

habitat	
natural distribution	Caucasus, Turkey
in N.W. Europe since	1822, Germany
natural areas The Netherlands	not indigenous
geological landscape types The Netherlands (Hoek 1997)	coversand area, ice-pushed ridges
forested areas The Netherlands	sandy soils; former heath fields
area Netherlands	<1700 ha (2002, Probos)
% of forest trees in the Netherlands	<0,7 (2002, Probos)
soil type	sandy, loamy, clay
pH-KCl	4-6
soil fertility	medium to nutrient rich
light	highly shade tolerant
① shade tolerance (0=no tolerance to 5=max. tolerance)	no data, probably comparable to <i>Picea abies</i>
① drought tolerance (0=no tolerance to 5=max. tolerance)	no data, probably comparable to <i>Picea abies</i>
① waterlogging tolerance (0=no tolerance to 5=max. tolerance)	no data, probably comparable to <i>Picea abies</i>
plant communities in the Netherlands	Vaccinio-Piceetea (klasse der naaldbossen): -Leucobryo-Pinetum – Kussentjesmos-Dennenbos
management	
status Europe	infrequent species in forests
status The Netherlands	infrequent exotic species in forests
application	timber tree
propagation	seed, cuttings
regeneration	planting; natural regeneration
optimal gap size for regeneration	1-2x tree length
first plantation Netherlands	
resprouting after cutting	no
growth rate (M.A.I. in $m^3ha^{-1}j^{-1}$)	medium; ...
diseases	<i>Heterobasidion annosum</i> , fungus on roots (Wortelzwam) <i>Rhizina undulata</i> , fungus on roots (Koffievuurtjeszwam)
insects	
wood	
wood	European spruce (Vuren)
wood structures key characteristics of pores	Resin canals. Continous transition from earlywood to latewood
density heartwood (kg/m^3)	<i>P. abies</i> : (300-)460(-620) (12% moisture content)
elastic modulus (N/mm^2)	<i>P. abies</i> : 11.600-13.500
durability heartwood	fungus 4
heartwood colour	white
sapwood colour	white
contents	resin (hars)
products	construction timber, cladding, pulpwood for paper, packing-wood
non-timber products	
seeds	raw edible
resin	for turpentine

① Ülo Niinemets and Fernando Valladares. 2006. Tolerance to shade, drought, and waterlogging of temperate Northern Hemisphere trees and shrubs. Ecological Monographs 76:521–547



branches with shiny green leaves in spring



mature cones, opened with seed-fall



Cone-loaded tree top, Main cemetery, Veenendaal
photo's 4x ©Leo Goudzwaard, Wageningen University



mature cones in October, Schovenhorst Pinetum, Putten



Bark



Oriental Spruce stand, Schovenhorst Pinetum, Putten



Mature tree, Schovenhorst Pinetum, Putten



Gall caused by the leaf aphid *Adelges nordmannianae* (Dutch: Ananasgal), Schovenhorst Pinetum, Putten