of *P. menziesii* introduction which will have to be monitored in the future and will constitute a fundamental contribution to enrich the knowledge on appropriate management in Calabria and evaluate the health state and stability of the forest stand in the future.

Keywords: Douglas fir, historical data, forest management, forest ecology, Pavari.

Introduction

The last century was an intense period for the experimentation of exotic species in Italy. The need of expanding wood production using non-native species characterized by greater productivity increased (Castaldi et al. 2020). Over time, other objectives have emerged: improvement of the bio-ecological status of existing forests and plantations; greater tree cover and hydrogeological defense; use of conifer species in the Apennine areas lacking in indigenous ones.

In Italy, a first experimentation about exotic species was started by Aldo Pavari in 1916 (Ciancio et al. 1981-82). In 1922, with the establishment in Florence of the Regia Stazione di Selvicoltura (now CREA Forestry and Wood research centre), a first network of test plots was established throughout the national territory. Later, in the period 1922-38, following the results obtained during the first phase, a vast research program on exotic species and their potential was carried out (Allegri 1962).

The experimental plots network was permanent, relates to 166 species of conifers (55) and broad-leaved trees (111) and led to the publication of first results twenty years after (Avolio and Bernardini 2000). CREA-FL continued the monitoring of the experimental plots until the second half of the 1990s. Not all monitoring activities lasted on a constant basis. However, some plots are still monitored every 5-10 years.

Among the exotic species tested, Douglas fir *P. menziesii* var. *menziesii* (=*viridis*) (Schwerin) immediately proved to be the most responsive to the prefigured experimental objectives (Thomas et al. 2022).

[Digitare qui]

This paper reports a dataset of dendrometric data from experimental Plot 412 established by A. Pavari with Douglas fir in the coastal mountain range of Calabria region (Southern Italy), 90 years after its plantation. 242 Douglas fir trees were sampled and measured over five annual inventories (1987, 1996, 2002, 2013 and 2022).

The experimental plot 412 "Mercurella"

The experimental Plot 412 is located on the western side of the Calabrian Coastal Range, in locality "Rio di Mercurella" at an altitude of 800 m a.s.l., exposure S and SW, on a slight slope (5-10%), 3 km air-line distance from the Tyrrhenian Sea (Fig.1).

HERE FIGURE 1

Geomorphology and climate

Soil of sandstone-siliceous nature, 80-100 cm deep, rich in skeleton, loose and permeable in the upper horizons, with a consistent clayey layer in the lower ones, with a subacid reaction, moderately fertile, suitable for both agricultural and grazing activities and for forestry cultivation. According to F. Mancini's Soil Map of Italy (1966), it is part of the association of the Mediterranean brown lands of the mesophilic forest. Coastal Mediterranean is characterized by submontane climate, with mild, rainy winters and hot, dry summers. Average annual temperature is about 13 ° C, annual rainfall 1,550 mm distributed over 110 days. Drought in the warmer months is mitigated by a considerable humidity in the air, given by the currents from the Tyrrhenian Sea, which favors the formation of frequent fogs even during the summer season. Snowfalls are not rare in winter, with a short stay of snow on the ground. The winds blow mainly towards the west. When they blow east, they are more impetuous and dangerous. From a phytoclimatic point of view, the "Rio di Mercurella" area is part of the hot sub-zone *Castanetum*, as indicated by Pavari (1916).

Tree forest vegetation

Avolio and Bernardini (2000) describe Mercurella forest vegetation as formations of mesothermophilic deciduous broad-leaved trees, pure or mixed, managed as high forest or coppice, at full density, with a prevalence of Turkey oak (*Quercus cerris* L.), Neapolitan alder (*Alnus cordata* Desf.) and chestnut (*Castanea sativa* Mill.). These species are associated with isolated plants or groups of hornbeam (*Carpinus betulus* L.), opalus maple (*Acer opulifolium* W. Et K.) and common whitebeam (*Sorbus aria* L. Crantz.). At the higher altitudes Neapolitan alder and Turkey oak populations stay and those of beech (*Fagus sylvatica* L.) start appearing, mostly as high forest and with majestic and luxuriant specimens up to an altitude of 970 m, mixed with mountain maple (*Acer pseudoplatanus* L.) and holly (*Ilex aquifolium* L.). At lower altitudes there are reforestations of Italian stone pine (*Pinus pinea* L.) and Aleppo pine (*Pinus halepensis* Mill.) and natural groups of holly oak (*Quercus ilex* L.) and / or pubescent oak (*Quercus pubescens* L.), at sparse density and in a precarious vegetative state.

Planting and cultivation interventions

Seeds collected from Douglas fir trees in Vallombrosa Arboretum were used. Seedlings were grown for two years (1929 and 1930) and for one more year (1931) as transplants not far from the Mercurella area. In March 1932, the plantation was started and completed. 1,988 plants of 3-year-old seedlings were used, averaging 60-70 cm tall. The forest treatments consisted of: cleaning invasive shrub and herbaceous vegetation, removal and compensation of dead seedlings (2-3%), pruning of dry low branches. The plot had an irregular polygonal shape. Initially it occupied an area of 7,425 m^2. In 1964 a sub-area of 6,361 m^2 was delimited within.

Materials and methods

Dataset content

To describe stand characteristics of the Douglas fir forest, a tree-level dataset was implemented with the variables: diameter at breast height (DBH), tree height (H_t), basal area (BA) and stem volume (V) for each tree. Data were collected along five surveys in 1987, 1996, 2002, 2013 and 2022.

Access to data and metadata description

The dataset can be download using the following reference Plutino Manuela, Di Marco Carlo, & Bernardini Vincenzo. (2022). Tree inventory data of *P. menziesii* var. *menziesii* (=*viridis*) (Schwerin) Franco in Pavari's Plot 412 ninety years after plantation. [Data set]. Zenodo. https://doi.org/10.5281/zenodo.6674669. Associated metadata available at https://doi.org/10.5281/zenodo.6674669

The dataset publicated on the Zenodo platform refers to the period 1987-2019.

Following the publication of the dataset on the Zenodo platform, a further survey was performed in 2022 within the activities related to the PSR 2014 – 2022 — Mis. 16.1.1 — Phase 2 "TECNO WOOD-04250018308", supported by Regione Calabria. Since this was a very short period (3 years) compared to the previous ones, this manuscript considers only 2022 as a survey after 2013 to maintain periodic uniformity.

Technical validation

The dataset includes 242 trees measured in 1987, 1996, 2002, 2013 and 2022. Each tree has been carefully checked before data publication, avoiding misspelling or error among measures from different time.

Dataset reuse and utilities

A possible dataset reuse is described in tables 1, 2, 3, 4, 5 and figure 2 that shows a descriptive statistical analysis of data collected for single tree.

HERE TABLE 1

HERE TABLE 2

HERE TABLE 3

HERE TABLE 4

HERE TABLE 5

Tables show the dendrometric parameters DBH, basal area and volume, increase as well as variability range and this is evident both from the width of the boxes (Fig. 2) and from the standard error values reported in. The increase in variability suggests the evolutionary direction of the plantation towards a more complex situation.
The H/D ratio decreases over time, resulting in a structural stability increase.
Over time, the management of the stands has not been carried out adequately and planned thinning has been almost completely ignored. Such interventions would have allowed: *(i)* to mitigate the negative biological effects due to the strong radical and aerial competition; (*ii*) to release a stand less vulnerable to meteoric and parasitic disturbances; (*iii*) to regularize the structure and spatial distribution of plants.
Thinning was almost always, of slight intensity or limited to removal of the plants damaged by meteoric events. In any case, they have never achieved the aim of testing or enhancing the structural and productive aspects of the stand. Despite this, Douglas fir has shown good soil cover capacity, growth in both diameter and height, insertion into the landscape.

HERE FIGURE 2

The knowledge of data referring to experimental plots we have information for such a long period (90 years) should be monitored in the future also because they represent an important source of historical memories useful for future management purpose.
Despite the lack of Douglas fir trees annual growth data (increment cores), the dataset of dendrometric attributes allows to study the population dynamic of Douglas fir stands and the role of each tree in the structure, stability and biodiversity for conifer artificial forests. The dataset has also the potential to provide information for management, conservative purposes and health status monitoring of Douglas fir in relation to natural and anthropogenic disturbances and climate change.
The Mercurella area is the most important historical legacy about Douglas fir introduction and experimentation of in southern Italy, characterized by a typically Mediterranean climate regime, which deserves to be preserved and monitored in the future.

Contribution of the co-authors

The authors contributed equally to dataset implementation and manuscript writing.

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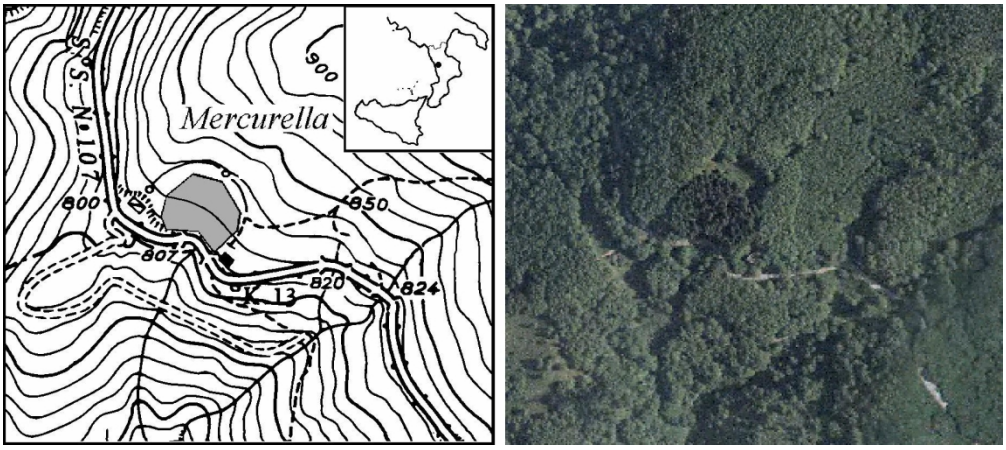

Figure 1. Geographical location (left) and aerial view (right) of the experimental Plot 412 (from Avolio & Bernardini 2000)

646x285mm (72 x 72 DPI)

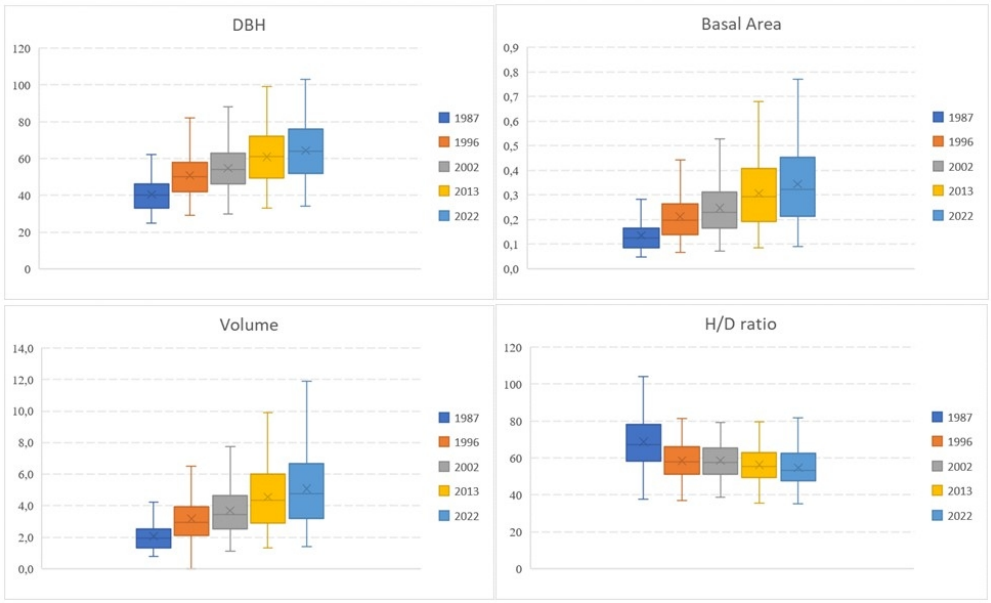

Figure 2. Box and Whiskers plot of DBH (top left), Basal Area (top right), Volume (lower left), H/D ratio (lower right).

258x156mm (96 x 96 DPI)

Table 1 - Descriptive statistics of dendrometric parameters in 1987.

	DBH	Ht	BA	V	H/D
Min	25,00	25,00	0,05	0,79	37,67
Max	73,00	34,50	0,42	6,17	104,00
Average	40,53	28,90	0,14	2,08	68,78
Std. Dev.	9,57	2,34	0,07	0,97	14,34
CV	0,24	0,08	0,49	0,47	0,21
SE	0,62	0,15	0,00	0,06	0,92

Table 2 - Descriptive statistics of dendrometric parameters in 1996.

	DBH	Ht	BA	V	H/D
Min	29,00	25,10	0,07	0,00	36,83
Max	82,00	36,00	0,53	7,74	92,90
Average	50,84	30,35	0,21	3,17	58,39
Std. Dev.	10,68	2,32	0,09	1,32	10,30
CV	0,21	0,08	0,43	0,42	0,18
SE	0,72	0,16	0,01	0,09	0,69

Table 3 - Descriptive statistics of dendrometric parameters in 2002.

	DBH	Ht	BA	V	H/D
Min	30,00	25,30	0,07	1,11	38,85
Max	88,00	39,80	0,61	8,89	94,55
Average	54,77	32,60	0,25	3,68	58,67
Std. Dev.	11,96	2,83	0,11	1,57	9,90
CV	0,22	0,09	0,44	0,43	0,17
SE	0,80	0,19	0,01	0,11	0,66

Table 4 - Descriptive statistics of dendrometric parameters in 2013.

	DBH	Ht	BA	V	H/D
Min	33,00	25,70	0,09	1,33	35,56
Max	99,00	42,10	0,77	11,20	91,11
Average	60,90	34,82	0,31	4,55	56,29
Std. Dev.	14,03	3,08	0,14	2,01	9,82
CV	0,23	0,09	0,45	0,44	0,17
SE	0,94	0,21	0,01	0,14	0,66

Table 5 - Descriptive statistics of dendrometric parameters in 2022.

	DBH	Ht	BA	V	H/D
Min	34,00	26,20	0,09	1,41	35,31
Max	103,00	43,00	0,83	12,10	96,29
Average	64,25	36,25	0,34	5,07	54,61
Std. Dev.	15,56	3,02	0,16	2,34	10,01
CV	0,24	0,08	0,47	0,46	0,18
SE	1,06	0,21	0,01	0,16	0,68