

AGE ESTIMATION OF RADIATA PINE (PINUS RADIATA D. DON) WITH LANDSAT IMAGES.

Wilfred Richard Lewis Ernst

The main objective of this study was to use Landsat MSS images in estimating radiata pine (Pinus radiata D. Don) ages, the most important forestry resource in the country.

The selected area was Constitución (35°30' lat sur, 72°30' long west) in the Séptima Región de Chile, an important forestry zone. This zone is covered by a large variety of different radiata pine (Pinus radiata D. Don) stands ages.

The base information for this study, was generated by the Centro de Investigaciones de Recursos Naturales (CIREN), as a forestry inventory done in 1981.

The CIREN information are many maps with the radiata pine stands on them, with a complementary directory, where appears the stand age, surface, etc.

To have information from the same date, was necessary to process images from February 18, 1981, from Landsat B orbit 250.

Based in the CIREN information, were obtained a 3X3 pixels matrix for each spectral MSS band. Those matrix, were used as a starting point of two different atmospheric correction.

The first atmospheric correction used is the Turner and Spencer (1972). This model assumes the atmosphere is made of many parallels planes crossed by the downwelling and upwelling energy. The second method used, consist in a solar elevation angle standarization in 45 degrees.

The original digital counts were corrected by both methodologies transforming them in two different gorups of values.

For Turner and Spencer model was necessary transform the digital counts in radiance values using the Landsat correcting parameters for each MSS, and then transform radiance values in reflectance values.

The final part of this study consisted in process corrected values for both methodologies in a microcomputer statistical package to obtain the best regression for predicting ages.

To process corrected values towards to get better correlation data, were treated for both methodologies as groped year by year data and grouped in a paired of two years data, related with its age.

The results obtained are the followings:

METODOLOGIA:  
VARIABLES EN LA REGRESION:

Turner y Spencer cada un año  
Edad, Banda 3

TIPO DE REGRESION: Reciproco  $1/Y = a + bX$

PARAMETROS	ESTIMADOR	ERROR ESTANDAR	T	NIVEL DE PROB.
INTERCEP.	-0.26971	0.063315	-4.2599	4.24E-04
PENDIENTE	1.39015	0.256813	5.41309	3.19E-05

ANALISIS DE VARIANZA

FUENTE	SUMA DE CUADRADOS	G. de L.	CUAD. MEDIOS	F
MODELO	0.026564	1	0.026564	29.30136
ERROR	0.017225	19	0.000906	
TOTAL	0.043789	20		

COEFICIENTE DE CORRELACION 0.77887  
ERROR ESTANDAR DE ESTIMACION 0.030109

METODOLOGIA: Turner y Spencer cada dos años  
 VARIABLES EN LA REGRESION: Banda 3

TIPO DE REGRESION: Reciproca  $1/Y=a+bX$

PARAMETROS	ESTIMADOR	ERROR ESTANDAR	T	NIVEL DE PROB.
INTERCEP.	-0.07470	0.020217	-3.6952	4.14E-03
PENDIENTE	0.824688	0.10861	7.59314	1.85E-05

ANALISIS DE VARIANZA

FUENTE	SUMA DE CUADRADOS	G.de L.	CUAD. MEDIOS	F
MODELO	0.019536	1	0.019536	57.65572
ERROR	0.003388	10	0.000338	
TOTAL	0.022924	11		

COEFICIENTE DE CORRELACION -0.92314  
 ERROR ESTANDAR DE ESTIMACION 0.018407

METODOLOGIA: Segunda cada un año  
 VARIABLES EN LA REGRESION: Edad, Banda 3

TIPO DE REGRESION: Exponencial  $Y = \exp(a+bx)$

PARAMETROS	ESTIMADOR	ERROR ESTANDAR	T	NIVEL DE PROB.
INTERCEP.	7.03189	0.65061	10.8082	1.48E-09
PENDIENTE	-0.12315	0.018871	-6.5259	2.99E-06

ANALISIS DE VARIANZA

FUENTE	SUMA DE CUADRADOS	G.de L.	CUAD. MEDIOS	F
MODELO	4.508349	1	4.508349	42.58735
ERROR	2.011363	19	0.105861	
TOTAL	6.519712	20		

COEFICIENTE DE CORRELACION -0.83156  
 ERROR ESTANDAR DE ESTIMACION 0.325363

METODOLOGIA: Segunda cada dos años  
 VARIABLES EN LA REGRESION: Edad, Banda 3

TIPO DE REGRESION: Exponencial  $Y = \exp(a+bX)$

PARAMETROS	ESTIMADOR	ERROR ESTANDAR	T	NIVEL DE PROB.
INTERCEP.	7.48878	0.729181	10.2701	1.24E-06
PENDIENTE	-0.1368	0.021015	-6.50944	6.81E-05

ANALISIS DE VARIANZA

FUENTE	SUMA DE CUADRADOS	G.de L.	CUAD. MEDIOS	F
MODELO	2.886604	1	2.886604	42.37281
ERROR	0.681239	10	0.068123	
TOTAL	3.567843	11		

COEFICIENTE DE CORRELACION -0.89947  
 ERROR ESTANDAR DE ESTIMACION 0.261006