CLIMATIC CYCLES AND TREE-GROWTH, VOL. II

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649100903

Climatic cycles and tree-growth, Vol. II by A. E. Douglass

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd. Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

www.triestepublishing.com



CLIMATIC CYCLES AND TREE-GROWTH, VOL. II

Trieste

CARNEGIE INSTITUTION OF WASHINGTON PUBLICATION NO. 289, Vol. II

.





CLIMATIC CYCLES AND TREE-GROWTH

VOLUME II

A STUDY OF THE ANNUAL RINGS OF TREES IN RELATION TO CLIMATE AND SOLAR ACTIVITY

BY

A. E. DOUGLASS Director of Steward Observatory, University of Arizona



10

Published by the Carnegie Institution of Washington Washington, 1928

31

CONTENTS

	AGE
I. INTRODUCTION	3
Affiliations	3
Development	4
Cooperation	5
Acknowledgments	6
Previous work	7
II. TREE SELECTION	8
Species	8
Location: grouping, soil, topography,	
altitude	12
Condition: injuries, fire scars	14
Collection purposes: cycles and secu-	•••
	15
lar changes, age estimates	
III. RADIALS	17
Selection	17
Living trees: place and direction of	
boring	17
Fallen trees	19
Stumps: v-cut and its location	19
	21
Preparing the radial	
Radial studics	22
Circuit uniformity: eccentricity,	
lobes and gross rings	22
Vertical uniformity; tests at	
different heights	24
IV. Rings	28
Udention i. menn	
Selection in group	28
Mean conformity	28
Mean sensitivity	29
Selection within record	30
Parts of tree's record; infancy,	
youth, maturity, age	30
Ring errors: superfluous, missing,	ana.
reinforced, and false rings	31
V. INSTRUMENTS AND TECHNIQUE	34
Collecting tools: saws, borers, paraffin	
treatment	34
Measuring instruments	37
Early forms	37
Plotting micrometer; auto-plot	37
Longitudinal plotter; long-plot.	39
Clerical operations	40
Standardizing	40
Cycle Diols: skeleton plots.	
smoothing, Hanning	42
The eyelograph (periodograph)	45
Comparison of analyzing methods	45
Principle of the cyclograph	46
The White cyclograph	47
Cveloscope	50
Cycloscope	
VI. TREE RECORDS: LENGTH	51
Old sequoia records	51
Third sequoia trip, 1919	51
Fourth sequoia trip, 1924	52
Fifth sequoia trip, 1925	54
Coast redwood records	55
Sonto Cruz arour 1021	55
Santa Cruz group, 1921	
Santa Cruz group, 1921 Scotin trip, 1925 Deficiency of the coast redwood	55 56

	PAGE
VI. TREE RECORDS: LENGTH-continued	222
Old pinc records Search for old trees; 500- and	57
640-year pines, burnt centers .	
Prehistoric material	59
California and Arizona cross-	1000
dating	61
Charleston Mountain trip	61
VII. TREE RECORDS: GEOGRAPHICAL DIS-	
TRIBUTION	63
Western circuit, 1925	63
Western contours and rainfall	64
The three zones	64
The Pueblo area	65
Southwestern contours	
Western pine groups: statistics and	
treatment	67
Arizona region	68
First Flagstaff group	68
Flagetaff 500-year group	69
Fort Valley group	69
High-level group	71
Flagstaff shadow group	71
Flagstaff northcast group	72
Grand Canyon group	72
Dixie Forest (Utah) group	
Upper Rim group	
Lower Rim group	74
Cibeoue group	74
Pinal Mountain group	75
Catalina Mountain group.	
Santa Rita group	
The Rocky Mountain zone	
The Rocky Mountain zone	
Yellowstone group	77
Laramie, Wyoming, group	77
Clements's Pike's Peak group	77
Pike's Peak Timberline group	. 79
Pike's Peak Basin group	79
Upper North Transect group	
Lower North Transcet group	80
South Transect group	. 80
Brook group of Douglas fir Brook group of Engelmann	
Spruce	. 81
Cloudcroft, New Mexico, group.	. 81
Santa Fe group	
Basin Mountain Upper group	. 82
Basin Mountain Lower group	
Aztec East group	
The Coast zone	
Boise, Idaho, group	
Baker, Oregon, group	
Dalles group	. 85
Oregon Coast group	85
Klamath Falls group	00
Pluras County group	86
Calaveras group of pines	
Big Creek group	. 87
Springville group of pines	
Mount Wilson group	. 88

V

CONTENTS

	920
	GR
VII. TREE RECORDS: GEOGRAPHICAL DIS- TRIBUTION. The Coast zone- continued	
San Bernardino group	89
Charleston Mountain group	89
Pine Valley group	90
Miscellancous groups	90
Sequoias	90
Coast redwoods	91
Arizona groups	91
Other western groups	91
North American groups	93
Foreign groups	93
VIII. ENVIRONMENT	94
Effects in trees	94
Climate: single and double rings.	84
Rainfall correlations: Prescott, Flagstaff, Cibecue drought record; securia	97
Conservation: reversed and dis-	
torted effects	100
Other climatic correlations; wind	102
Topography	102
Sequois topography: ring type and moisture, sensitivity and	
cycle lag Pike's Peak topography; kind	103
of tree	106
shadow effect, and soil	107
Changing conditions: shade, drain	
age, soil, and grouping	
Environment indicators	
Evidence in individual rings	111

i.	PAGE
i	VIII. ENVIRONMENT. Environment indi- cators-continued
1	Evidence in single trees 111
l	Changing ring-size 112
h	IX. CYCLES 113
	Cycle origins
	radiation
8	etc 115
1	Cycles in tree-growth
1	cycles, criteria and tests 117
00000	The periodocrite
ŝ	curves
ł	lem of combination
	zone summarics, sequoia cycles 123 Solar records in tree-growth; histori-
	cal confirmation, dearth cycles, wet and dry climatic effects 125 Solar cycles, historical changes, cli-
	matic patterns
j	Cycles and climate; cautions; possible
ŝ	future Flagstaff variations 133
	SUMMARY 136
S.	APPENDIX
	AFFENDIA
P.	TABLES OF GROUP AVERAGES, STANDARD-
	1560
	BIBLIOGRAPHY 159

vi

ILLUSTRATIONS

PLATES

PAGE	2	PLATE 4-continued.	
------	---	--------------------	--

PLATE 1.	1000	P	AGE
 A. Fire injury on D-12 (stump) showing repair and gross rings and in- closed bark. B. Center of oldest sequois, D-21, show- ing ring grown in 1305 n.c.; three pins stand at 1300 n.c 	14	B. Sequoia "California," Enterprise; and Mr. C. A. Elster PLATE 5. A. Plotting micrometer B. Longitudinal plotter C. White cyclograph.	26 38 38 38
PLATE 2.		PLATE 6.	
 A. Weathering in 60 years, CV-4; bark gone, sapwood mostly gone; Cala- veras Grove. B. Weathering in 125 years; CV-3, sapwood and center entirely gone; Calaveras Grove. 	20 20	 A. Site of 500-year pines, Flagstaff, Fl. 35, in foreground; looking south. B. Stump of 640-year pine, Fisher's Tank, Flagstaff. 	58 58
PLATE 3.		PLATE 7.	
 A. Forms of v-cut on stumps. B. Complacent sequoia rings, D-8, grown in wet basin C. Sensitive sequoia rings, D-4, grown in uplands. 	22 22 22	 A. Sequoia topography, ridges; area of D-1, 2, 3, 4, 5, 18, 19, 28, 29 and 30 B. Sequoia topography, basins; area of D-6, 7, 8, 9, 10, 11 and 27 	
D. Hyper-sensitive or erratic yellow pine rings, Pr. 62, grown near lowest yellow pine levels, Arizona	23	PLATE 8. Spruce, S-14, from South Sweden, show- ing sunspot cycle; wet climate	
PLATE 4.		reaction. Dots give dates of sun-	32/25
A. Fallen sequoia, Enterprise, in which		spot maxima beginning with 1830	126
vertical uniformity tests were	1000	PLATE 9.	
made	26	Cyclograms	132

TEXT-FIGURES

PAGE	PAGE
 Ring-size, sensitivity, and rainfall correlations, Prescott	. Heartwood rings at different heights in the sequoia
	. Sapwood rings in fallen sequoia 26
	 Mean sensitivity and soil moisture
14. Sierra Nevada area mean curve, SNM;	 Rocky Mountain zone, smoothed group curves
	5. Coast zone, smoothed group curves 84
	. Prescott rainfall and tree-growth 98
10. Sequoia cycles 125 17. Flagstaff century curve, FLC, A.D.	 Flagstaff rainfall and tree-growth, with comparison curves; tree-growth
1285-1700; standardized and smoothed 127 18, (1) Flagstaff area mean curve, FAM:	shows close relation to winter pre- cipitation
avorage of eight groups, standardized	 Cibceue drought record traced directly from autoplot. 100
	. Sequois growth and rainfall
19. Details of cyclogram patterns in	. Land contours and annual growth of
	sequoias in Redwood Basin 104

vii

*

CLIMATIC CYCLES AND TREE-GROWTH

VOLUME II

A STUDY OF THE ANNUAL RINGS OF TREES IN RELATION TO CLIMATE AND SOLAR ACTIVITY

> BY A. E. DOUGLASS Director of Steward Observatory, University of Arizona

> > With nine plates end ninetcen text figures

1