TREE-RING CHRONOLOGIES OF THE SOUTHERN HEMISPHERE

2. CHILE

V. C. LaMarche, Jr., R. L. Holmes,
P. W. Dunwiddie and L. G. Drew

CHRONOLOGY SERIES V
LABORATORY OF TREE-RING RESEARCH
UNIVERSITY OF ARIZONA
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Volumes in Laboratory of Tree-Ring Research Chronology Series V:

1. Argentina
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5. South Africa

PREFACE

This report is one of a series documenting dendrochronological studies in the Southern Hemisphere carried out by the Laboratory of Tree-Ring Research from 1973 to 1979 with the support of the U. S. National Science Foundation. Initial studies in Chile and Argentina in 1973-1974 were part of the International Biological Program, Origin and Structure of Ecosystems project, administered by the San Diego State University Foundation. Subsequent work there, and in Australia, New Zealand and South Africa was supported directly by grant GV 41450, from the Office of Polar Programs, and by grants ATM 75-15495, ATM 76-24267, and ATM-7823008, all from the Climate Dynamics Program, Division of Atmospheric Sciences.

The purpose of these investigations was to develop long, accurately dated, and climatically sensitive tree-ring records and to use them as a basis for inference about past climatic fluctuations. We have collected several thousand tree-ring samples from some 200 sites in temperate latitudes in South America, New Zealand, Australia and southern Africa. We have developed 71 ring-width index chronologies, each incorporating the growth records of a large number of trees. The longest approaches 1000 years in length. In these reports, we present these time series of average annual ring-width indices together with information on the sample size, the location and nature of the sample site, and statistics describing both the site chronology and its component series. Information is also presented on other sample collections where no index chronology was developed.

In order to make our Southern Hemisphere tree-ring records as widely available and as useful as possible, the data have also been entered in the International Tree-Ring Data Bank. Two types of data are available in machine-readable (punched-card or magnetic tape) form. First, we have entered the basic data in the form of all the measured radial ring-width series that were used in development of each site chronology. Second, we have also entered the derived site chronologies themselves, as published in this volume. For information on current holdings, cost, and formats, contact:

Manager
International Tree-Ring Data Bank
Laboratory of Tree-Ring Research
University of Arizona
Tucson, Arizona 85721

Although we had overall responsibility for site selection, sample collection, preparation, dating, ring-width measurement, and for data processing, evaluation and analysis, we received a great deal of help in this effort. Information, logistic and other support, and field assistance were generously provided by individuals, academic institutions and government agencies in each of the countries that we visited. They are acknowledged in the introduction to each volume. Dating of the samples was carried out mainly by R. L. Holmes, P. W. Dunwiddie and B. J. Richards,

assisted at times by J. Ambrose, P. Brown, H. L. Fleischauer, V. C. LaMarche, and D. A. Campbell. T. P. Harlan and J. B. Harsha dated the initial Chilean collections. Ring-width measurements and measurement checks were made by those listed above, and by S. D. Morton, B. L. Fine, M. R. Henry, J. B. Heider, P. Houghton and K. A. Black. M. S. Crebbs, M. A. Kempinski and J. G. Miller aided in sample preparation. Computer operations were managed by L. G. Drew, with assistance from D. J. Buecher, R. B. Minton, C. S. Carlson, K. L. Kreutzer, S. L. Ward and others in the Data Processing Section of the Laboratory. M. K. Cleaveland developed some of the computer software that was used, and also helped with processing. Typing of the manuscripts was ably handled by A. K. Allen.

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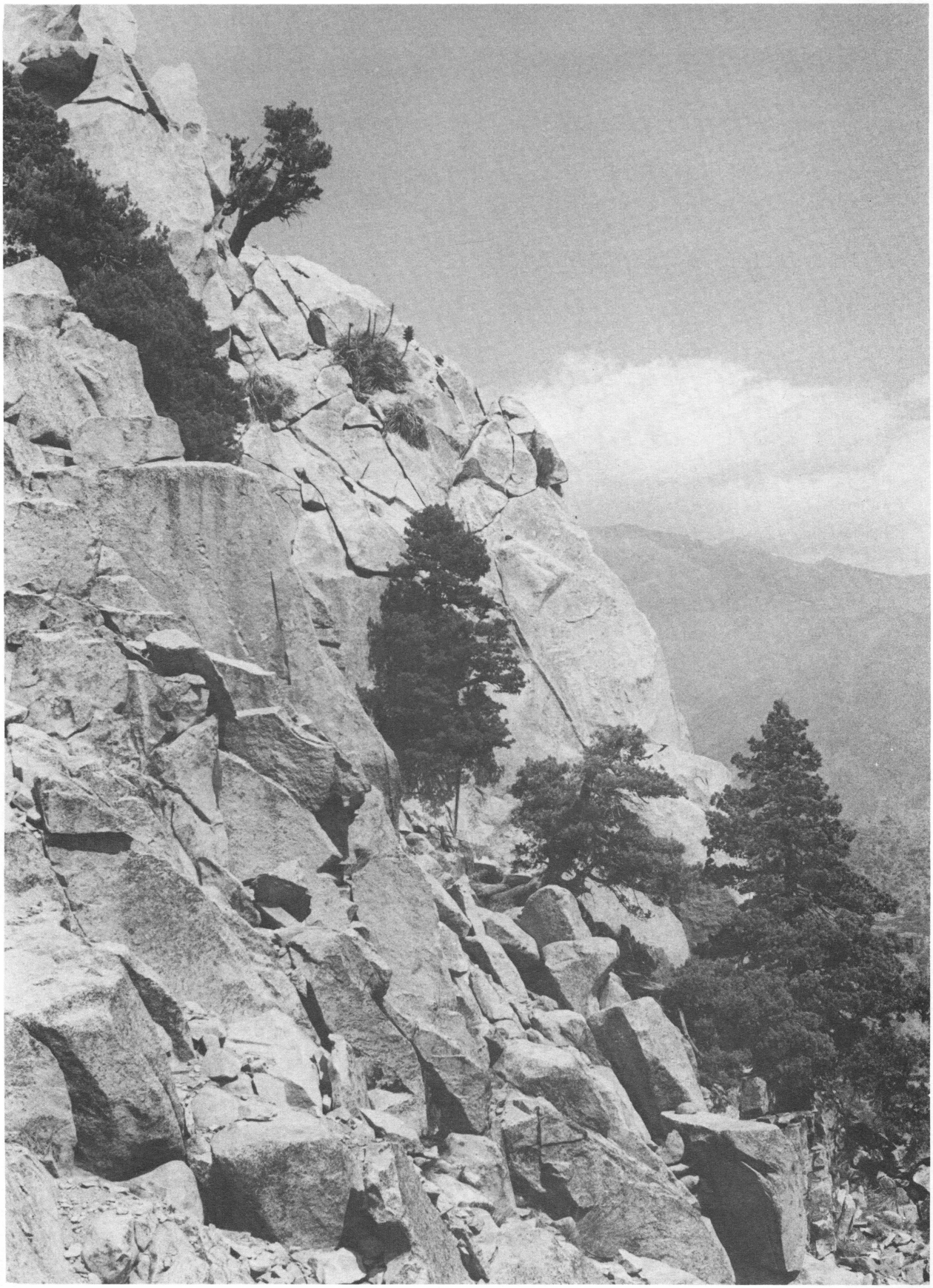


Plate 1. *Austrocedrus chilensis*, San Gabriel site, Santiago Province, looking east toward the highest ranges of the Andes.

INTRODUCTION

Background

South America is of special interest for Southern Hemisphere dendroclimatology because of the great latitudinal extent, reaching 55°S, or some 900 km farther than any other forested continent. However, at the time we began this work the tropical and subtropical forests and woodland of the north did not seem to offer great potential for dendrochronological studies. Problems included poorly defined rings, circuit irregularity, and relatively rapid growth rates with consequently low maximum ages. Chile thus seemed particularly attractive because temperate forest species are found much farther north on the wetter, western side of the Andes in Chile than they are in Argentina, which lies in the Andean rain shadow. We knew from Schulman's earlier exploratory work in Patagonia (Schulman, 1956) that two Chilean coniferous species (*Austrocedrus chilensis* and *Araucaria araucana*) and possibly a third (*Fitzroya cupressoides*) offered potential for development of long and climatically sensitive tree-ring records.

Our current program of Southern Hemisphere studies began in late 1972, in cooperation with biologists and physical geographers associated with the International Biological Program's Origin and Structure of Ecosystems Project. These workers, focusing on comparison of the biota of the mediterranean climatic zones of Southern California and central Chile, became concerned that their understanding of the climates of the two regions was based on records that were too short to characterize adequately the climatic regimes on the time scales required for operation of evolutionary processes, for the development of contemporary ecosystems, or even for the growth of long-lived individual trees and shrubs. To obtain a somewhat broader time perspective than offered by the available instrumental records (about 100 years) they wondered whether dendroclimatology offered a means of extending these records even a few hundred years farther into the past. Good tree-ring records were already available in California, but no dendrochronological work had been done in Chile, apart from Schulman's limited sampling of *Araucaria* and *Fitzroya* in south-central Chile. Therefore, the senior author undertook a reconnaissance sampling trip to central Chile in early 1973, with very promising indications that *Austrocedrus chilensis* at its northern limits near Santiago could provide an excellent basis for climatic reconstruction. A larger expedition followed in early 1974. Some of the results are reported by Miller *et al* in Mooney (1977).

In this and subsequent work in Chile, our sample collections were concentrated on conifers of the coastal ranges and the Andean foothills between about 32°S and 40°S. Exploratory samples were also taken of a variety of non-conifers. We also studied a large collection of increment cores from *Fitzroya cupressoides* from areas farther south, around Puerto Montt, that had been collected in 1946-1947 by R. T. Patton, a former

student of Schulman's. Because of severe logistical problems, and because the dominant Nothofagus species seemed to offer less promise for dendrochronological studies, we did not attempt to sample along the southern Chilean coast.

Sample Collection and Documentation

The tree-ring samples described in this volume are housed at the Laboratory of Tree-Ring Research, and were collected during the period 1973-1977 by members of the Laboratory working in cooperation with Chilean scientists. The general procedure was to collect increment core samples from several radii of each of a number of trees on a geographically limited and ecologically homogeneous site. In a few cases it was also possible to collect discs (complete or partial transverse sections) from stumps or logs of recently felled trees. An embossed aluminum tag bearing an identification number was attached to each tree sampled. A brief site description accompanies each chronology; a description and pertinent collection information are also presented for those sites from which no index chronology was developed. The site location map (Figure 2) is keyed to an Index to Localities (Table 1) by use of a 3-letter site code.

Dating and Chronology Development

Each collection was evaluated, both in the field and upon return to the Laboratory, in terms of its dendrochronological potential. Criteria included clarity of ring structure, circuit uniformity, sensitivity, and the feasibility of cross-dating patterns of wide and narrow rings and of other features between different radii and between different trees in the site. Development of the dating chronology followed standard cross-dating procedures (Stokes and Smiley, 1968). We adopted Schulman's convention of assigning the date of the annual ring to the year in which ring growth begins. The annual rings in all suitable samples from each site were dated; others were rejected because of complacency, short length, poor wood quality, an unusually high frequency of locally absent rings, the presence of pronounced growth surges or suppression, or for other reasons. One person normally had responsibility for evaluating and dating all the material from a particular site. The dating was then independently checked by another worker to ensure the accuracy of assignment of each annual ring in each sample to the correct calendar year.

After dating and checking were completed, the ring widths in each dated sample were measured to the nearest 0.01 mm using a Henson (Bannister model) measuring machine in conjunction with a Bausch and Lomb stereoscopic microscope with crosshairs, normally at 15X to 30X magnification. In the case of particularly difficult material, such as much of the Araucaria araucana, measurements were made by a senior research assistant. In all cases, spot checks were made of the security of ring-width measurements using a test based on the Chi-square statistic. The printed tapes produced by the measuring machine were checked for errors, and the ring widths transferred to punched cards by keypunch operators.

A standard procedure was followed in the processing and evaluation of the data. First, descriptive statistics were calculated for each ring-width series and the series was listed and plotted for visual inspection and an error check, using the Laboratory's RWLST and TRPLT programs. Some series were deleted from the data set at this stage because of poor statistical quality, or because the plots showed evidence of gross non-climatic growth surges or periods of extreme growth suppression.

The remaining ring-width series were then transformed to dimensionless ring-width indices using the Laboratory's program INDXA. The purpose of this transformation is to remove effects of non-climatic growth trends or fluctuations, as well as the effect of differences in average growth rate between different trees (Fritts, 1976). The curve-fitting option for each ring-width series was carefully selected, based on the general appearance of the plotted series, as well as our knowledge of the local site history and general environmental conditions. In a majority of cases, a negative exponential or straight-line curve was fit, although the orthogonal polynomial option was occasionally used with considerable discretion.

Finally, the individual radial ring-width index series were combined by averaging to produce the site chronology, either as part of the INDXA run, or in a subsequent step using the SMSR or SUMAC programs. In addition to the site chronology, which normally includes all the good quality ring-width index series available for a site, we also produced a so-called "statistical" chronology, incorporating a selected sub-set of the available index series.

Descriptive Statistics

Two sets of statistics are presented for most of the sites for which a chronology was developed. These can be very useful in providing a quantitative basis for evaluating the dendroclimatic potential of a tree-ring chronology (Fritts, 1976).

The first set, designed "Sample Statistics", is based on analysis of the data sub-set incorporated in the statistical chronology. Most of the parameters provide measures of the relationships among the component radial ring-width index series, and are calculated for a period common to all the series, using a replicated sample in which, in most cases, at least two radii are available for each tree in the sub-set. The results of the analysis of variance show how the total variance in the chronology is partitioned among potential sources of variation. A high percentage of the variance retained by the mean chronology generally indicates that ring-width fluctuations are very similar in all the radii. However, differences between trees often account for a large percentage of the variance, particularly on more complacent sites or on those that have been disturbed. Other sources of variation may include differences between radius classifications, differences between groups of trees in different areas of the site, and other "unexplained" sources of variation that are not explicitly considered in the analysis. The estimated mean square of Y, as given here, is the estimated population value of the amount of

variance in common among all series that is retained in the final chronology, and corresponds to the "Variance Component" used by Fritts in his Table 6.VII (1976, p. 288). The cross-correlation analysis duplicates the analysis of variance results to some extent, but also provides additional insights. The values given are the average linear cross-correlation coefficients between different sets of ring-width index series. The average correlation between radii within trees is always larger than the average correlation among radii from different trees, and reflects the tendency for growth records from individual radii of the same tree to be more similar than records from radii of different trees. Another measure of the similarities or differences between trees is provided by the average correlation between the tree mean chronologies, obtained by averaging the replicated records from the different radii of the same trees, and calculating correlation coefficients.

The second set of data, labelled "Chronology Statistics", describes the properties of the site chronology presented on the facing page. Each chronology is identified by a 6-character code. The three letters correspond to the site code given in Table 1 and used in Figure 2. The first two numbers constitute a two-digit species code, explained in Table 3, and the "9" in the last position of the code for most chronologies follows a Laboratory convention indicating that it is a site chronology, incorporating all available good-quality radial index series. Three statistics are given that describe time-series properties of the chronology (Fritts, 1976). Autocorrelation is the first-order autocorrelation coefficient - a measure of the tendency for high or low index values to persist from one year to the next. The standard deviation of the series is calculated in the usual way, and measures the total amount of variation at all frequencies. The mean sensitivity is a statistic developed for the description of tree-ring series, but corresponds to the mean average first difference. High mean sensitivity indicates that there are large differences in index value from one year to the next. The standard error measures the amount of dispersion of the index values in the sample about the mean value in each year; they are averaged for the entire series to produce the mean standard error given here. In general, the closer the individual values are to the mean value, and the larger the sample size, the smaller the standard error. The chronology statistics are summarized in Table 2.

Acknowledgments

Many individuals and organizations helped to support our work in Chile. H. A. Mooney of Stanford University and A. W. Johnson of California State University, San Diego, were instrumental in supporting the initial Chilean tree-ring studies under the International Biological Program. J. Mercer of Ohio State University gave valuable suggestions and advice in the early planning stages of the project. We especially appreciate the help of Dr. Ernesto Hajek, Director of the Laboratorio de Ecología, Universidad Católica de Chile, Santiago. Through the cooperation of Dr. Hajek and Professor Fernando Martínez, Vice-Rector Académico, we were able to use the Laboratorio as headquarters during

much of our time in Chile. Eduardo Fuentes accompanied the senior author on the initial sampling trips in 1973, and Manuel Mahu made it possible to revisit the San Gabriel site in 1974. Field assistance in 1974 was also provided by T. P. Harlan and J. B. Harsha of this Laboratory.

Julio Gutiérrez was our valuable field assistant on the collecting trips of 1976 and 1977. We were assisted in the field also by Juan Salazar, José Manuel Gallinato, Marcelo Fuentes, Carlos Gutiérrez, Pedro Vidal G.-H., and Luis Machuca. Dr. Rodolfo Gajardo of the Faculty of Forestry Science, Universidad de Chile, provided us with much useful information. Ing. Francisco Díaz also contributed useful contacts and access to information. Advice and information on Chilean flora came from Dr. Carlos Muñoz Pizarro of the Museo Nacional de Historia Natural.

Contacts, information and access to forests were facilitated by the Instituto de Investigaciones de Recursos Naturales (IREN-CORFO) and the Corporación Nacional Forestal (CONAF) in Santiago, and by the CONAF offices in Osorno, Los Angeles, La Unión, Cañete and Malalcahuello, and the Superintendent of the Nahuelbuta National Park near Angol.

Plate 2. *Araucaria araucana*, Nalcas site, Malleco Province.
To the west lies the Lonquimay volcano.

TABLE 1. INDEX TO LOCALITIES

Site Code	Site Name	Species Code	Lat.	Long.	Altitude, mts.	Site Chronology
ABA	Abanico	AUCH	37°21'S	71°36'W	820	ABA479
AGU	Piedra del Aguila	ARAR	37°50'S	73°02'W	1250 to 1318	AGU799
BLV	Bellavista	AUCH	34°47'S	70°45'W	2000	
CAR	Caramávida	ARAR	37°41'S	73°10'W		CAR799
CHY	El Chacay	AUCH	37°21'S	71°30'W	850 to 1000	CHY479
ELA	El Asiento	AUCH	32°40'S	70°49'W	1700-2200	ELA479
GAB	San Gabriel	AUCH	33°46'S	70°13'W	1360 to 1630	GAB479
HEC	Hueicolla, El Mirador, Las Trancas	AEPU, DAFO DRWI, EUCO FICU, GUAV LAPH, LASM MYLU, NOAL NOOB, PELI PLUV, PONU SACO, WETR	40°07'S to 40°13'S	73°21'W to 73°37'W	150 to 800	
HUB	Hueicolla	PLUV	40°08'S	73°31'W	800	HUB219
ISA	Santa Isabel de las Cruces	AUCH	34°52'S	70°45'W	850	ISA477
LON	Volcán Lonquimay	ARAR	38°23'S	71°34'W	1510	LON799
MAL	Malalcahuello	ARAR	38°24'S	71°33'W	1340	
MES	Alto de las Mesas	AUCH	34°55'S	70°42'W	1020	MES477
NAL	Nalcas	ARAR	38°20'S	71°29'W	1420	NAL799
PIN	Mirador de los Pincheira	ARAR	37°47'S	73°02'W	1300	
RAY	Rayenco	POAN	37°16'S	71°37'W	870	
ROB	Roble	NOOB	33°13'S	71°00'W	2000	
VIL	Alto Vilches	NODO, NOOB	35°36'S	71°00'W	1200 to 1335	

TABLE 2. CHRONOLOGY STATISTICS SUMMARY

Chronology Identification Code	Mean Sensitivity	Standard Deviation	Auto-Correlation	Mean Standard Error	Time Span A. D.
ABA479	0.16	0.19	0.40	0.05	1733-1975
AGU799	0.10	0.16	0.65	0.08	1242-1975
CAR799	0.09	0.19	0.79	0.08	1440-1975
CHY479	0.20	0.30	0.73	0.08	1641-1975
ELA479	0.18	0.25	0.57	0.06	1011-1972
GAB479	0.17	0.25	0.60	0.07	1131-1975
HUB219	0.14	0.19	0.55	0.06	1868-1975
ISA477	0.14	0.22	0.60	0.06	1568-1975
LON799	0.11	0.16	0.63	0.06	1664-1975
MES477	0.17	0.24	0.59	0.09	1796-1975
NAL799	0.13	0.23	0.72	0.09	1386-1975

TABLE 3. SPECIES COLLECTED

Species	Alphabetic Species Code	Numerical Species Code	Number of Sites Collected
Aextoxicon punctatum	AEPU		1
Araucaria araucana	ARAR	79	6
Austrocedrus chilensis	AUCH	47	7
Dacrydium fonckii	DAFO		1
Drimys winteri	DRWI		1
Eucryphia cordifolia	EUCO		1
Fitzroya cupressoides	FICU	48	1
Guevina avellana	GUAV		1
Laurelia philippiana	LAPH		1
Laurelia sempervirens	LASM		1
Myrtus luma	MYLU		1
Nothofagus alpina	NOAL		1
Nothofagus dombeyi	NODO		1
Nothofagus obliqua	NOOB		3
Persea lingue	PELI		1
Pilgerodendron uviferum	PLUV	21	1
Podocarpus andinus	POAN		1
Podocarpus nubigenus	PONU		1
Saxegothaea conspicua	SACO		1
Weinmannia trichosperma	WETR		1

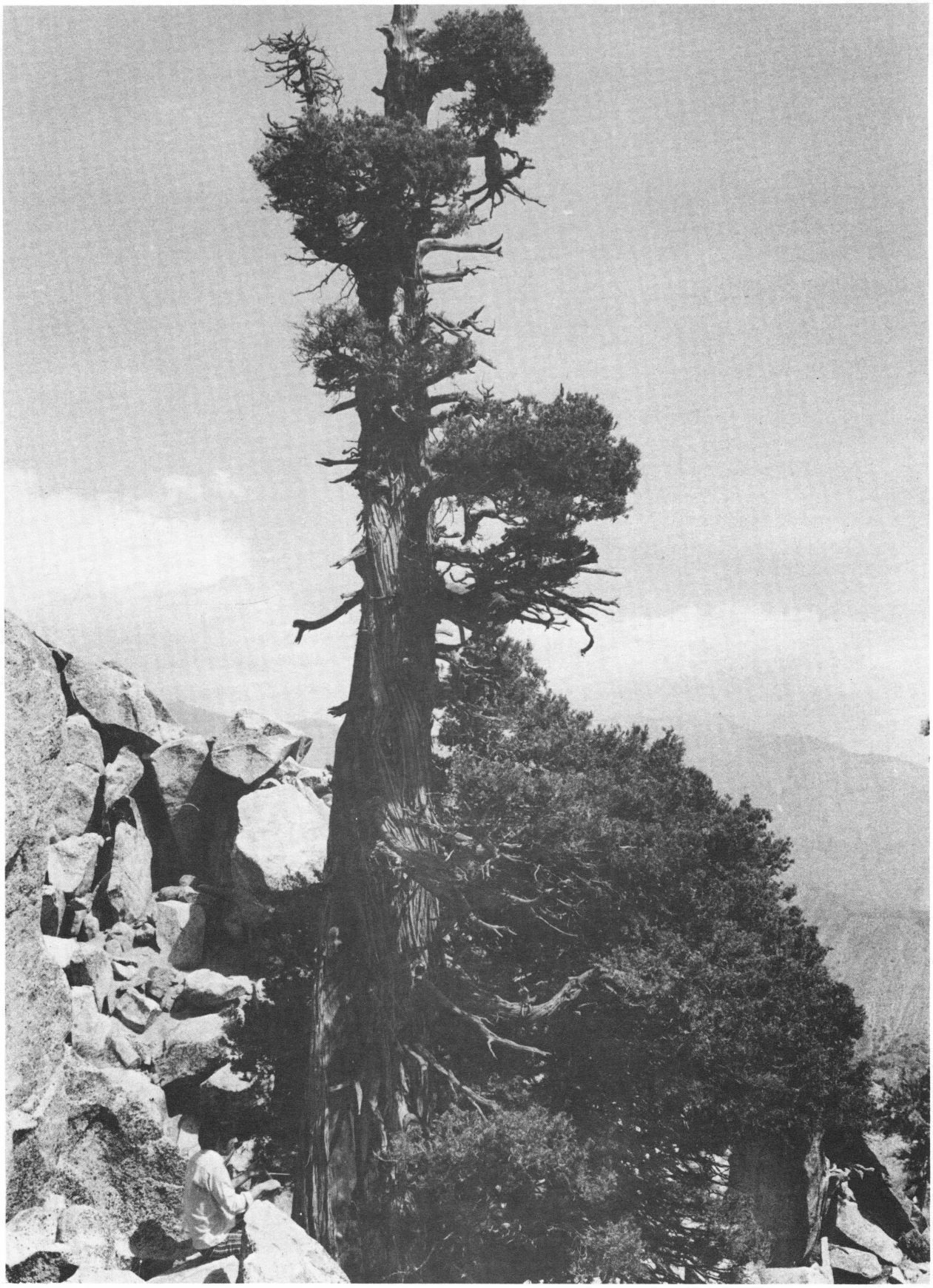
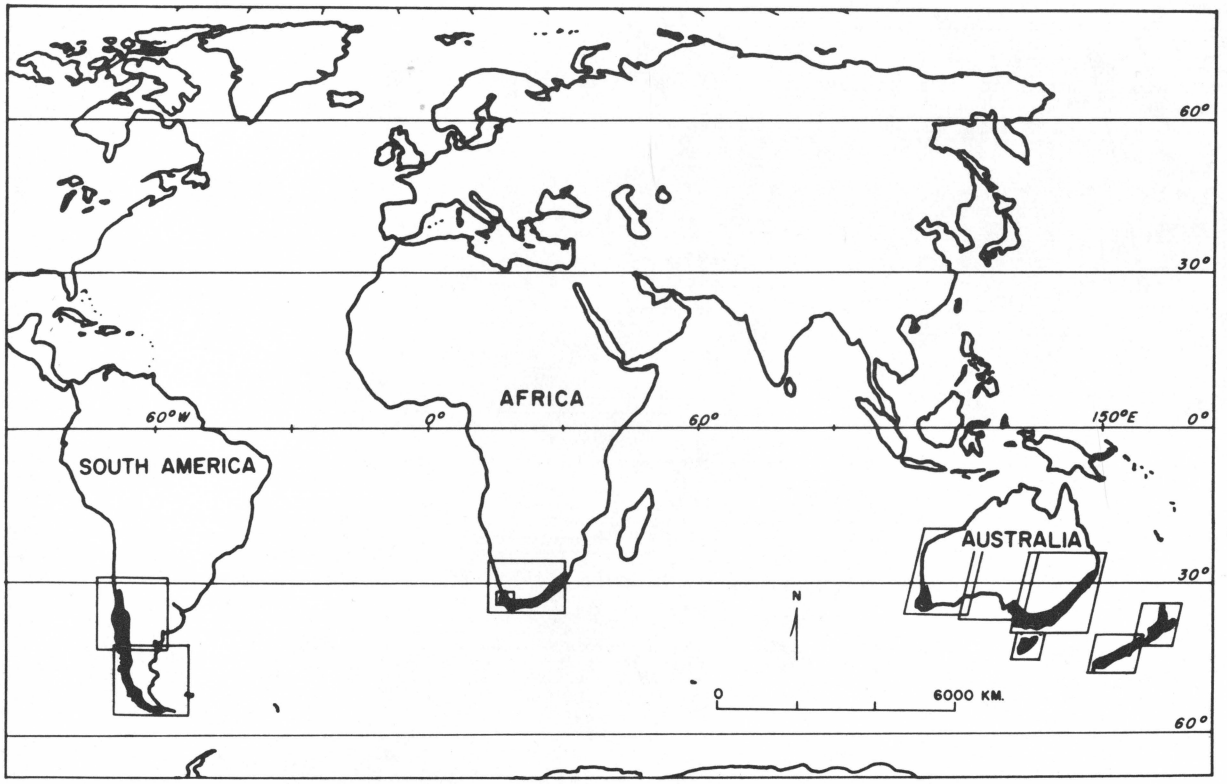


Plate 3. *Austrocedrus chilensis* showing signs of stress, San Gabriel site, Santiago Province.


60°
30°
AFRICA
60°W
0°
60°
150°E
0°
SOUTH AMERICA
AUSTRALIA
30°
N
0
6000 KM.
60°


CENTRAL
CHILE
CHRONOLOGY
OTHER COLLECTIONS
0
300 KM.
N
LA SERENA
30°
ELA
VALPARAISO
ROB
MENDOZA
SANTIAGO
GAB
34°
BLV
ISA
MES
PACIFIC OCEAN
VIL
ARGENTINA
CHILE
CONCEPCION
RAY
ABA
CHY
CAR
PIN
AGU
38°
NAL
LON
MAL
NEUQUEN
VALDIVIA
HUB
HEC
BARILOCHE
42°
74°
70°
66°

SITE CHRONOLOGIES

SITE AND COLLECTION INFORMATION

Site name *EL ASIENTO*
Country *CHILE* **State or Province** *ACONCAGUA*
Latitude *32°39'S* **Longitude** *70°49'W* **Altitude** *1700 m - 2200 m*
Species collected *Austrocedrus chilensis*
Date of collection *27 January 1973, 9-12 March 1974*
Collectors *V.C.LaMarche, T.P.Harlan, J.Harsha*
No. of trees sampled *43* **No. of cores** *95* **No. of discs** *0*

Site description:

The site is 13 kilometers northwest of San Felipe in a straight line, northwest and above the village of El Asiento in the upper reaches of Quebrada del Asiento on the south-facing slope of Cerro Tabaco. Austrocedrus are widely scattered on an extremely barren, steep (20° to 35°) andesite talus slope.

This stand was reported as the most northerly known stand of Austrocedrus chilensis in a 1962 article entitled "Hallazgo de un bosque de cipreses cordilleranos en la Provincia de Aconcagua" (Discovery of a stand of mountain cypress in Aconcagua Province) by Friederich Schlegel of the University of Chile.

SAMPLE STATISTICS

Interval analyzed (A.D.)	*1840 - 1971*
No. of trees *9* No. of radii per tree *2*	
Mean ring width (mm)	*0.56*
% locally absent rings	*0.84*
Analysis of variance:	
Estimated mean square of Y	*0.057*
Sources of variation, % variance	
Mean chronology	*33*
Differences between trees	*15*
Other	*52*
Cross-correlation analysis:	
Radii within trees	*0.49*
Radii among trees	*0.34*
Between tree means	*0.35*

CHRONOLOGY STATISTICS

Identification	*ELA479*
Interval (A.D.)	*1011 - 1972*
No. of trees *25* Total no. of radii *42*	
Autocorrelation	*0.57*
Standard deviation	*0.25*
Mean sensitivity	*0.18*
Mean standard error	*0.06*

EL4479
EL ASIENTO
AUSTROCEDRUS CHILENSIS

DATE	TREE RING INDICES										NUMBER OF SAMPLES									
	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1011		133	126	152	197	176	160	162	174	130		1	1	1	1	1	1	1	1	1
1020	85	97	87	36	52	64	76	55	105	50	1	1	1	1	1	1	1	1	1	1
1030	210	143	110	129	146	120	161	74	139	99	1	1	1	1	1	1	1	1	1	1
1040	91	60	77	85	70	44	34	45	54	27	1	1	1	1	1	1	1	1	1	1
1050	44	37	51	61	76	78	64	74	74	96	1	1	1	1	1	1	1	1	1	1
1060	123	209	133	116	141	106	104	87	94	87	1	1	1	1	1	1	1	1	1	1
1070	82	75	97	92	120	68	108	169	135	98	1	1	1	1	1	1	1	1	1	1
1080	65	86	78	101	83	106	99	94	68	56	1	1	1	1	1	1	1	1	1	1
1090	58	69	69	59	31	28	77	95	131	116	1	1	1	1	1	1	1	1	1	1
1100	100	100	98	72	80	59	80	78	132	130	1	1	1	1	1	1	1	1	1	1
1110	138	141	91	63	57	52	110	92	157	144	1	1	1	1	1	1	1	1	1	1
1120	89	105	119	113	90	100	146	117	133	98	1	1	1	1	1	1	1	1	1	1
1130	106	101	133	155	158	110	126	107	91	97	1	1	1	1	1	1	1	1	1	1
1140	113	102	138	119	114	127	100	103	117	109	1	1	1	1	1	1	1	1	1	1
1150	52	55	87	123	88	88	80	63	44	17	1	1	1	1	1	1	1	1	1	1
1160	50	58	75	80	80	86	100	125	95	95	1	1	1	1	1	1	1	1	1	1
1170	87	179	143	157	104	87	90	124	132	144	1	1	1	1	1	1	1	1	1	1
1180	88	76	105	91	102	125	114	131	126	66	1	1	1	1	1	1	1	1	1	1
1190	109	117	152	166	106	138	107	150	133	124	1	1	1	1	1	1	1	1	1	1
1200	101	168	180	131	143	134	79	70	56	62	1	1	1	1	1	1	1	1	1	1
1210	62	118	106	94	45	84	82	84	89	122	1	2	2	2	2	2	2	2	2	2
1220	124	85	144	98	103	101	101	103	120	144	2	2	2	2	2	2	2	2	2	2
1230	144	137	136	107	115	101	113	91	112	86	2	3	3	3	3	3	3	3	3	3
1240	100	134	86	99	85	103	104	95	99	120	4	5	5	5	5	5	5	5	5	5
1250	110	113	114	96	108	110	79	93	117	111	5	5	6	6	6	6	6	6	6	6
1260	123	131	106	115	101	88	92	105	106	110	6	6	6	6	6	6	6	6	6	6
1270	119	90	91	104	109	149	96	135	112	96	6	6	6	6	6	6	6	6	6	6
1280	89	135	109	103	87	93	109	83	91	96	6	6	6	6	6	6	6	6	6	6
1290	86	86	104	111	111	115	119	105	107	92	6	6	6	6	6	6	6	6	6	6
1300	91	94	71	69	29	60	88	110	123	99	7	6	6	6	6	6	6	6	6	6
1310	82	89	91	87	91	88	90	96	80	98	6	6	6	6	7	7	7	7	7	7
1320	91	114	95	103	77	71	52	88	88	95	7	7	7	7	7	7	7	7	7	7
1330	110	125	118	115	138	97	93	84	83	68	7	7	7	7	7	7	7	7	7	7
1340	88	70	71	85	23	87	87	90	100	104	7	7	7	7	7	7	7	7	7	7
1350	97	125	114	91	100	120	113	120	118	102	7	7	7	7	7	7	7	7	8	8
1360	106	108	106	90	96	95	115	103	106	99	8	8	8	8	8	8	8	8	8	8
1370	88	81	89	115	145	111	113	95	79	86	8	8	8	8	8	8	8	8	9	9
1380	91	41	61	89	83	72	79	96	91	69	9	9	9	9	9	9	9	9	9	9
1390	79	95	86	94	88	95	145	131	119	88	9	9	9	9	9	9	9	9	9	9
1400	95	112	77	78	94	75	60	72	75	52	9	9	9	9	9	9	9	9	9	9
1410	71	75	89	110	95	90	88	82	84	69	9	9	9	9	9	9	9	9	9	9
1420	70	89	80	58	72	91	88	94	85	64	9	9	9	9	9	9	10	10	10	10
1430	67	87	75	72	84	74	100	82	71	72	10	10	10	10	10	10	11	11	11	11
1440	37	73	92	83	79	85	102	118	113	126	11	10	10	10	10	10	10	10	10	10
1450	118	132	110	124	107	95	88	100	46	54	10	10	10	10	10	10	10	10	10	10
1460	72	92	112	98	119	131	128	125	176	162	10	10	10	10	10	10	10	10	10	10
1470	143	156	128	103	112	114	112	108	94	110	10	10	10	10	10	10	10	10	10	10
1480	100	77	89	92	101	100	125	135	121	136	10	10	10	10	10	10	10	10	10	10
1490	137	110	119	115	130	119	123	85	99	87	10	10	10	10	10	10	10	10	10	10
1500	92	103	105	110	115	139	108	96	100	129	10	10	10	10	10	10	10	10	10	10
1510	123	127	84	92	103	115	104	127	122	110	10	10	10	10	10	11	11	11	11	11
1520	128	110	68	121	105	117	127	104	133	142	11	11	11	11	11	11	11	11	11	11
1530	117	132	99	111	91	117	115	117	127	145	12	12	12	12	12	12	12	12	12	12
1540	54	97	97	101	110	130	112	42	67	85	12	12	12	13	13	13	13	13	13	13
1550	85	87	108	108	103	106	118	98	107	113	13	13	13	13	13	14	14	14	14	14
1560	93	140	131	121	108	126	135	114	132	120	15	15	15	15	15	15	15	15	15	15
1570	101	96	76	63	84	76	85	91	77	94	15	15	16	16	16	16	16	16	16	16
1580	87	114	117	87	106	113	126	117	84	147	16	16	16	16	16	16	16	16	16	16
1590	150	132	126	178	157	147	141	133	54	118	16	16	16	16	16	16	16	16	17	17
1600	117	108	123	106	95	103	84	97	117	114	18	18	18	18	18	18	18	18	18	18
1610	94	109	92	82	94	97	102	93	99	93	18	18	18	18	18	18	18	18	18	18
1620	124	103	80	85	72	87	97	72	49	62	18	18	18	18	18	18	18	18	18	18
1630	80	78	95	77	104	117	86	94	85	103	18	18	18	18	18	18	18	18	18	18
1640	100	115	119	123	93	77	80	74	106	77	19	19	19	19	19	19	19	19	19	20
1650	80	81	99	121	126	143	121	146	117	99	21	21	21	21	21	21	21	21	22	22
1660	112	103	104	120	97	92	126	110	102	99	23	23	23	23	23	23	23	23	23	23
1670	115	92	104	118	120	108	112	87	59	75	27	27	27	27	27	27	27	27	27	27
1680	100	80	91	99	94	88	89	105	101	109	27	26	26	27	28	28	28	28	28	28
1690	99	102	101	81	108	110	54	102	110	93	28	28	28	28	28	28	28	28	28	28

(CONTINUED)

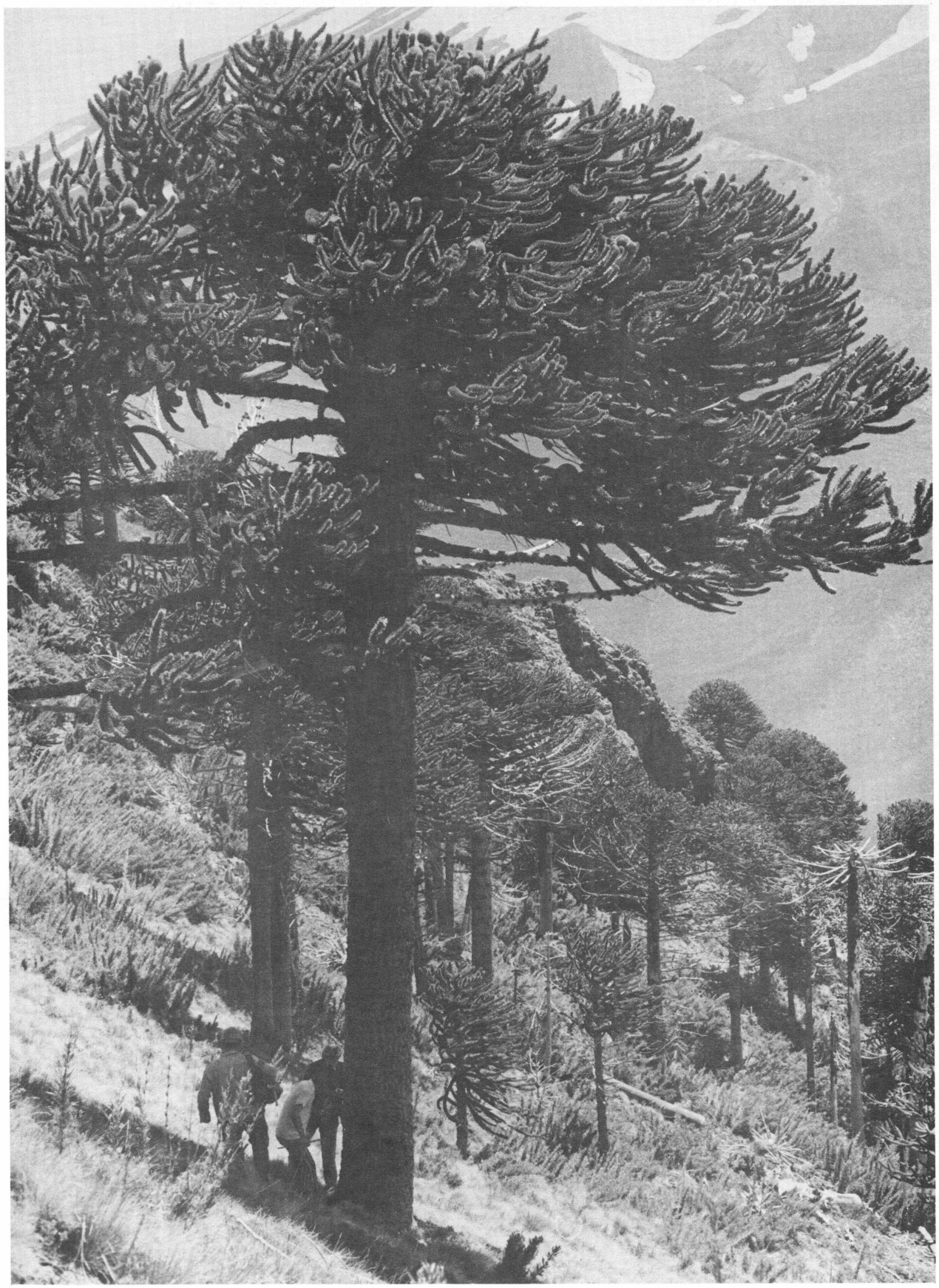


Plate 4. *Araucaria araucana* at Volcán Lonquimay site, Malleco Province.

(CONTINUED)

FLA479
EL ASIENTO
AUSTROCEDRUS CHILENSIS

	TREE RING INDICES										NUMBER OF SAMPLES									
DATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1700	78	120	94	92	100	87	84	106	101	107	28	28	28	28	28	28	28	28	28	28
1710	91	106	110	99	101	98	100	92	105	96	29	29	29	29	29	29	29	29	29	29
1720	110	99	94	112	116	88	99	82	109	51	30	30	30	30	30	31	31	31	31	31
1730	77	85	84	92	90	101	72	98	118	99	31	31	31	32	32	32	32	32	32	32
1740	100	107	105	115	132	126	124	132	122	110	32	32	32	32	32	32	33	33	33	33
1750	119	92	91	93	95	97	88	47	80	63	33	33	33	33	33	33	33	33	33	33
1760	85	98	101	113	130	129	113	110	96	110	33	34	34	34	34	34	34	34	34	34
1770	115	82	79	85	83	102	124	113	110	101	35	35	35	35	35	35	35	35	35	36
1780	106	66	74	99	83	98	104	89	95	93	36	36	36	36	36	36	36	36	36	36
1790	93	78	111	93	93	119	108	89	98	85	36	36	36	36	36	36	36	36	36	36
1800	89	99	91	86	98	86	90	78	78	94	36	36	36	36	36	36	36	36	36	36
1810	115	109	89	84	86	88	91	78	82	85	36	37	37	37	37	37	37	37	37	37
1820	80	102	72	61	79	108	116	127	106	121	38	38	38	38	38	38	38	38	38	38
1830	116	84	99	104	108	120	136	138	121	101	38	38	38	38	38	38	39	39	39	39
1840	82	102	109	125	93	126	117	106	118	114	39	39	39	39	39	39	39	39	39	39
1850	122	111	95	84	90	114	122	120	117	100	39	39	39	39	39	39	39	39	39	39
1860	104	108	122	31	82	81	72	91	92	79	39	39	39	39	39	39	39	39	39	39
1870	117	116	95	101	115	91	90	105	103	63	39	39	39	39	39	39	39	39	39	39
1880	96	125	98	125	143	132	34	116	128	99	39	38	38	38	38	38	38	38	38	38
1890	109	120	49	72	83	83	81	85	122	134	38	38	38	38	38	38	38	38	38	38
1900	141	124	138	109	132	151	110	103	72	89	38	37	37	37	37	37	37	37	37	37
1910	74	71	95	89	116	98	69	80	90	97	37	37	37	37	37	37	37	37	37	37
1920	103	109	116	128	28	92	102	99	106	118	37	37	37	37	37	37	37	37	37	37
1930	141	142	142	130	103	84	69	103	85	95	36	35	35	35	35	34	34	34	34	34
1940	114	123	150	98	115	80	60	77	91	76	34	34	34	34	34	34	34	34	34	34
1950	120	104	84	104	85	104	108	110	104	107	34	33	33	33	33	33	33	32	32	32
1960	89	117	114	117	98	106	107	84	32	59	32	31	31	31	31	31	31	31	31	30
1970	84	90	103								30	30	25							

SITE AND COLLECTION INFORMATION

Site name *CARAMÁVIDA*
Country *CHILE* **State or Province** *ARAUCO*
Latitude *37°41'S* **Longitude** *73°10'W* **Altitude** *900 m*
Species collected *Araucaria araucana*
Date of collection *22 December 1976*
Collectors *R.L.Holmes, P.W.Dunwiddie, J.Gutiérrez, L.Machuca*
No. of trees sampled *12* **No. of cores** *44* **No. of discs** *0*

Site description:

This site is in the Cordillera de Nahuelbuta, a range of mountains running north-south near the Pacific coast with peaks up to 1472 m. Access is by a road ascending the west slopes of the range from a point halfway between the towns of Cañete and Los Álamos. The road follows the Río Caramávida through plantations of Pinus insignis and Valdivian forest, climbing to stands of Araucaria araucana which in this range tend to have slim trunks and full crowns.

The first site is a burned area, logged 18 years previous, much disturbed. Some Nothofagus dombeyi and Chusquea quila grow in the stand. All Araucaria have charred bark. (Six trees sampled) The second subsite is a gentle west-facing slope near the crest of a ridge. Mixed-age Araucaria with abundant Spanish moss, some logging; also Nothofagus dombeyi, small Drimys winteri and Embothrium coccineum. (Three trees sampled) The third subsite is a ridge crest at the edge of an immature forest of Nothofagus dombeyi 15 m tall with abundant Spanish moss. There are scattered Araucaria next to a logged area. (Three trees sampled)

SAMPLE STATISTICS

Interval analyzed (A.D.)	*1785 - 1902*
No. of trees *5* No. of radii per tree *2*	
Mean ring width (mm)	*0.83*
% locally absent rings	*0.00*
Analysis of variance:	
Estimated mean square of Y	*0.005*
Sources of variation, % variance	
Mean chronology	*7*
Differences between trees	*38*
Other	*55*
Cross-correlation analysis:	
Radii within trees	*0.31*
Radii among trees	*0.14*
Between tree means	*0.16*

CHRONOLOGY STATISTICS

Identification	*CAR799*
Interval (A.D.)	*1440 - 1975*
No. of trees *7* Total no. of radii *26*	
Autocorrelation	*0.79*
Standard deviation	*0.19*
Mean sensitivity	*0.09*
Mean standard error	*0.08*

CAR799
CARAMAVIDA
ARAUCARIA ARAUCANA

TREE RING INDICES

DATE	0	1	2	3	4	5	6	7	8	9
1440	63	61	52	41	52	54	101	88	132	120
1450	100	84	109	124	121	139	173	109	111	134
1460	171	179	190	151	162	169	167	159	142	170
1470	168	134	126	101	94	104	97	88	90	100
1480	97	91	91	92	102	85	100	96	89	102
1490	108	98	96	94	103	96	85	77	85	85
1500	95	97	86	103	100	101	132	122	112	111
1510	99	90	97	113	98	95	95	97	100	75
1520	91	120	121	125	123	105	128	133	134	116
1530	112	108	107	95	101	94	93	82	87	79
1540	85	98	90	70	75	94	94	100	117	115
1550	111	100	94	108	91	85	90	97	113	113
1560	131	124	105	109	106	101	88	95	98	93
1570	98	89	94	88	75	75	81	95	98	95
1580	100	96	105	104	102	89	101	103	91	89
1590	82	95	107	88	97	90	105	85	85	80
1600	77	91	84	105	84	75	87	80	97	113
1610	112	109	108	100	112	106	98	101	81	85
1620	86	90	89	86	75	82	89	75	91	86
1630	93	128	109	109	131	104	103	107	122	118
1640	126	122	86	101	94	130	162	157	131	127
1650	128	91	97	86	97	91	99	92	78	82
1660	93	84	86	99	104	103	99	92	97	123
1670	119	124	135	133	133	120	116	122	116	114
1680	102	104	117	102	98	110	96	105	109	104
1690	102	100	106	117	134	114	116	103	96	70
1700	87	83	83	75	69	72	71	73	72	69
1710	69	84	100	98	93	93	86	108	92	96
1720	83	106	98	100	97	113	106	104	85	98
1730	88	95	114	131	109	110	103	86	93	79
1740	70	68	65	78	78	75	88	89	100	99
1750	82	73	88	95	99	116	128	125	134	135
1760	126	119	124	124	110	99	99	100	112	116
1770	117	125	112	117	116	121	110	99	103	111
1780	114	101	94	90	108	103	110	93	96	98
1790	95	101	98	109	107	117	97	112	99	98
1800	107	102	95	89	101	99	109	110	113	121
1810	104	111	98	96	117	136	116	93	82	88
1820	101	100	107	101	113	115	110	103	103	102
1830	97	100	102	92	109	114	102	98	85	87
1840	107	109	120	94	92	106	114	109	107	109
1850	93	87	104	101	98	97	88	93	86	82
1860	96	81	95	100	112	96	93	90	101	101
1870	106	111	110	107	109	96	99	99	79	76
1880	98	115	116	110	115	96	98	93	79	94
1890	95	101	103	95	98	92	71	63	102	96
1900	95	101	114	133	110	106	98	112	88	89
1910	115	109	101	96	106	105	111	95	91	72
1920	59	75	87	80	75	76	85	91	91	100
1930	82	102	103	109	109	112	97	90	93	86
1940	81	76	99	94	98	110	126	139	124	111
1950	97	95	82	87	96	70	87	94	80	91
1960	86	95	88	119	138	137	129	136	139	135
1970	119	131	117	115	129	111				

NUMBER OF SAMPLES

DATE	0	1	2	3	4	5	6	7	8	9
1440	1	1	1	1	1	1	1	1	1	1
1450	1	1	1	1	1	1	1	1	1	1
1460	1	1	1	1	1	1	1	1	1	1
1470	1	1	1	1	2	2	2	2	2	3
1480	3	3	3	3	3	3	3	3	4	4
1490	4	4	4	4	4	4	4	4	4	4
1500	4	4	4	4	4	4	4	4	4	4
1510	4	4	4	4	4	4	4	4	4	4
1520	4	4	4	4	4	4	4	4	4	4
1530	4	4	4	4	4	4	4	4	4	4
1540	4	4	4	4	4	4	4	4	5	5
1550	5	5	5	5	5	5	5	5	5	5
1560	5	5	5	5	5	5	5	5	5	5
1570	6	6	6	6	6	6	6	6	6	6
1580	6	6	6	6	6	6	6	6	6	6
1590	6	6	6	6	6	6	6	6	6	6
1600	6	6	6	6	6	6	6	6	6	6
1610	6	6	6	6	6	6	6	6	6	6
1620	6	6	6	6	6	6	6	6	6	6
1630	6	6	6	6	6	6	6	6	6	6
1640	6	6	6	6	6	6	6	6	6	6
1650	6	6	6	6	5	5	5	5	5	5
1660	5	6	6	6	6	6	6	6	6	6
1670	6	7	7	7	7	7	7	7	6	6
1680	6	6	6	6	6	6	6	6	6	6
1690	6	6	6	6	6	6	6	6	6	6
1700	7	7	7	7	7	7	7	8	8	8
1710	8	7	7	7	7	7	7	7	7	7
1720	7	8	8	8	8	8	8	8	8	8
1730	8	6	6	6	6	6	6	6	6	6
1740	6	6	6	6	6	6	6	6	6	6
1750	6	6	6	6	6	6	6	6	6	6
1760	6	6	6	6	6	6	6	6	6	6
1770	9	9	9	10	10	10	10	10	10	10
1780	10	12	12	12	12	14	14	16	16	16
1790	16	16	16	17	17	17	17	17	17	17
1800	18	18	18	18	18	18	18	19	19	19
1810	20	20	20	20	20	20	20	20	20	20
1820	20	20	20	20	20	20	20	20	20	20
1830	20	20	20	20	20	20	20	20	20	20
1840	20	20	20	20	20	20	20	20	20	20
1850	20	20	20	20	20	20	20	20	20	20
1860	20	20	20	20	20	20	20	20	20	20
1870	20	20	20	20	20	20	20	20	20	20
1880	20	19	19	19	19	19	19	19	19	19
1890	19	19	19	19	19	18	17	17	17	17
1900	17	17	17	16	16	16	16	15	15	15
1910	15	15	15	15	15	15	15	15	15	15
1920	13	13	13	12	11	11	11	11	11	11
1930	11	11	11	11	11	11	11	11	11	11
1940	10	10	10	10	10	10	10	10	10	10
1950	10	10	10	10	10	9	9	9	9	9
1960	9	9	9	8	8	8	8	8	8	8
1970	8	8	8	8	8	8				

SITE AND COLLECTION INFORMATION

Site name *ABANICO*
Country *CHILE* State or Province *BÍO-BÍO*
Latitude *37° 21'S* Longitude *71° 36'W* Altitude *820 m*
Species collected *Austrocedrus chilensis*
Date of collection *9 January 1977*
Collectors *R.L.Holmes, P.W.Dunwiddie, J.Gutiérrez*
No. of trees sampled *13* No. of cores *39* No. of discs *0*

Site description:

The site is near the road from Los Ángeles to the large lake, Laguna de la Laja, about one kilometer east of the town of Abanico and across the stream. The sampled Austrocedrus are scattered on a steep (41°) northeast-facing basalt talus slope and outcrops and on a slightly more mesic east-facing slope with less talus. Associated vegetation includes Lomatia hirsuta, Berberis sp., Cryptocarya alba and Azara.

SAMPLE STATISTICS

Interval analyzed (A.D.)	*1875 - 1972*
No. of trees *9* No. of radii per tree *2*	
Mean ring width (mm)	*0.88*
% locally absent rings	*0.00*
Analysis of variance:	
Estimated mean square of Y	*0.028*
Sources of variation, % variance	
Mean chronology	*19*
Differences between trees	*25*
Other	*56*
Cross-correlation analysis:	
Radii within trees	*0.52*
Radii among trees	*0.21*
Between tree means	*0.23*

CHRONOLOGY STATISTICS

Identification	*ABA479*
Interval (A.D.)	*1733 - 1975*
No. of trees *11* Total no. of radii *31*	
Autocorrelation	*0.40*
Standard deviation	*0.19*
Mean sensitivity	*0.16*
Mean standard error	*0.05*

ABA479
ABANICO
AUSTROCEDRUS CHILENSIS

	TREE RING INDICES										NUMBER OF SAMPLES									
DATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1733				130	197	100	106	83	91	102				1	1	1	1	1	1	1
1740	111	103	111	82	98	76	91	76	81	131	1	1	1	1	1	1	1	1	1	1
1750	122	67	53	72	87	88	106	66	60	69	1	1	1	1	1	1	1	1	1	1
1760	90	106	113	123	79	68	105	92	105	87	1	1	1	1	1	1	1	1	1	1
1770	78	97	115	135	102	88	101	131	117	72	1	1	1	1	1	1	1	1	1	1
1780	103	83	76	71	69	85	104	73	105	116	1	1	1	1	1	1	1	1	1	1
1790	133	101	104	106	105	87	90	79	109	72	1	1	1	3	3	3	4	4	4	4
1800	91	102	83	101	115	105	117	98	110	129	4	4	4	4	6	6	6	8	8	8
1810	101	101	95	88	90	104	103	103	111	96	8	9	10	11	11	11	11	11	11	11
1820	88	107	101	104	115	93	87	90	88	109	11	11	12	12	12	12	12	12	12	12
1830	123	94	86	78	119	104	73	95	107	105	12	12	13	13	13	13	13	13	18	18
1840	86	75	78	97	116	105	109	93	115	128	19	19	20	20	20	20	20	20	21	21
1850	127	119	123	97	95	85	87	102	97	73	21	21	21	21	21	21	22	22	22	22
1860	69	78	88	98	99	89	88	103	127	126	23	23	24	24	25	25	25	25	25	25
1870	117	94	117	99	101	104	102	91	120	130	25	26	26	26	26	28	28	29	29	29
1880	127	115	118	102	106	126	124	93	98	100	29	29	29	29	29	29	29	29	29	30
1890	95	99	117	112	103	119	84	112	121	113	30	30	30	30	30	30	30	31	31	31
1900	114	103	94	94	90	89	96	105	89	86	31	31	31	31	31	31	31	31	31	31
1910	84	52	75	56	43	89	102	88	86	99	31	31	31	31	31	31	31	31	31	31
1920	111	119	83	85	78	89	128	86	138	119	31	31	31	31	31	31	30	30	30	30
1930	126	124	88	116	108	86	96	99	105	104	30	30	30	30	30	30	30	30	30	30
1940	114	118	82	72	74	103	123	99	113	83	30	30	30	30	30	30	30	30	29	29
1950	99	97	111	94	111	99	134	77	102	87	29	29	29	29	29	29	29	28	28	28
1960	73	76	49	80	125	137	120	107	107	106	28	28	28	28	28	28	28	28	28	28
1970	71	123	84	78	104	117					28	28	27	25	22	21				

SITE AND COLLECTION INFORMATION

Site name *EL CHACAY*
Country *CHILE* **State or Province** *BÍO-BÍO*
Latitude *37° 21'S* **Longitude** *71° 30'W* **Altitude** *850 m - 1000 m*
Species collected *Austrocedrus chilensis*
Date of collection *8 January 1977*
Collectors *R.L.Holmes, P.W.Dunwiddie, J.Gutiérrez*
No. of trees sampled *13* **No. of cores** *27* **No. of discs** *0*

Site description:

The site is along the road from Los Angeles to the large lake, Laguna de la Laja, some 15 kilometers west of the lake and from two to five kilometers west of the Carabineros post at El Chacay, on the foothill slopes of Volcán Antuco. The eastern subsite is a 30° northwest slope with rounded basalt cobbles on a river terrace. It is a semixeric site with medium stand density and various shrubs to three meters tall, including Lomatia hirsuta. There is some disturbance from road building. The western subsite is more mesic, with sparse to moderate grass on a north slope above a small stream.

SAMPLE STATISTICS

Interval analyzed (A.D.)	*1867 - 1973*
No. of trees *5* No. of radii per tree *2*	
Mean ring width (mm)	*0.68*
% locally absent rings	*0.19*
Analysis of variance:	
Estimated mean square of Y	*0.095*
Sources of variation, % variance	
Mean chronology	*33*
Differences between trees	*37*
Other	*30*
Cross-correlation analysis:	
Radii within trees	*0.69*
Radii among trees	*0.36*
Between tree means	*0.40*

CHRONOLOGY STATISTICS

Identification	*CHY479*
Interval (A.D.)	*1641 - 1975*
No. of trees *5* Total no. of radii *16*	
Autocorrelation	*0.73*
Standard deviation	*0.30*
Mean sensitivity	*0.20*
Mean standard error	*0.08*

CHY479
EL CHACAY
AUSTROCEDRUS CHILENSIS

	TREE RING INDICES										NUMBER OF SAMPLES									
DATE	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1641		93	79	108	65	42	46	83	128	101		1	1	1	1	1	1	1	1	1
1650	104	143	125	132	106	68	66	103	139	120	1	1	2	2	2	2	2	2	2	2
1660	106	80	101	124	82	95	129	112	107	77	4	4	5	6	7	7	7	8	8	8
1670	105	103	87	91	131	119	147	116	111	87	9	9	9	9	9	9	9	9	9	9
1680	58	69	62	98	107	92	78	91	99	148	9	9	9	9	9	9	9	9	9	9
1690	141	122	110	57	82	75	87	85	95	78	9	9	9	9	9	9	9	9	9	9
1700	73	81	93	113	132	134	126	188	171	116	9	9	9	9	9	9	9	9	9	9
1710	81	89	72	84	82	82	96	95	70	76	9	9	9	9	9	9	9	9	9	9
1720	108	97	61	81	125	114	124	113	129	133	9	9	9	9	9	9	9	9	9	9
1730	115	140	140	100	112	88	114	100	84	112	9	9	9	9	9	9	9	9	9	9
1740	126	115	129	131	96	58	54	58	18	48	9	9	9	9	9	9	9	9	9	9
1750	49	41	37	63	83	83	100	77	45	38	9	9	9	9	9	9	9	9	9	9
1760	56	89	88	90	73	50	79	73	102	95	9	9	9	9	9	9	9	9	9	9
1770	143	140	147	180	165	127	136	154	132	93	9	9	9	9	9	9	9	9	9	9
1780	58	85	95	119	111	93	98	80	71	75	9	9	9	9	9	9	9	9	9	9
1790	88	75	63	85	73	80	68	78	77	69	9	9	9	9	9	9	9	9	9	9
1800	102	108	123	113	109	104	83	77	81	117	9	9	9	9	9	9	9	9	9	10
1810	124	107	99	100	103	119	105	110	106	78	10	10	10	11	11	12	12	12	12	12
1820	103	111	126	130	117	150	107	108	86	105	12	12	12	12	12	12	12	13	13	13
1830	117	90	97	105	115	84	67	83	96	72	14	14	14	14	14	14	14	14	14	14
1840	72	63	77	79	89	79	77	80	103	117	14	14	14	14	14	14	14	14	14	14
1850	115	128	148	111	93	106	126	154	127	90	14	14	14	14	14	14	14	14	14	14
1860	75	92	110	131	92	133	122	145	174	180	14	14	14	14	14	15	15	16	16	16
1870	197	150	170	147	128	143	130	149	170	183	16	16	16	16	16	16	16	16	15	15
1880	162	131	129	136	131	150	163	137	90	107	15	15	15	15	15	15	15	15	15	15
1890	114	102	110	95	106	110	88	66	108	96	15	15	15	15	15	15	15	15	15	15
1900	78	94	75	81	82	99	80	106	112	97	15	15	15	15	15	15	15	15	15	15
1910	94	59	85	57	25	81	78	99	97	107	15	15	15	15	15	15	15	15	15	15
1920	114	82	77	66	74	54	101	46	82	93	15	15	15	15	15	15	15	15	15	15
1930	78	84	47	73	87	90	100	76	68	74	15	15	15	15	15	15	15	15	15	15
1940	96	100	49	32	43	72	104	84	84	83	15	15	15	15	15	15	15	15	15	15
1950	87	105	97	60	65	62	88	58	59	74	15	15	15	15	15	15	15	15	15	15
1960	83	106	66	118	164	142	140	129	173	139	15	15	15	15	15	15	15	15	15	15
1970	91	121	87	91	79	95					15	15	15	15	13	13				

SITE AND COLLECTION INFORMATION

Site name *ALTO DE LAS MESAS*
Country *CHILE* **State or Province** *COLCHAGUA*
Latitude *34°55'S* **Longitude** *70°42'W* **Altitude** *1020 m*
Species collected *Austrocedrus chilensis*
Date of collection *13 December 1976*
Collectors *R.L.Holmes, J.M.Gallinato*
No. of trees sampled *8* **No. of cores** *23* **No. of discs** *0*

Site description:

From the city of San Fernando a road runs southeast up the valley of the Río Tinguiririca. Twenty-seven kilometers along this road, a narrow road leads off to the south roughly 15 kilometers to the Hacienda Santa Isabel de las Cruces. The site is about 16 kilometers by horse trail (seven kilometers in a straight line) southeast of the Gallinato home, headquarters of the Hacienda.

The sampled trees are widely scattered over about two kilometers, on 15° to 30° west-, north- and east-facing slopes. The trees grow among espino (Acacia cavenia) and shrubs to three meters tall. Roots are exposed on several of the trees.

SAMPLE STATISTICS

Interval analyzed (A.D.)	*1859 - 1940*
No. of trees *3* No. of radii per tree *3*	
Mean ring width (mm)	*1.75*
% locally absent rings	*0.00*
Analysis of variance:	
Estimated mean square of Y	*0.021*
Sources of variation, % variance	
Mean chronology	*24*
Differences between trees	*45*
Other	*31*
Cross-correlation analysis:	
Radii within trees	*0.73*
Radii among trees	*0.37*
Between tree means	*0.46*

CHRONOLOGY STATISTICS

Identification	*MES477*
Interval (A.D.)	*1796 - 1975*
No. of trees *5* Total no. of radii *17*	
Autocorrelation	*0.59*
Standard deviation	*0.24*
Mean sensitivity	*0.17*
Mean standard error	*0.09*

MES477
ALTO DE LAS MESAS
AUSTROCEDRUS CHILENSIS

TREE RING INDICES

DATE	0	1	2	3	4	5	6	7	8	9
1796							141	143	88	81
1800	97	126	115	76	97	101	133	117	78	84
1810	76	105	126	125	110	57	118	100	47	37
1820	41	50	49	54	91	79	57	69	93	91
1830	73	70	66	66	74	61	73	98	101	83
1840	75	77	95	118	99	87	95	98	118	118
1850	128	132	118	108	101	134	113	154	129	100
1860	107	113	123	113	100	94	92	95	128	115
1870	101	84	78	83	103	121	99	84	99	86
1880	88	104	86	101	139	127	103	116	101	92
1890	68	87	79	67	79	92	82	85	104	93
1900	81	85	85	95	126	136	101	93	82	82
1910	95	85	98	84	100	116	107	97	116	125
1920	159	131	114	111	75	76	80	105	108	91
1930	104	104	108	71	63	67	77	74	94	102
1940	121	116	138	117	117	105	92	92	97	95
1950	115	108	85	95	115	138	122	91	94	109
1960	93	102	79	127	118	133	190	132	48	96
1970	88	124	110	133	114	119				

NUMBER OF SAMPLES

DATE	0	1	2	3	4	5	6	7	8	9
1796							1	1	1	1
1800	1	1	1	1	1	1	1	1	1	1
1810	1	1	1	1	1	1	1	1	1	1
1820	1	1	1	1	1	2	2	2	2	2
1830	2	2	2	2	4	4	4	4	4	4
1840	7	7	7	7	7	7	8	8	8	9
1850	10	10	10	10	10	11	11	11	14	15
1860	15	15	15	15	15	15	15	15	15	15
1870	15	15	15	15	15	15	15	15	15	15
1880	15	15	15	15	15	15	15	15	15	15
1890	15	15	15	15	15	15	15	15	14	14
1900	14	14	14	14	14	14	14	14	14	14
1910	13	13	13	13	13	13	13	13	13	13
1920	13	13	13	13	13	13	12	12	12	12
1930	13	13	13	13	13	14	14	14	14	14
1940	14	11	11	11	10	10	10	10	10	10
1950	10	10	10	10	10	10	10	10	10	10
1960	10	10	10	10	10	10	10	10	10	10
1970	10	10	10	10	10	10				

SITE AND COLLECTION INFORMATION

Site name *SANTA ISABEL DE LAS CRUCES*
Country *CHILE* **State or Province** *COLCHAGUA*
Latitude *34°52'S* **Longitude** *70°45'W* **Altitude** *850 m*
Species collected *Austrocedrus chilensis*
Date of collection *12,13 December 1976*
Collectors *R.L.Holmes, P.W.Dunwiddie, J.Gutiérrez, J.M.Gallinato, M.Fuentes*
No. of trees sampled *30* **No. of cores** *105* **No. of discs** *0*

Site description:

From the city of San Fernando a road runs southeast up the valley of the Río Tinguiririca. Twenty-seven kilometers along this road, a narrow road leads off to the south roughly 15 kilometers to the Hacienda Santa Isabel de las Cruces.

The first subsite (sixteen trees sampled) is on a very dry, highly siliceous white volcanic rock outcrop of consolidated ash or pumice, 500 meters east of the Hacienda headquarters, north of the road. Vegetation is primarily scattered individuals of Austrocedrus chilensis and some Nothofagus obliqua with little ground cover.

The second subsite (six trees sampled) is on a ridge 200 meters west of the first, at the same altitude and with similar site characteristics.

The third subsite (eight trees sampled) is on a very dry ash bench across a stream with the same characteristics as the previous subsites, but has also some Cactaceae.

SAMPLE STATISTICS

Interval analyzed (A.D.)	*1855 - 1975*
No. of trees *8* No. of radii per tree *2*	
Mean ring width (mm)	*0.47*
% locally absent rings	*1.24*
Analysis of variance:	
Estimated mean square of Y	*0.051*
Sources of variation, % variance	
Mean chronology	*26*
Differences between trees	*7*
Other	*67*
Cross-correlation analysis:	
Radii within trees	*0.47*
Radii among trees	*0.27*
Between tree means	*0.28*

CHRONOLOGY STATISTICS

Identification	*ISA477*
Interval (A.D.)	*1568 - 1975*
No. of trees *20* Total no. of radii *78*	
Autocorrelation	*0.60*
Standard deviation	*0.22*
Mean sensitivity	*0.14*
Mean standard error	*0.06*

ISA477
SANTA ISABEL DE LAS CRUCES
AUSTROCEDRUS CHILENSIS

TREE RING INDICES

DATE	0	1	2	3	4	5	6	7	8	9
1568									120	105
1570	119	109	102	70	56	93	51	64	71	85
1580	100	69	109	83	84	88	82	169	140	77
1590	131	130	111	109	156	110	105	98	114	76
1600	55	56	165	107	90	79	149	98	157	132
1610	191	134	113	95	100	95	97	129	101	117
1620	114	124	79	59	67	71	80	78	74	57
1630	62	39	70	81	82	103	98	90	72	81
1640	80	85	111	96	90	82	91	113	141	123
1650	120	126	135	124	120	112	121	107	102	122
1660	115	102	94	112	109	110	109	121	107	95
1670	99	89	98	101	103	115	124	88	68	71
1680	79	86	71	76	76	77	81	95	102	104
1690	114	134	117	101	134	121	95	93	91	80
1700	70	83	83	90	90	87	90	121	108	104
1710	112	106	122	133	136	122	117	110	113	107
1720	122	105	108	104	96	83	84	76	100	88
1730	77	89	90	89	101	115	118	102	111	118
1740	101	88	118	92	71	69	80	91	87	102
1750	125	95	78	82	112	107	93	81	77	79
1760	114	116	100	94	89	90	100	103	94	111
1770	120	128	113	116	99	92	89	91	90	78
1780	108	89	89	100	106	104	127	124	112	111
1790	125	108	126	119	112	150	129	117	103	103
1800	106	102	92	98	106	108	84	79	86	92
1810	111	110	120	93	80	130	99	95	94	89
1820	84	90	96	120	105	86	72	85	72	65
1830	83	65	67	75	74	73	88	111	99	76
1840	76	83	91	107	111	97	105	108	121	120
1850	126	135	116	104	112	140	127	137	133	98
1860	79	111	118	114	103	104	94	87	121	121
1870	102	102	94	95	122	124	116	104	131	101
1880	106	135	103	108	127	127	103	92	99	81
1890	52	79	87	64	71	99	87	83	111	99
1900	70	56	73	71	85	84	60	55	81	74
1910	76	76	88	77	88	108	84	95	110	104
1920	126	99	91	106	78	59	90	104	96	96
1930	89	107	92	73	93	63	86	92	102	97
1940	107	122	114	124	133	131	116	99	102	108
1950	136	121	106	116	134	136	148	111	85	123
1960	102	106	113	154	144	152	160	139	104	99
1970	91	114	98	146	132	134				

NUMBER OF SAMPLES

DATE	0	1	2	3	4	5	6	7	8	9
1568									1	1
1570	1	1	1	1	1	1	1	1	1	1
1580	1	1	1	1	1	1	1	1	1	1
1590	1	1	1	1	1	1	1	1	1	1
1600	1	1	1	1	1	1	1	1	1	1
1610	1	1	1	2	2	2	2	2	2	2
1620	2	2	2	2	3	3	3	3	4	4
1630	4	4	4	5	5	5	5	5	5	5
1640	5	5	5	5	6	7	8	8	8	8
1650	8	9	10	10	10	11	11	11	11	11
1660	12	12	13	13	13	14	14	14	14	14
1670	14	14	15	15	16	16	16	16	16	16
1680	16	16	16	16	16	16	16	16	16	16
1690	17	17	17	17	18	18	19	19	19	20
1700	21	21	21	21	21	22	24	24	25	26
1710	26	25	28	31	33	34	37	37	37	37
1720	37	37	37	38	40	40	40	41	42	42
1730	45	45	45	45	46	46	46	50	52	52
1740	52	52	52	53	53	53	53	54	54	54
1750	54	54	55	55	57	57	57	57	57	58
1760	59	59	59	60	60	60	60	60	60	60
1770	60	60	60	60	60	60	60	60	60	60
1780	60	61	61	62	62	62	63	63	63	63
1790	63	63	64	65	67	67	67	68	68	68
1800	68	68	68	67	68	68	68	68	68	68
1810	68	68	68	69	70	70	70	70	70	70
1820	70	69	69	69	69	69	69	69	69	69
1830	67	65	65	65	65	65	65	65	66	65
1840	65	65	66	66	65	65	65	65	65	65
1850	65	65	65	65	65	66	67	67	67	66
1860	65	64	64	64	64	65	64	63	63	63
1870	62	60	60	59	59	59	59	59	59	59
1880	58	58	58	58	58	59	58	57	57	57
1890	56	54	54	54	54	53	53	53	53	53
1900	53	53	53	53	53	53	52	52	52	51
1910	51	51	51	51	51	51	51	51	51	51
1920	51	51	51	51	50	50	48	48	47	46
1930	44	44	44	44	44	44	44	44	44	44
1940	44	44	43	39	39	39	39	39	38	38
1950	36	36	36	36	36	36	36	36	35	35
1960	34	34	34	34	34	33	32	32	31	31
1970	30	30	30	30	30	30				

SITE AND COLLECTION INFORMATION

Site name *NALCAS*
Country *CHILE* **State or Province** *MALLECO*
Latitude *38°20'S* **Longitude** *71°29'W* **Altitude** *1420 m*
Species collected *Araucaria araucana*
Date of collection *6 January 1977*
Collectors *R.L.Holmes, P.W.Dunwiddie, J.Gutiérrez*
No. of trees sampled *17* **No. of cores** *71* **No. of discs** *0*

Site description:

From eight kilometers northeast of the village of Malalcahuello on the road between the towns of Curacautín and Villa Portales a road marked "Lolco" runs northwest, climbing through Araucaria forest to the cinder and lava fields of Volcán Lonquimay, descending and continuing north to the site, a total of 17.5 kilometers along the Lolco road. The site is on the east side of the road on a steep (33°) slope of loose volcanic ash. Some "coirón" (Stipa sp.) grows near many of the trees; there is much bare ash. The stand of Araucaria is mostly very open; all trees are on a similar slope.

SAMPLE STATISTICS

Interval analyzed (A.D.)	*1808 - 1919*
No. of trees *8* No. of radii per tree *3*	
Mean ring width (mm)	*0.87*
% locally absent rings	*0.00*
Analysis of variance:	
Estimated mean square of Y	*0.005*
Sources of variation, % variance	
Mean chronology	*5*
Differences between trees	*49*
Other	*46*
Cross-correlation analysis:	
Radii within trees	*0.55*
Radii among trees	*0.11*
Between tree means	*0.15*

CHRONOLOGY STATISTICS

Identification	*NAL799*
Interval (A.D.)	*1386 - 1975*
No. of trees *8* Total no. of radii *29*	
Autocorrelation	*0.72*
Standard deviation	*0.23*
Mean sensitivity	*0.13*
Mean standard error	*0.09*

NAL799
NALCAS
ARAUCARIA ARAUCANA

TREE RING INDICES

DATE	0	1	2	3	4	5	6	7	8	9
1386							74	87	97	68
1390	112	93	92	126	118	187	130	98	104	103
1400	130	99	119	108	58	87	87	67	111	83
1410	87	86	97	133	124	98	91	75	71	70
1420	57	57	74	102	61	83	75	91	73	68
1430	61	60	73	85	73	102	107	109	98	94
1440	101	94	115	119	116	119	104	88	127	97
1450	87	91	67	74	62	76	102	84	102	105
1460	110	83	110	105	116	129	104	69	69	81
1470	79	72	101	101	92	99	110	103	89	94
1480	95	113	109	108	137	143	110	106	112	125
1490	127	101	138	105	78	106	133	122	113	125
1500	112	112	114	114	148	191	155	144	128	157
1510	128	101	122	97	88	109	121	132	117	108
1520	102	140	178	192	188	167	151	115	102	112
1530	101	93	93	82	98	114	101	91	95	88
1540	78	105	104	97	89	103	93	92	95	94
1550	140	132	94	138	122	105	93	76	103	113
1560	123	150	123	154	120	95	80	85	92	129
1570	100	119	115	104	100	109	70	111	106	107
1580	118	163	134	106	117	125	133	154	135	112
1590	94	87	112	82	122	131	112	98	71	67
1600	70	81	55	80	73	74	69	140	120	89
1610	106	86	71	92	94	78	92	81	70	71
1620	80	73	80	103	86	81	74	58	64	74
1630	72	81	63	56	48	50	70	75	76	78
1640	112	158	127	99	65	55	65	83	98	87
1650	83	60	77	109	92	79	68	65	71	63
1660	63	51	31	53	69	60	57	61	70	74
1670	73	71	82	61	60	56	78	83	84	77
1680	65	60	43	57	67	81	70	61	70	95
1690	95	84	96	91	91	94	75	77	82	83
1700	90	99	109	92	87	88	73	65	90	88
1710	85	84	78	80	66	79	61	85	73	57
1720	81	94	76	84	84	85	78	82	84	91
1730	89	93	92	95	79	91	106	89	112	113
1740	118	122	117	96	93	100	105	114	155	163
1750	142	116	111	118	107	112	109	104	101	92
1760	96	103	84	88	87	83	84	79	79	98
1770	103	97	97	90	97	93	87	86	81	73
1780	74	92	94	84	100	91	89	80	94	92
1790	110	95	94	104	105	113	118	112	109	101
1800	120	96	87	91	114	114	110	104	108	115
1810	99	92	100	77	97	102	114	117	93	84
1820	102	97	104	105	118	107	95	85	98	109
1830	118	107	108	105	107	117	104	101	111	91
1840	97	89	87	91	99	95	107	105	115	118
1850	111	106	121	115	117	117	100	105	98	94
1860	95	83	93	99	109	98	103	93	112	105
1870	106	102	105	102	97	88	120	114	108	99
1880	130	118	115	104	112	105	108	113	97	98
1890	86	81	96	83	77	81	78	62	104	106
1900	103	98	102	133	128	102	84	95	87	68
1910	100	97	89	79	88	88	104	86	87	57
1920	80	109	111	102	81	111	139	106	93	87
1930	84	102	91	107	106	106	79	86	114	110
1940	127	130	142	120	111	123	170	149	137	116
1950	113	130	101	111	116	102	118	101	98	120
1960	101	109	95	108	125	126	118	100	104	112
1970	106	141	119	109	136	143				

NUMBER OF SAMPLES

DATE	0	1	2	3	4	5	6	7	8	9
1386							1	1	1	1
1390	1	1	1	1	1	1	1	1	1	1
1400	1	1	1	1	1	1	1	1	1	1
1410	1	1	1	1	1	1	1	1	1	1
1420	1	1	1	1	1	1	2	2	2	2
1430	2	2	2	2	2	2	2	2	2	2
1440	2	2	2	2	2	2	3	3	3	3
1450	3	3	3	3	3	3	3	3	3	3
1460	3	3	3	3	3	3	3	3	3	3
1470	3	3	3	3	3	3	3	3	3	3
1480	3	3	3	3	3	3	3	3	3	3
1490	3	3	3	3	3	3	3	3	3	3
1500	3	3	3	3	3	3	3	3	3	3
1510	3	3	3	3	3	3	3	3	3	3
1520	3	3	3	3	4	4	4	4	4	4
1530	4	4	4	4	4	4	4	4	4	4
1540	4	4	4	4	4	4	4	4	4	4
1550	4	4	4	4	4	4	4	4	4	4
1560	4	4	4	4	4	4	4	4	4	4
1570	4	4	4	4	4	4	4	4	4	4
1580	4	4	4	4	4	4	4	4	4	4
1590	4	4	4	4	4	4	4	4	4	4
1600	4	4	4	4	4	4	4	4	4	4
1610	4	4	4	4	4	4	4	4	4	4
1620	4	4	4	4	4	4	4	4	4	4
1630	4	4	4	4	4	4	4	4	4	4
1640	4	4	4	4	4	4	4	4	4	4
1650	4	4	4	4	4	4	4	4	4	4
1660	4	4	4	4	4	4	4	5	5	5
1670	5	5	5	5	5	5	5	5	5	5
1680	5	5	5	5	5	5	5	5	5	5
1690	6	6	6	6	6	6	6	6	6	6
1700	7	7	7	7	7	7	7	7	8	8
1710	8	8	9	9	9	9	9	9	9	9
1720	9	9	9	9	9	9	9	9	10	10
1730	12	13	13	13	13	13	13	13	13	13
1740	17	17	18	18	18	18	18	18	18	18
1750	18	18	18	19	19	19	19	19	19	19
1760	22	22	22	22	22	22	23	23	23	23
1770	23	24	24	24	24	24	24	24	24	24
1780	26	26	27	27	27	27	27	27	27	27
1790	27	27	27	27	27	27	27	27	28	28
1800	28	28	28	28	28	28	28	28	29	29
1810	29	29	29	29	29	29	29	29	29	29
1820	29	29	29	29	29	29	29	29	29	29
1830	29	29	29	29	29	29	29	29	29	29
1840	29	29	29	29	29	29	29	29	29	29
1850	29	29	29	29	29	29	29	29	29	29
1860	29	29	29	29	29	29	29	29	29	29
1870	29	29	29	29	29	29	29	29	29	29
1880	29	29	29	29	29	29	29	29	29	29
1890	29	29	29	29	29	29	29	29	29	29
1900	29	29	29	29	29	29	29	29	29	29
1910	29	29	29	29	29	29	29	29	29	43
1920	42	42	42	42	42	42	42	42	42	42
1930	42	42	42	42	42	42	42	42	42	42
1940	42	42	42	42	42	42	42	42	42	41
1950	41	41	41	41	40	40	40	40	40	40
1960	40	40	40	40	40	40	40	38	38	38
1970	38	38	38	38	38	38				

SITE AND COLLECTION INFORMATION

Site name *PIEDRA DEL ÁGUILA*
Country *CHILE* **State or Province** *MALLECO*
Latitude *37°50'S* **Longitude** *73°02'W* **Altitude** *1250 m - 1318 m*
Species collected *Araucaria araucana*
Date of collection *24,25,26 December 1976*
Collectors *R.L.Holmes, P.W.Durwiddie, J.Gutiérrez, P.Vidal, D.Cross*
No. of trees sampled *19* **No. of cores** *54* **No. of discs** *0*

Site description:

This site is in the Cordillera de Nahuelbuta, a mountain range near the Pacific coast with peaks to 1472 meters. Access is from Angol, going west into Nahuelbuta National Park. The site is near the end of the right fork in the road, where there is a tall rock outcrop called Piedra del Águila. Three subsites were sampled; reproduction is strong at the first two.

One subsite is at the end of the road on undulating ground with large boulders. It is a mesic site with dense ground cover of Nothofagus pumilio and N. dombeyi to two meters, and Chusquea quila and Berberis darwinii to 70 cm. Tall Araucaria are scattered throughout, several with fire scars. Another subsite is a large outcrop with pockets of very thin soil, sloping 16° to the north, with scattered bunch grasses (Stipa sp.). Araucaria are widely spaced, many damaged by fire. This is the most xeric locale in the Nahuelbuta range. At a third subsite Araucaria and equally tall Nothofagus dombeyi average five meters apart in very dense underbrush of Chusquea quila two meters tall, with Berberis and Drimys. This is the most humid locale where we have seen Araucaria araucana.

SAMPLE STATISTICS

Interval analyzed (A.D.)	*1793 - 1922*
No. of trees *6* No. of radii per tree *2*	
Mean ring width (mm)	*0.59*
% locally absent rings	*0.38*
Analysis of variance:	
Estimated mean square of Y	*0.018*
Sources of variation, % variance	
Mean chronology	*18*
Differences between trees	*43*
Other	*39*
Cross-correlation analysis:	
Radii within trees	*0.63*
Radii among trees	*0.17*
Between tree means	*0.21*

CHRONOLOGY STATISTICS

Identification	*AGU799*
Interval (A.D.)	*1242 - 1975*
No. of trees *14* Total no. of radii *42*	
Autocorrelation	*0.65*
Standard deviation	*0.16*
Mean sensitivity	*0.10*
Mean standard error	*0.08*

AGU799
PIEDRA DEL AGUILA
ARAUCARIA ARAUCANA

TREE RING INDICES

DATE	0	1	2	3	4	5	6	7	8	9
1242			134	104	117	107	91	69	65	84
1250	102	96	100	100	112	123	144	155	111	103
1260	85	117	21	21	142	157	158	159	127	127
1270	129	117	123	107	112	128	128	114	94	97
1280	97	84	97	111	105	113	80	69	64	72
1290	85	90	81	89	98	107	94	122	95	99
1300	96	103	111	83	91	79	71	91	107	94
1310	123	102	96	109	94	115	126	111	81	83
1320	114	95	105	101	87	86	89	86	107	116
1330	85	87	105	114	110	99	97	95	95	93
1340	96	96	89	74	69	80	89	96	73	72
1350	70	73	81	89	100	99	97	94	96	95
1360	105	108	96	91	101	89	89	94	83	81
1370	84	76	87	87	94	103	87	99	105	93
1380	95	87	83	77	71	87	77	81	86	92
1390	91	89	81	89	88	107	108	103	102	97
1400	92	87	84	105	86	111	140	120	111	106
1410	108	84	80	101	105	95	91	86	95	89
1420	89	105	110	121	104	100	92	82	96	101
1430	97	112	97	109	96	90	106	84	99	89
1440	99	94	104	94	90	94	92	93	100	95
1450	85	93	84	92	79	103	122	111	116	115
1460	132	115	118	90	106	114	86	84	93	104
1470	110	98	112	112	122	118	124	112	109	102
1480	87	89	85	72	75	85	90	98	96	92
1490	88	79	97	82	82	90	109	95	87	85
1500	77	111	98	96	112	96	87	90	74	105
1510	75	62	70	74	80	99	99	116	112	101
1520	97	124	137	118	150	133	123	114	101	97
1530	117	119	115	89	103	96	98	93	85	80
1540	84	101	104	114	95	105	105	113	112	101
1550	114	112	91	90	84	80	100	102	122	110
1560	117	112	104	113	104	106	90	93	93	93
1570	87	100	94	104	100	95	94	109	97	96
1580	110	124	128	113	116	121	111	125	114	91
1590	81	101	108	81	101	117	137	97	103	112
1600	107	111	96	121	107	95	92	79	80	98
1610	111	103	105	109	116	121	113	122	109	107
1620	95	95	92	95	83	89	88	78	90	85
1630	83	111	102	111	113	107	114	102	121	124
1640	122	122	85	92	96	91	109	114	112	102
1650	124	95	122	125	137	120	110	113	117	103
1660	108	90	96	115	108	91	80	86	91	109
1670	100	108	104	99	115	107	110	112	104	101
1680	89	92	84	91	96	108	100	100	113	107
1690	96	92	95	98	109	93	90	82	106	110
1700	127	122	121	98	94	104	97	95	91	96
1710	80	104	92	108	106	109	96	126	103	86
1720	98	111	96	116	114	127	114	96	110	107
1730	102	94	91	88	75	94	97	94	109	98
1740	106	109	96	91	92	80	85	95	85	100
1750	83	87	90	91	86	88	96	100	89	101
1760	100	104	92	98	102	90	74	81	82	86
1770	82	91	95	99	100	94	92	86	98	90
1780	96	109	112	97	117	108	112	117	107	89
1790	96	89	92	93	109	129	123	130	114	112
1800	123	107	102	87	97	100	111	108	109	114
1810	93	87	97	83	98	96	110	97	75	88
1820	88	82	93	93	104	120	108	109	120	122
1830	118	126	118	110	113	134	121	105	90	85
1840	101	84	85	82	96	96	98	91	97	116
1850	105	91	101	98	111	109	105	116	97	87
1860	70	61	66	75	80	80	82	76	96	98
1870	105	92	97	94	83	82	85	79	75	72
1880	84	80	93	73	87	84	99	94	71	82
1890	83	89	104	97	95	91	65	64	96	91
1900	99	107	108	142	132	141	120	124	96	80
1910	106	98	82	86	89	98	118	111	96	101
1920	91	126	115	97	89	91	101	103	112	102
1930	84	108	104	123	137	159	142	120	134	144
1940	139	129	115	94	92	99	112	106	116	131
1950	119	143	143	129	121	113	124	111	110	107
1960	82	94	80	83	105	98	89	97	95	87
1970	76	95	74	81	83	87				

NUMBER OF SAMPLES

	0	1	2	3	4	5	6	7	8	9
			1	1	1	1	1	1	1	1
	1	1	1	1	2	2	2	2	2	2
	2	2	2	2	3	3	3	3	3	3
	3	3	4	4	4	4	4	4	4	4
	4	4	4	4	4	4	4	4	4	4
	4	4	4	4	4	4	4	4	4	4
	5	5	5	5	5	5	5	5	5	5
	5	5	5	5	5	5	5	5	5	5
	5	5	5	5	5	5	5	5	5	6
	6	6	6	6	6	6	6	6	6	6
	6	6	6	6	6	6	6	6	6	6
	7	7	7	7	7	7	7	8	8	8
	8	8	8	8	8	8	8	8	8	8
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	9	9	9	9	10	10	10	10	10	10
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	11	11	11	11	11	12	12	12	12	12
	12	12	12	12	12	12	13	13	13	13
	13	13	12	12	12	12	12	12	12	12
	12	12	12	12	12	14	14	14	14	14
	15	16	16	16	16	16	16	16	16	16
	16	16	16	16	16	16	16	16	16	16
	16	16	16	16	16	16	16	16	16	16
	16	16	16	17	17	18	19	19	19	19
	19	19	19	19	19	19	19	19	19	20
	20	20	20	20	20	20	20	20	20	20
	20	21	21	21	21	21	21	21	21	21
	21	21	21	21	21	21	21	21	21	21
	21	21	21	21	21	21	21	21	21	21
	21	21	21	21	21	22	23	23	23	23
	23	23	23	23	23	23	24	24	24	24
	25	25	24	24	24	23	23	23	23	23
	23	23	23	23	23	23	23	23	23	23
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	23	23	23	23	24	24	24	24	25	25
	25	26	25	25	25	26	26	26	26	26
	25	27	27	27	27	27	27	27	27	27
	27	27	27	27	27	27	27	27	27	27
	27	27	27	27	27	27	28	28	28	28
	28	27	27	27	27	27	27	27	27	27
	27	27	27	27	28	28	29	29	29	29
	29	29	29	29	29	30	30	30	30	30
	30	30	30	30	30	32	32	32	32	32
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	30	28	28	28	28	27	27	27	27	27
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	27	26	26	26	26	26	26	26	26	26
	26	26	26	26	26	26	26	26	26	26
	26	25	25	25	25	25	25	25	25	25
	25	24	24	24	24	24	24	24	24	24
	24	21	21	21	21	21	21	21	21	21
	21	21	21	21	21	21	20	20	20	20
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	20	19	19	19	19	19	19	19	19	19
	19	19	19	19	19	19	19	19	19	19
	19	19	19	16	16	16	16	16	16	16
	15	15	15	15	13	13	13	13	13	13
	13	13	13	13	13	13	13	13	13	12
	12	12	12	12	12	12	12	11	11	11
	11	11	11	11	11	11	11	11	11	11
	11	11	11	11	11	11				

SITE AND COLLECTION INFORMATION

Site name *VOLCÁN LONQUIMAY*
Country *CHILE* **State or Province** *MALLECO*
Latitude *38°23'S* **Longitude** *71°34'W* **Altitude** *1510 m*
Species collected *Araucaria araucana*
Date of collection *5 January 1977*
Collectors *R.L.Holmes, P.W.Dunwiddie, J.Gutiérrez*
No. of trees sampled *18* **No. of cores** *65* **No. of discs** *0*

Site description:

From eight kilometers northeast of the village of Malalcahuello on the road between the towns of Curacautín and Villa Portales a road marked "Lolco" runs northwest. About seven kilometers on this road a poor dirt road goes off to the west toward Volcán Lonquimay. The site is a steep(35° to 50°) northeast slope facing the volcano across a snowmelt creek. Soil is volcanic ash with a few rocks. Grass covers the slope, with patches of "quila" (Chusquea quila).

The sampled stand of trees is on the central of three ridges where Araucaria grow. The trees on the other two ridges are smaller and most have severe fire scars.

SAMPLE STATISTICS

Interval analyzed (A.D.)	*1850 - 1912*
No. of trees *15* No. of radii per tree *2*	
Mean ring width (mm)	*1.05*
% locally absent rings	*0.05*
Analysis of variance:	
Estimated mean square of Y	*0.016*
Sources of variation, % variance	
Mean chronology	*23*
Differences between trees	*27*
Other	*50*
Cross-correlation analysis:	
Radii within trees	
Radii among trees	
Between tree means	

CHRONOLOGY STATISTICS

Identification	*LON799*
Interval (A.D.)	*1664 - 1975*
No. of trees *15* Total no. of radii *47*	
Autocorrelation	*0.63*
Standard deviation	*0.16*
Mean sensitivity	*0.11*
Mean standard error	*0.06*

LON799
VOLCAN LONQUIMAY
ARAUCARIA ARAUCANA

TREE RING INDICES

DATE	0	1	2	3	4	5	6	7	8	9
1664					64	93	72	51	71	83
1670	101	109	79	84	93	77	88	72	68	74
1680	77	86	78	94	85	81	91	100	98	106
1690	102	89	74	84	97	74	59	80	72	58
1700	87	90	76	87	86	76	92	78	98	92
1710	73	78	88	89	81	92	68	84	79	58
1720	129	118	96	104	93	96	93	86	90	86
1730	96	90	85	92	88	89	97	80	101	120
1740	112	107	113	91	92	106	119	101	112	122
1750	97	88	87	88	81	81	100	105	110	102
1760	130	136	114	137	113	101	114	94	114	123
1770	112	104	96	90	94	92	92	101	103	91
1780	93	100	110	86	98	93	85	87	95	95
1790	108	103	95	110	105	115	114	102	95	105
1800	112	98	102	110	110	103	98	98	110	109
1810	103	92	101	83	105	109	122	117	92	85
1820	107	94	114	117	124	125	118	113	115	119
1830	126	122	110	110	112	112	102	100	104	80
1840	90	74	84	91	106	94	106	97	92	112
1850	100	97	115	111	113	104	90	107	109	83
1860	92	84	95	92	107	92	102	94	119	113
1870	119	108	111	102	95	88	108	103	103	96
1880	124	103	98	102	117	105	112	104	88	85
1890	91	93	100	78	75	83	80	74	125	129
1900	127	120	114	121	112	93	78	92	92	76
1910	101	108	89	68	71	69	85	90	99	87
1920	74	94	110	103	86	104	113	105	103	125
1930	107	107	88	103	92	98	78	74	94	90
1940	100	97	96	98	89	87	114	102	108	95
1950	100	109	87	93	91	77	83	74	76	98
1960	88	93	76	97	115	152	158	131	132	130
1970	96	105	87	73	89	109				

NUMBER OF SAMPLES

0	1	2	3	4	5	6	7	8	9
				1	1	1	1	1	1
1	1	1	1	1	1	2	2	2	2
2	2	3	3	4	6	6	7	7	7
8	8	8	8	8	8	8	8	8	8
8	8	9	10	10	10	10	11	11	11
11	11	11	14	14	14	14	14	15	15
15	15	15	16	17	17	17	17	17	17
17	18	18	18	19	19	19	19	19	19
20	20	20	20	20	21	21	21	21	21
21	21	21	22	22	22	22	22	22	22
22	22	22	22	22	23	23	23	23	24
24	24	24	24	24	24	24	24	26	26
27	28	29	29	30	30	30	30	31	32
34	34	34	34	34	34	34	34	34	34
34	34	34	34	36	36	36	36	36	36
36	36	36	36	36	36	37	37	37	38
39	39	39	39	39	39	39	39	40	41
44	44	44	44	44	44	44	44	44	44
44	44	44	44	44	44	44	45	45	45
47	47	47	47	47	47	47	47	47	47
47	47	47	47	47	47	47	47	47	47
47	47	47	47	47	47	47	47	47	47
47	47	47	47	47	47	47	47	47	47
47	47	47	47	47	47	47	47	47	47
47	47	47	47	47	47	47	47	47	47
47	47	47	44	44	44	44	44	44	44
44	42	42	42	42	42	42	42	42	42
42	42	42	42	42	42	42	42	42	42
42	42	42	42	42	42	42	42	42	42
42	40	40	40	40	40	40	40	40	40
39	38	38	38	38	38	38	38	38	38
37	37	37	36	36	35				

SITE AND COLLECTION INFORMATION

Site name *SAN GABRIEL*
Country *CHILE* **State or Province** *SANTIAGO*
Latitude *33°46'S* **Longitude** *70°13'W* **Altitude** *1360 m - 1630 m*
Species collected *Austrocedrus chilensis*
Date of collection *28 January 1973, 30 December 1976*
Collectors *R.L.Holmes, P.W.Dunwiddie, J.Gutiérrez, C.Gutiérrez*
No. of trees sampled *27* **No. of cores** *78* **No. of discs** *0*

Site description:

The site is 74 kilometers by road southeast of the city of Santiago (54 kilometers in a straight line) in the "Cajón del Maipo" (Canyon of the River Maipo), to the north of the road just east of the village of San Gabriel and above the point where the stream Estero El Manzanito joins the Río Maipo.

The sampled stand is on a very steep (37° to 51°) south-facing rock and talus slope overlooking the canyon of the Río Maipo. Soil is very thin, and the trees are growing in the small pockets of available soil. Some trees have been mutilated, probably for firewood, particularly those at the lower end of the stand and in the steep watercourses. Nearly all trees in the stand have a drought-stricken appearance.

In 1973 only six trees were sampled near the lower edge of the stand due to lack of time. In 1976 21 trees were sampled throughout the stand.

SAMPLE STATISTICS

Interval analyzed (A.D.)	*1877 - 1955*
No. of trees *9* No. of radii per tree *2*	
Mean ring width (mm)	*0.41*
% locally absent rings	*0.14*
Analysis of variance:	
Estimated mean square of Y	*0.046*
Sources of variation, % variance	
Mean chronology	*38*
Differences between trees	*24*
Other	*38*
Cross-correlation analysis:	
Radii within trees	*0.64*
Radii among trees	*0.41*
Between tree means	*0.42*

CHRONOLOGY STATISTICS

Identification	*GAB479*
Interval (A.D.)	*1131 - 1975*
No. of trees *21* Total no. of radii *59*	
Autocorrelation	*0.60*
Standard deviation	*0.25*
Mean sensitivity	*0.17*
Mean standard error	*0.07*

GAB479
SAN GABRIEL
AUSTROCEDRUS CHILENSIS

DATE	TREE RING INDICES										NUMBER OF SAMPLES									
	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1131		102	126	150	132	135	119	120	126	83		1	1	1	1	1	1	1	1	1
1140	214	171	137	97	148	167	91	87	86	88	1	1	1	1	1	2	3	3	3	3
1150	78	87	112	113	73	95	91	57	48	46	3	3	3	3	3	3	3	3	3	3
1160	63	46	121	141	99	67	146	150	44	48	3	3	3	3	3	3	3	3	3	3
1170	91	107	158	109	66	81	81	123	110	100	3	3	3	3	3	3	3	3	3	3
1180	82	72	75	77	81	57	132	121	96	138	3	3	3	3	3	3	3	3	3	3
1190	153	78	87	101	98	123	103	147	107	65	3	3	3	3	3	3	3	3	3	3
1200	112	179	150	100	119	124	96	85	68	88	4	4	4	4	4	4	4	4	4	4
1210	133	114	95	83	78	81	102	90	78	129	4	4	4	4	4	4	4	4	4	4
1220	138	66	109	107	80	70	80	74	78	134	4	4	4	4	4	4	4	4	4	4
1230	86	98	97	73	82	79	77	89	103	87	4	4	4	4	4	4	4	4	4	4
1240	84	112	145	120	112	103	80	83	75	126	4	4	4	4	4	4	4	4	4	4
1250	88	106	109	81	81	84	68	81	106	122	4	4	4	4	4	4	4	4	4	4
1260	71	75	71	79	80	101	88	98	102	113	4	4	4	4	4	4	4	4	4	4
1270	124	57	55	76	102	161	207	174	130	93	4	4	4	4	4	4	5	5	5	5
1280	91	108	101	126	116	94	114	97	73	80	5	5	5	5	5	5	5	5	5	5
1290	71	68	82	85	92	85	86	83	87	56	5	5	5	5	5	5	5	5	5	5
1300	66	76	74	88	94	114	117	112	116	86	5	5	5	5	5	5	5	5	6	6
1310	73	78	75	89	92	79	112	117	95	84	6	7	7	7	7	7	7	7	7	7
1320	94	119	115	138	100	88	91	112	96	114	7	7	7	7	7	7	7	7	7	7
1330	130	136	110	126	161	128	135	137	116	92	7	7	7	7	7	8	8	8	8	8
1340	82	79	80	106	94	92	85	98	104	96	8	8	8	8	8	8	8	8	8	8
1350	86	116	105	73	46	63	80	97	95	94	8	8	8	8	8	8	8	8	8	8
1360	91	86	111	78	89	95	102	118	122	105	8	8	8	8	8	8	8	8	8	8
1370	120	95	114	127	127	117	117	114	97	106	8	8	8	8	9	9	9	9	9	9
1380	123	45	75	133	120	113	116	149	145	146	9	9	9	9	9	9	9	9	9	9
1390	152	94	69	87	82	110	123	169	155	128	9	9	9	9	9	9	9	9	9	9
1400	130	135	112	118	132	92	90	103	117	76	9	9	9	9	9	9	9	9	9	9
1410	88	96	112	149	156	130	118	100	103	117	9	9	9	9	9	9	9	9	9	9
1420	126	130	117	91	106	114	138	125	129	100	9	9	9	9	9	9	9	9	9	9
1430	107	120	105	121	123	91	92	100	79	100	9	9	9	9	9	9	9	9	9	9
1440	82	99	93	82	116	125	112	114	83	76	9	9	9	9	9	9	9	9	9	9
1450	96	101	80	93	81	74	60	54	29	36	9	9	9	9	9	9	9	8	8	8
1460	76	75	94	72	71	73	77	74	60	85	8	8	8	8	8	8	8	8	7	7
1470	89	79	75	59	71	81	56	69	55	62	7	7	7	7	7	7	7	7	7	7
1480	67	57	62	65	73	80	77	73	92	111	8	8	8	8	8	8	8	8	8	8
1490	133	100	103	125	112	113	109	87	85	83	8	8	8	8	8	8	8	8	8	8
1500	84	104	107	79	88	96	104	80	63	64	8	8	8	8	8	8	8	8	8	8
1510	74	89	106	147	105	107	108	112	79	82	8	8	6	6	6	6	6	6	6	6
1520	89	89	102	119	86	129	154	99	107	103	6	7	7	7	7	7	7	7	7	7
1530	99	134	138	134	125	125	117	120	117	68	7	8	8	8	8	8	8	8	8	8
1540	74	80	96	120	135	126	142	88	78	89	8	9	9	9	11	11	11	11	11	11
1550	86	91	96	128	102	123	122	100	97	102	11	11	11	11	11	11	11	11	11	11
1560	82	118	128	105	93	96	104	95	138	129	11	12	12	12	12	12	12	12	12	12
1570	100	82	76	76	73	64	69	74	75	64	12	12	12	12	12	12	12	12	12	12
1580	68	89	63	72	85	97	104	92	77	114	12	12	12	12	12	12	12	12	13	13
1590	157	157	140	172	163	123	125	108	105	88	15	16	16	17	17	17	17	17	17	17
1600	118	127	124	106	124	104	86	96	114	131	18	18	18	18	18	19	19	19	19	19
1610	91	92	78	85	80	78	79	85	89	116	22	22	22	23	23	24	24	24	24	24
1620	136	121	87	81	67	71	83	97	87	73	25	26	26	26	26	26	26	26	26	26
1630	75	82	83	64	85	128	107	82	97	114	26	26	26	26	26	26	26	26	26	26
1640	96	110	154	119	78	68	81	65	110	97	26	26	26	26	26	26	25	25	26	26
1650	77	84	119	144	123	120	100	159	138	114	26	26	26	26	26	26	26	27	27	28
1660	111	106	96	86	64	66	96	87	86	104	29	29	29	29	29	29	29	29	29	29
1670	114	95	116	110	109	109	115	73	54	73	29	30	30	30	30	31	31	31	31	31
1680	80	75	72	86	86	62	80	86	87	124	31	31	31	32	32	32	32	32	32	32
1690	148	139	121	79	117	120	73	88	89	93	32	32	32	32	32	32	32	32	32	32
1700	73	94	98	88	86	68	68	95	103	92	32	32	32	32	32	32	32	32	32	32
1710	109	120	150	130	132	94	78	79	89	105	33	33	33	33	33	33	33	33	34	34
1720	133	106	85	83	92	87	81	71	103	87	38	38	38	38	38	38	38	38	38	38
1730	80	83	75	66	86	88	95	95	108	122	38	38	38	38	38	38	39	39	39	39
1740	95	102	128	110	108	112	90	160	142	152	39	39	39	39	39	40	40	40	41	41
1750	156	115	99	111	114	132	101	79	76	50	41	41	41	41	41	42	42	42	42	42
1760	81	94	93	116	110	111	94	103	92	102	43	43	43	43	43	43	43	43	43	43
1770	127	102	86	75	86	79	78	96	95	82	44	44	44	44	44	44	44	44	44	44
1780	91	72	56	77	94	91	100	96	93	77	44	44	44	44	44	44	44	44	44	44
1790	115	94	108	110	105	158	144	111	104	110	44	44	44	44	44	45	45	44	45	45
1800	104	114	91	99	113	106	105	86	94	104	45	45	45	45	45	45	45	45	45	45
1810	120	131	103	97	80	129	89	75	83	71	45	44	44	44	44	44	44	44	44	44
1820	87	81	101	105	104	123	122	145	117	109	44	44	45	45	48	48	48	48	49	49
1830	149	117	124	129	137	121	149	165	153	93	49	49	49	49	49	49	49	49	50	50
1840	86	91	86	129	116	109	117	105	132	141	50	50	50	50	50	50	50	50	50	50
1850	128	144	123	84	95	119	120	110	144	97	50	50	50	50	50	50	50	50	50	50
1860	93	110	128	76	84	70	77	87	107	101	49	49	49	48	47	47	47	47	47	47
1870	137	121	102	106	146	138	143	110	101	65	47	47	47	47	47	47	47	49	49	49
1880	76	114	103	107	124	116	76	94	85	81	49	47	47	47	47	47	47	47	45	45
1890	59	66	69	70	83	93	76	76	90	91	45	44	44	44	44	44	44	44	44	43
1900	82	106	112	116	149	138	89	93	76	73	43	41	41	41	41	41	41	41	41	41
1910	81	83	90	65	75	94	89	74	83	93	41	41	40	40	40	40	40	40	40	40
1920	89	93	73	87	57	54	82	63	82	91	40	40	40	40	40	40	40	40	40	40
1930	90	111	80	89	86	61	63	75	85	90	40	40	40	40	40	40	40	40	40	40
1940	106	108	143	115	115	119	81	53	70	66	39	37	37	37	37	37	37	37	36	36
1950	114	115	90	109	113	115	129	101	95	109	36	36	36	36	36	36	35	35	35	35
1960	51	73	84	108	105	121	126	94	54	62	34	34	34	34	34	34	34	34	34	34
1970	117	93	99	129	118	121					34	34	34	25	25	25				

SITE AND COLLECTION INFORMATION

Site name *HUEICOLLA*
Country *CHILE* State or Province *VALDIVIA*
Latitude *40°08'S* Longitude *73°31'W* Altitude *800 m*
Species collected *Pilgerodendron uviferum*
Date of collection *8 December 1976*
Collectors *R.L.Holmes, P.W.Dunwiddie, J.Salazar*
No. of trees sampled *7* No. of cores *11* No. of discs *0*

Site description:

The site is a bog 300 meters north of the road, 52 kilometers west of La Unión and 28 kilometers east of Hueicolla, a village on the coast. It is in the low coastal mountain range with typical Valdivian forest vegetation, a very dense , humid temperate forest containing many arboreal species.

At the bog in addition to Pilgerodendron uviferum are Nothofagus antarctica, some Fitzroya cupressoides, the dwarf conifer Dacrydium fonckii, Sphagnum and Drosera. All trees are under six meters tall.

The bog site is not typical of the Valdivian forest. A description of collections of twelve additional species at nearby sites is included in the Appendix.

SAMPLE STATISTICS

Interval analyzed (A.D.)	*1905 - 1974*
No. of trees *5* No. of radii per tree *2*	
Mean ring width (mm)	*0.40*
% locally absent rings	*0.00*
Analysis of variance:	
Estimated mean square of Y	*0.032*
Sources of variation, % variance	
Mean chronology	*30*
Differences between trees	*17*
Other	*53*
Cross-correlation analysis:	
Radii within trees	*0.56*
Radii among trees	*0.32*
Between tree means	*0.35*

CHRONOLOGY STATISTICS

Identification	*HUB219*
Interval (A.D.)	*1868 - 1975*
No. of trees *5* Total no. of radii *14*	
Autocorrelation	*0.55*
Standard deviation	*0.19*
Mean sensitivity	*0.14*
Mean standard error	*0.06*

HUB219
HUEICOLLA
PILGERODENDRON UVIFERUM

DATE	TREE RING INDICES										NUMBER OF SAMPLES									
	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
1868									110	81									1	1
1870	60	87	104	96	97	106	86	101	101	85	1	1	1	1	1	1	1	1	1	1
1880	88	80	95	72	80	72	81	75	83	102	1	1	1	1	4	4	4	4	4	4
1890	135	143	125	81	102	129	106	90	98	109	4	4	6	6	6	6	6	6	6	6
1900	109	88	89	112	115	110	106	136	123	98	6	6	6	6	8	10	12	12	12	12
1910	100	99	93	105	98	120	98	104	104	95	12	12	12	12	12	12	12	12	12	12
1920	93	89	73	78	85	139	132	106	99	100	12	12	12	12	12	12	12	12	12	12
1930	102	100	101	115	94	124	90	84	92	101	12	14	14	14	14	14	14	14	14	14
1940	114	99	92	91	76	100	155	120	106	82	14	14	14	14	14	14	14	14	14	14
1950	99	98	66	69	70	50	62	63	78	94	14	14	14	14	14	14	14	14	14	14
1960	85	121	107	107	121	106	109	115	132	110	14	14	14	14	14	14	14	14	14	14
1970	98	104	94	112	121	119					14	14	14	14	14	13				

OTHER COLLECTIONS

SITE AND COLLECTION INFORMATION

Site name *BELLAVISTA*
Country *CHILE* **State or Province** *COLCHAGUA*
Latitude *34°47'S* **Longitude** *70°45'W* **Altitude** *2000 m*
Species collected *Austrocedrus chilensis*
Date of collection *31 January 1973*
Collectors *V.C.LaMarche, T.P.Harlan, J.Harsha*
No. of trees sampled *9* **No. of cores** *15* **No. of discs** *0*

Site description:

The site is southeast of San Fernando in the valley of the Río Tinguiririca. Underbrush is dense with Nothofagus growing among the Austrocedrus at a subsite two kilometers south of Bellavista; another subsite is five kilometers north, on a barren knoll with outcrops and sparse underbrush on a 20° north-facing slope. A third subsite is some four kilometers west of Bellavista on a 20° south-facing slope.

SITE AND COLLECTION INFORMATION

Site name *MALALCAHUELLO*
Country *CHILE* **State or Province** *MALLECO*
Latitude *38°24'S* **Longitude** *71°33'W* **Altitude** *1340 m*
Species collected *Araucaria araucana*
Date of collection *5 January 1977*
Collectors *R.L.Holmes, P.W.Dunwiddie, J.Gutiérrez*
No. of trees sampled *7* **No. of cores** *22* **No. of discs** *0*

Site description:

From eight kilometers northeast of the village of Malalcahuello on the road between Curacautín and Villa Portales a road marked "Lolco" runs northwest; about seven kilometers on this road a poor dirt road goes off to the west toward Volcán Lonquimay. The sampled stand grows on a very gentle (5°) south slope of volcanic ash and pumice adjacent to a large treeless ash deposit. The stand is open, with clumps of short grass, forbs to 15 cm tall, ericaceous shrubs, some Nothofagus antarctica and some Chusquea quila.

SITE AND COLLECTION INFORMATION

Site name *MIRADOR DE LOS PINCHEIRA*
Country *CHILE* **State or Province** *MALLECO*
Latitude *37° 47'S* **Longitude** *73° 02'W* **Altitude** *1300 m*
Species collected *Araucaria araucana*
Date of collection *25 December 1976*
Collectors *R.L.Holmes, P.W.Dunwiddie, J.Gutiérrez. P.Vidal, D.Cross*
No. of trees sampled *9* **No. of cores** *26* **No. of discs** *0*

Site description:

This site is in the Cordillera de Nahuelbuta, a range of mountains running north-south near the Pacific coast with peaks up to 1472 meters. Access is gained from the city of Angol, traveling westward into the Nahuelbuta National Park. Mirador de los Pincheira is a rounded mountain peak nearly as high as Piedra del Águila (q.v.), about six kilometers north of it.

The first subsite (two trees sampled) is along the trail between Piedra del Águila and Mirador de los Pincheira, somewhat closer to the latter, on an 8° northwest-facing slope. The stand has very few trees, widely spaced, with a ground cover of Stipa sp. ("coiron").

The second subsite (seven trees sampled) is about 300 meters north of the mountaintop on a 15° north-facing slope. Ground cover is "coiron" (Stipa sp.) and dwarf "ñire" (Nothofagus antarctica) to three meters tall.

Cores from this site were dated and measured, but they exhibit very low intercorrelation, and therefore were not used to produce a chronology.

SITE AND COLLECTION INFORMATION

Site name *RAYENCO*
Country *CHILE* **State or Province** *ÑUBLE*
Latitude *37° 16'S* **Longitude** *71° 37'W* **Altitude** *870 m*
Species collected *Podocarpus andinus*
Date of collection *8 January 1977*
Collectors *R.L.Holmes, P.W.Dunwiddie, J.Gutierrez*
No. of trees sampled *9* **No. of cores** *21* **No. of discs** *1*

Site description:

The site is seven kilometers north of the town of Abanico, which is on the road between Los Ángeles and Laguna de la Laja. The area is a dense, humid woods of Nothofagus dombeyi (the dominant species), Nothofagus antarctica, Podocarpus andinus and some Austrocedrus chilensis, on level or slightly sloping ground. Logging has been intense, and is still being practiced in the area.

SITE AND COLLECTION INFORMATION

Site name *ROBLE*
Country *CHILE* **State or Province** *SANTIAGO*
Latitude *33° 13'S* **Longitude** *71° 00'W* **Altitude** *2000 m*
Species collected *Nothofagus obliqua var. macrocarpa*
Date of collection *25 January 1973*
Collectors *V.C.LaMarche, T.P.Harlan, J.Harsha*
No. of trees sampled *11* **No. of cores** *15* **No. of discs** *0*

Site description:

The site is 45 kilometers in a straight line northwest of Santiago on the road above Caren leading to a television relay atop a mountain. Soil is deep, with abundant large granodiorite boulders. Trees were sampled in a gully (mostly single-trunk trees) and on an open slope (multi-trunk trees).

SITE AND COLLECTION INFORMATION

Site name *ALTO VILCHES*
Country *CHILE* **State or Province** *TALCA*
Latitude *35°36'S* **Longitude** *71°00'W* **Altitude** *1200 m - 1335 m*
Species collected *Nothofagus donbeyi, Nothofagus obliqua*
Date of collection *15 December 1976*
Collectors *R.L.Holmes, P.W.Durwiddie, J.Gutiérrez*
No. of trees sampled *15* **No. of cores** *52* **No. of discs** *0*

Site description:

Samples were taken from a dense, mixed-age forest of small and medium size Nothofagus dombeyi and Nothofagus obliqua, and some very large Nothofagus dombeyi. The general slope is west-facing of varying steepness. The site is some 80 kilometers east-southeast of Talca, to the east and south of the hotel and campground at Alto Vilches.

SITE AND COLLECTION INFORMATION

Site name *HUEICOLLA, EL MIRADOR, LAS TRANCAS*
Country *CHILE* State or Province *VALDIVIA*
Latitude *40° 07'-40° 13'S* Longitude *73° 21'-73° 37'W* Altitude *150 m - 800 m*
Species collected *Various species (see list below)*
Date of collection *7,8 December 1976*
Collectors *R.L.Holmes, P.W.Dunwiddie, J.Salazar*
No. of trees sampled *33* No. of cores *84* No. of discs *0*

Site description:

Exploratory sampling was done at seven sites in the low coastal mountain range between La Unión and the coastal village of Hueicolla. Vegetation type is the typical Valdivian forest, a very dense, humid temperate forest containing many arboreal species. The sampled sites are close to the road, and from 30 to 74 kilometers west of La Unión.

One site is a grassy pasture on a south-facing slope at 150 meters altitude; one is a dense forest near the crest of a hill on a moderate southeast slope at 400 meters; one is an open stand of fairly short trees on an exposed ridge crest at 750 meters; three sites are lush forest with many epiphytes; and one site is a bog with short trees at about 800 meters. This last mentioned site yielded a chronology of Pilgerodendron uviferum and is described on another page.

SPECIES REPORTED, OBSERVED AND COLLECTED IN THE COAST RANGE WEST OF LA UNIÓN:

Botanical Name	*Notes*	*Sites Where Collected*
Aextoxicon punctatum		*Lush humid forest*
Dacrydium fonckii	(2)	*Bog*
Drimys winteri		*Lush humid forest*
Eucryphia cordifolia		*Lush humid forest*
Fitzroya cupressoides		*Bog and exposed ridge crest*
Guevina avellana		
Laurelia phillippiana (also *L. serrata*)		*Forest near hill crest*
Laurelia sempervirens		
Lomatia hirsuta	(1)	
Myrtus luma		*Lush humid forest*
Nothofagus alpina		*Forest near hill crest*
Nothofagus dombeyi	(1)	
Nothofagus obliqua		*Pasture*
Nothofagus pumilio	(1)	
Persea lingue		
Pilgerodendron uviferum	(4)	*Bog*
Podocarpus nubigenus		*Lush humid forest*
Podocarpus salignus	(3)	
Saxegothaea conspicua		*Lush humid forest*
Weinmannia trichosperma		*Lush humid forest*

Notes:
(1) *This species has been sampled elsewhere, but not here.*
(2) *Diameter of this dwarf tree is less than 2 mm. Samples not kept.*
(3) *This species is reported present, but was not seen.*
(4) *Pilgerodendron uviferum yielded a chronology. The site is more fully described on another page.*

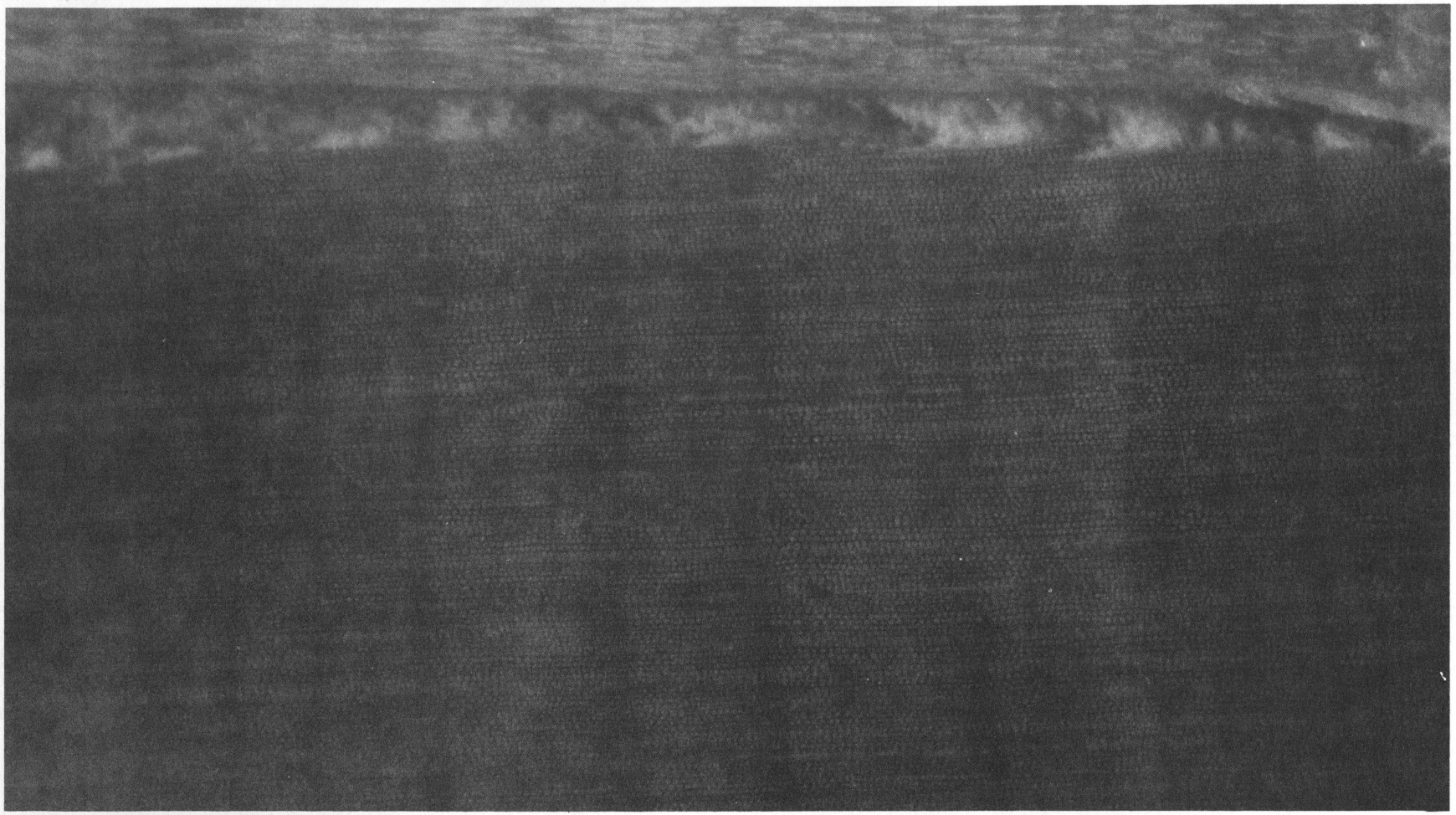

Plate 5. Enlarged core sample of *Araucaria araucana*. Note the variable appearance of the latewood bands. This species has excellent crossdating qualities.

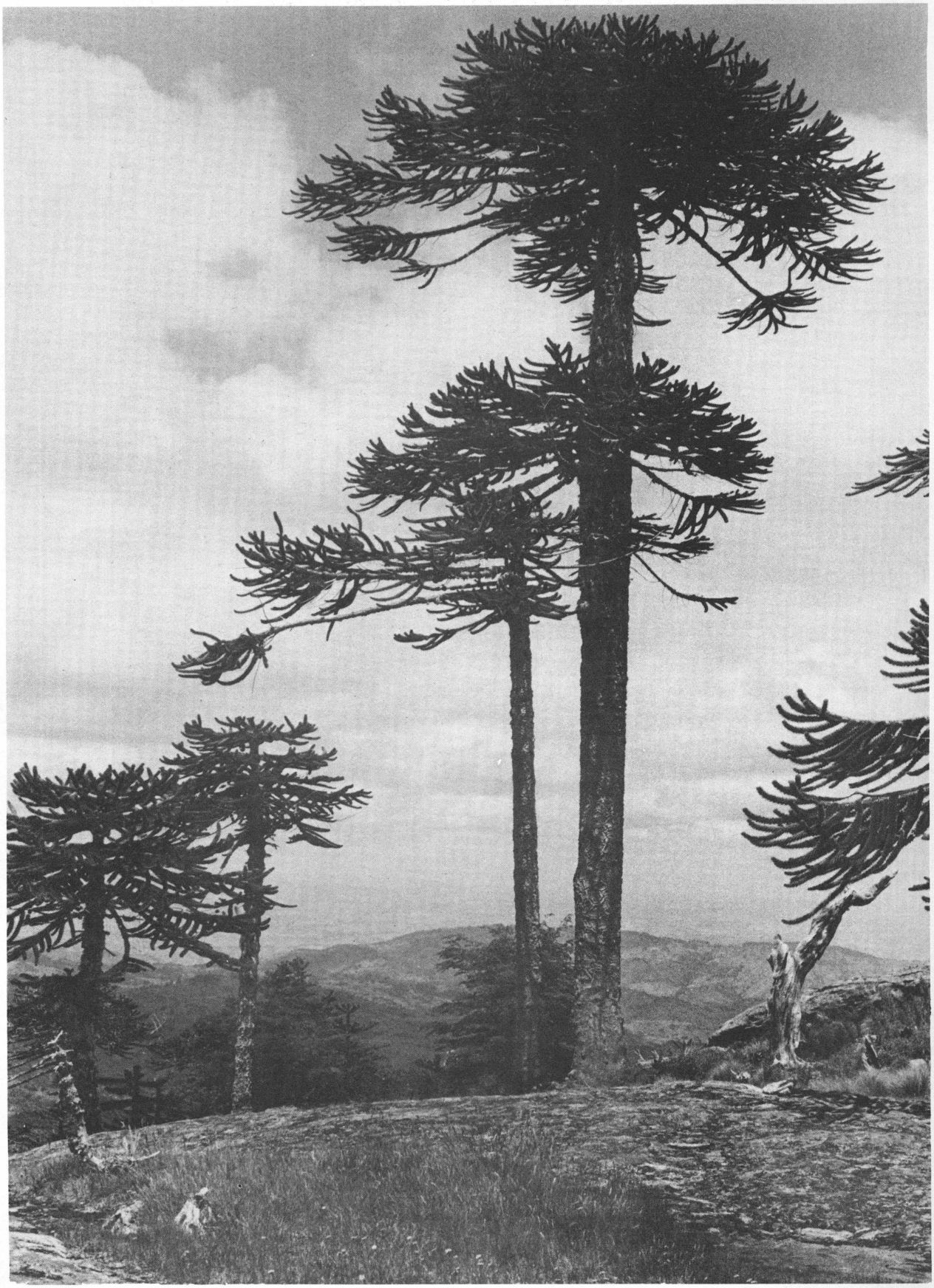

Plate 6. *Araucaria araucana*, Piedra del Aguila site in the Cordillera de Nahuelbuta, Malleco Province.

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