

## RADIATA PINE AS AN EXOTIC SPECIES

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Radiata pine (*Pinus radiata* D. Don) is one of the most extensively planted exotic conifer in the world, there are about 3.8 million hectares in plantations. Most of the plantations are in 5 countries; Chile, New Zealand, Australia, Spain and South Africa (Table 1).

Table 1. Radiata pine plantations worldwide

COUNTRY	PLANTATIONS (000 ha)	YEAR OF INTRODUCTION
CHILE	1.380	1887
NEW ZEALAND	1.338	1868
AUSTRALIA	642	1876
SPAIN	237	----
SOUTH AFRICA	66	1885
OTHER COUNTRIES	100	----
TOTAL	3.763	

The natural range of the species is restricted to 5 discrete populations in western North America. Three of these populations are in coastal California, USA; Año Nuevo, Monterey and Cambria with a total area not exceeding 5.000 to 6.000 ha (Burdon y Banister, 1970). The other two populations are located in two islands off Baja California in Mexico; Guadalupe and Cedros. The island populations are very small in size, specially Guadalupe, where only a few hundred trees are left (Burdon y Banister, 1970; Forde, 1964; Scott, 1962).

The role of radiata pine on different countries is described based on a survey sent to organizations and scientists worldwide. Radiata pine has been established in experimental

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plantations in many countries in the world, but it has been successful only in countries with Mediterranean climate. Summer rainfall promotes infection by *Dothistroma septosporum*. Climatic conditions of natural and exotic populations are presented on Table 2.

Table 2. Climatic information for radiata pine in natural and exotic populations

COUNTRY	ANNUAL RAINFALL (mm)	ANNUAL TEMP. (°C)	COLDEST MONTH (°C)	HOTTEST MONTH (°C)	ABSOLUTE MINIMUM (°C)
USA , California	420-700	13-15	10-11	16-18	- 7
AUSTRALIA	650-1300	11-14	0.4-6	24-30	- 10
CHILE	450-2500	11-15	7-12	16-21	- 10
N. ZEALAND	700-1500	8-13	3-6	13-17	- 10
S. AFRICA	900-1100	9-12	9-11	10-13	- 3

Radiata pine is the main plantation species in three countries; Australia, Chile and New Zealand. Information on total plantation compared to radiata pine plantations is presented on Table 3.

Table 3. Participation of radiata pine on the exotic plantations per country

COUNTRY	TOTAL EXOTIC PLANTATIONS (000 ha)	RADIATA PINE PLANTATIONS (000 ha)	PARTICIPATION (%)
AUSTRALIA	1,040	642	62
CHILE	1,818	1,380	76
N. ZEALAND	1,478	1,338	90
S. AFRICA	1,429	66	5
SPAIN	3,500	237	7

Annually, about 200,000 ha of radiata pine plantations are established. 50% of these plantations are new plantations and the other 50% are replacement of harvested plantations. Table 4 presents a projection of plantations per country, considering that the annual harvest programs and the rate of planting will be maintained for the next 10 years,

Table 4. Historical and projected plantation are of radiata pine per country

COUNTRY	ANNUAL PLANTING (ha)	AREA OF PLANTATIONS (000 ha)			
		1956	1986	1996	2006
CHILE	70,000	200	1,118	1,380	1,800
SPAIN	5,000	51	270	237	237
S.AFRICA	3,300	21	56	66	80
AUSTRALIA	17,000	122	621	642	600
N.ZEALAND	95,000	229	1,009	1,338	1,800
TOTAL	190,300	623	3,074	3,663	4,517

Because radiata pine is grown in a great variety of sites, expected growth is highly variable. Table 5 shows some predictions of average growth per country and some indications of maximum growth on the best sites (Lewis and Ferguson, 1993).

Table 5. Average and maximum annual growth of radiata pine per country

COUNTRY	AVERAGE ANNUAL GROWTH (m <sup>3</sup> /ha/yr)	MAXIMUM ANNUAL GROWTH (m <sup>3</sup> /ha/yr)
SPAIN	13	---
AUSTRALIA	21	43
N.ZEALAND	24	45
S.AFRICA	14	37
CHILE	25	46

Radiata pine is managed for the production of sawn timber and fiber. Rotation ages vary from 18 to 35 years. Information on rotation age per country and management objectives is presented on Table 6.

Table 6. Rotation age for sawn timber and fiber production in different countries

COUNTRY	ROTATION AGE (YR)	
	SAWN TIMBER	FIBER
AUSTRALIA	35	30
CHILE	25	18
N.ZEALAND	25-30	--
S.AFRICA	35	--
SPAIN	35	30

The actual wood production of radiata pine is close to 50 million cubic meter per year. The main uses for this wood is sawn timber, pulp and paper, panels and others. Based on the projection for the next 10 year of establishment of radiata, the long term wood production should double in year 2036. Information on wood production, actual and projected is presented on Table 7.

Table 7. Annual wood production of radiata pine per country

COUNTRY	ACTUAL WOOD PRODUCTION (000 m3/yr)	PROJECTED (2036) WOOD PRODUCTION (000 m3/yr)
CHILE	18,548	45,000
SPAIN	2,000	3,000
S.AFRICA	486	1,000
AUSTRALIA	10,400	12,000
N.ZEALAND	17,000	43,000
<b>TOTAL</b>	<b>48,434</b>	<b>104,000</b>

The main uses of wood in different countries is presented on Table 8.

Table 8. Main uses of wood in different countries

COUNTRY	WOOD USES (%)			
	SWAN TIMBER	PULP & PAPER	PANELS	OTHERS
CHILE	50	40	4	6
SPAIN	55	45	0	0
S.AFRICA	82	0	1	17 *
AUSTRALIA	45	53	0	2
N.ZEALAND	60	25	10	5

(\*): mainly poles

Finally, the main biotic damage present on radiata pine plantations in different countries is presented in Tables 9 to 13.

Table 9. Main animal damage in radiata pine plantations

COUNTRY	MONKEYS	KANGAROOS	RATS
	BABOONS	POSSUMS	MICE
AUSTRALIA		X	X
CHILE			X
N.ZEALAND			X
S.AFRICA	X		X

Table 10. Main insect damage in radiata pine plantations

COUNTRY	RHYACIONIA BUOLIANA	SIREX NOCTILIO	HYLASTER SPP.
AUSTRALIA		X	X
CHILE	X		
N.ZEALAND		X	X
S.AFRICA			X

Table 11. Main needle diseases in radiata pine plantations

COUNTRY	DOTHISTROMA SEPTOSPORUM	LOPHODERMIIUM PINASTRI	NAEMACYCLUS SPP.
AUSTRALIA	X	X	X
CHILE	X		X
N.ZEALAND	X	X	X
S.AFRICA	X	X	

Table 12. Main stem diseases in radiata pine plantations

COUNTRY	DIPLODEA PINEA
AUSTRALIA	X
CHILE	X
N.ZEALAND	X
S.AFRICA	X

Table 13. Main root rot diseases in radiata pine plantations

COUNTRY	ARMILLARIA SPP.	PHYTOPHTHORA SPP.
AUSTRALIA	X	X
CHILE	X	
N.ZEALAND	X	X
S.AFRICA	X	X

#### LITERATURE CITED

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