APPLIED PERIOD PRESENTATION

ON

Tree rings: an indicator of environmental impact on trees

Institute of Forest Growth (IWW)

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CONTENTS

OBJECTIVES

- Describe diameter and height growth development of sample trees;

- Analysing tree rings pattern and identify impact of environmental changes on radial growth.

HYPOTHESIS

- Short-term growth responses are synchronous among trees. Synchronity is caused by environmental conditions;

- Long-term growth trends vary among trees. Growth trends are are modified by the competitive status of the trees.

STUDY AREA


Flensburg
Stralsund
Kiel
Rostock
Lübeck
Schwerin
Neubrandenburg
Hamburg
Wilhelmshaven
Emden
Schwedt
Lüneburg
Oldenburg
Bremen
Berlin
Nordhorn
Wolfsburg
Brandenburg
Frankfurt an der Oder
Osnabrück
Hannover
Magdeburg
Potsdam
Münster
Minden
Braunschweig
Cottbus
Dessau
Wesel
Detmold
Dortmund
Halle
Hoyerswerda
Leipzig
Duisburg
Kassel
Görlitz
Essen
Nordhausen
Düsseldorf
Dresden
Siegen
Köln
Bonn
Chemnitz
Gera
Düren
Gießen
Fulda
Koblenz
Hof
Zwickau
Frankfurt am Main
Schweinfurt
Trier
Würzburg
Bayreuth
Mainz
Bamberg
Kaiserslautern
Heidelberg
Nürnberg
Regensburg
Heilbronn
Saarbrücken
Aalen
Ingolstadt
Karlsruhe
Stuttgart
Augsburg
Landshut
Ulm
Freiburg
München
Konstanz
Kempten

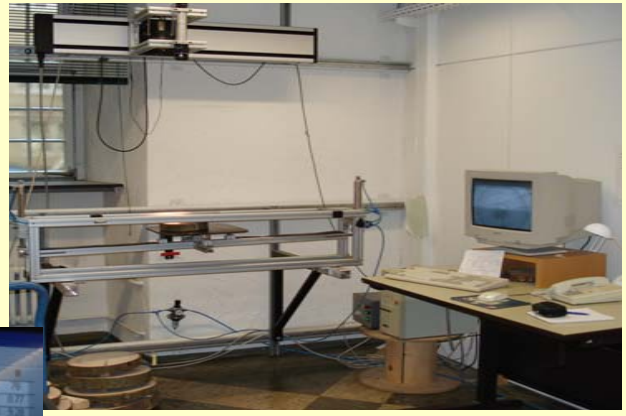
INSTRUMENTS USED FOR SAMPLE TREE SELECTION

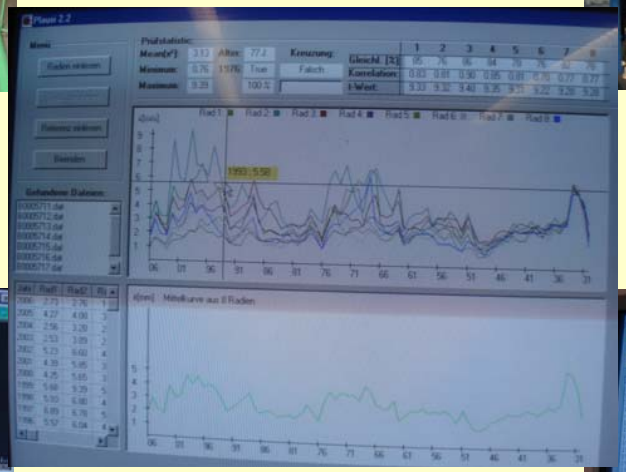
INSTRUMENTS USED FOR GROUND TRUTH COLLECTION

Software/machine used for laboratory analysis

Smoothening machine

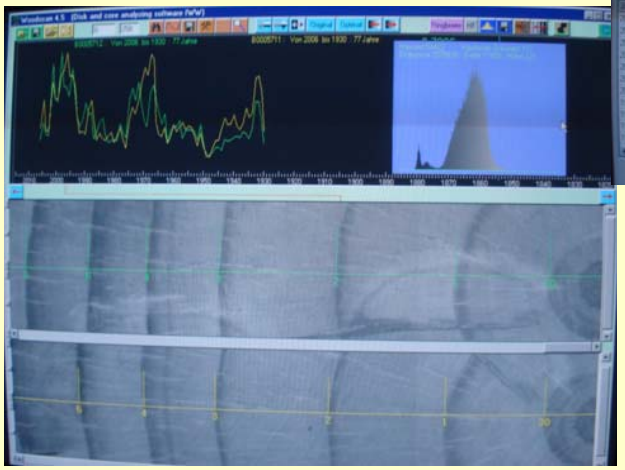
Scanning machine



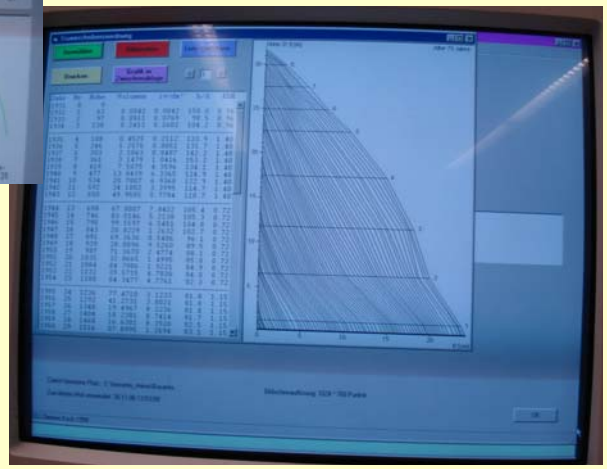


Plausi V. 2.2 software

Woodscan 4.5 software



Stamma V. 3.0 software



METHODOLOGY

1. Pre-field work stage

- Literature review/library consultation
- Field form preparation (sample tree selection and data collection)

2. Field work stage

Sample tree selection

Criteria's:

- Mature Spruce (*Picea abies*) stand with comparable density
- Pre-dominant
- Regular big crown
- Healthy/not damaged by fire, wind or other catastrophic factors
- Even aged stand structure
- No boarder tree/no solitary tree
- No heavy forestry operation in the recent past

Steps/procedures for sample tree selection:

Marking tree no and N

Fixing ranging rod

Fixing responder

Measuring distance

Measuring azimuth

Measuring height

Ground truth/data collection

Fixing the tape

Taking out disks

Counting the rings

Matching with whorls

Writting on disk

Collecting the disks

Removing the branches

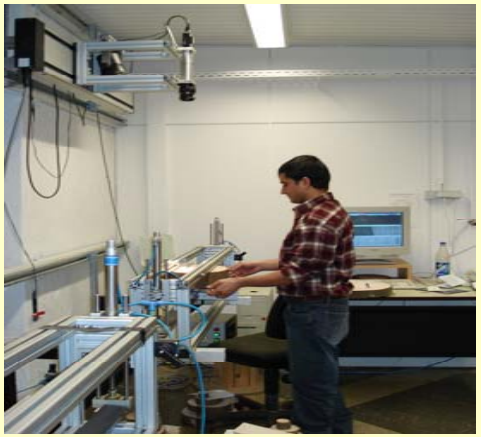
3. Post-field work stage (laboratory analysis)

A) Scanning the disk

Drying

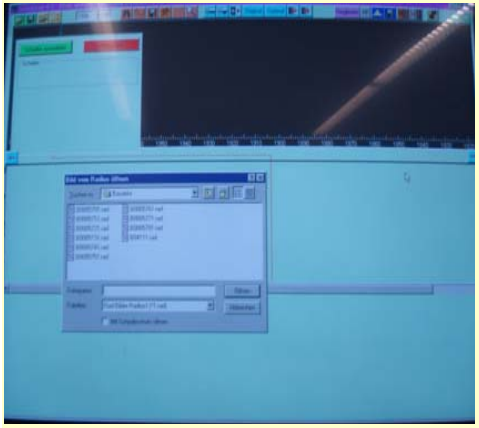
Smoothening

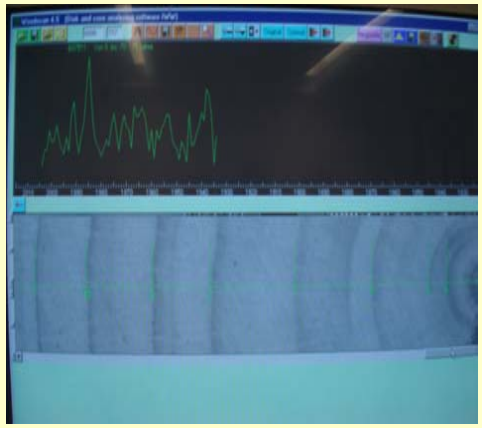
Scanning

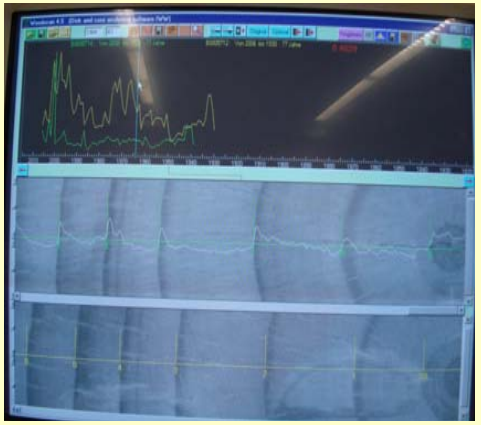


Inputting the information

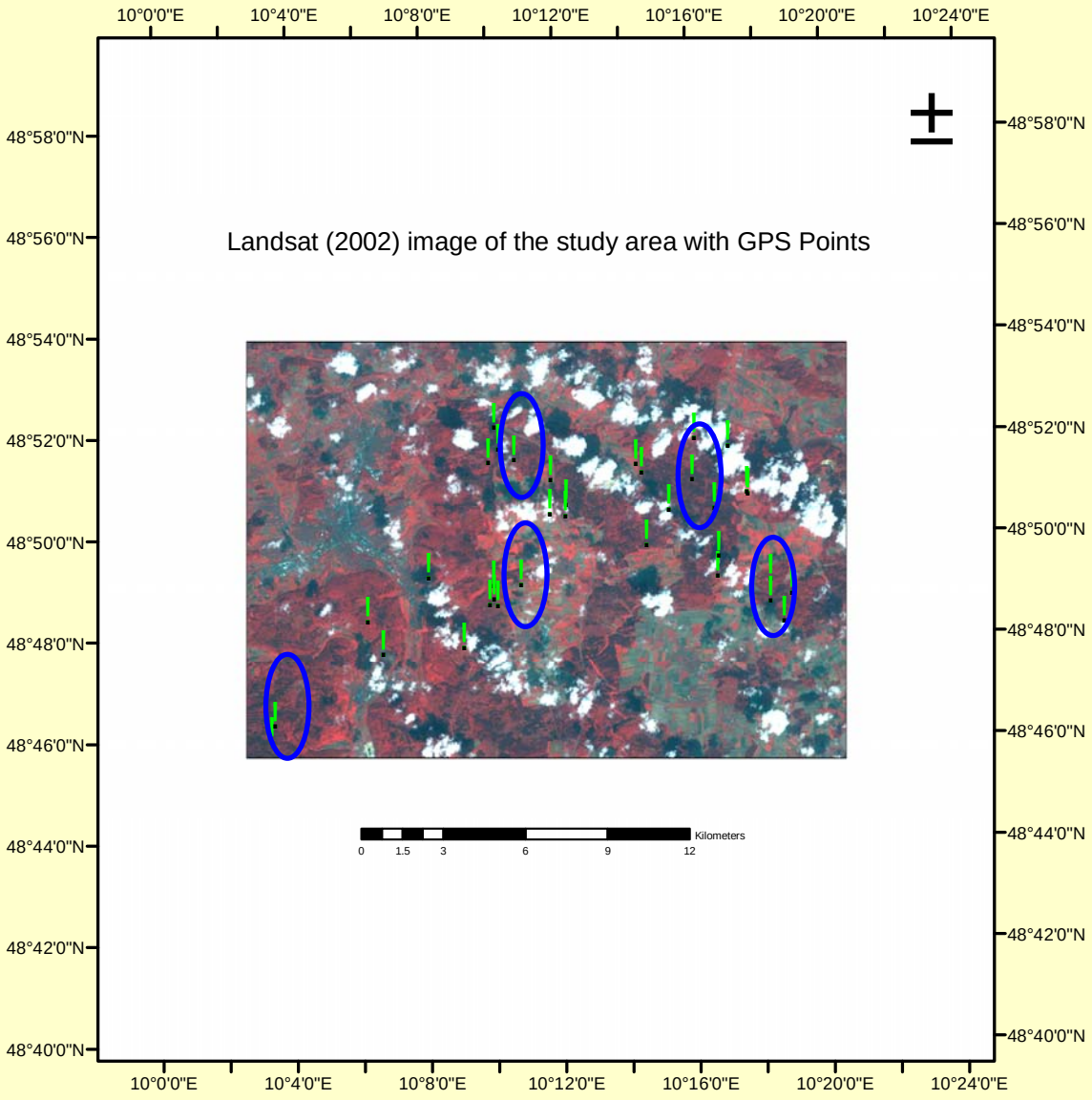
B) Analysing the picture



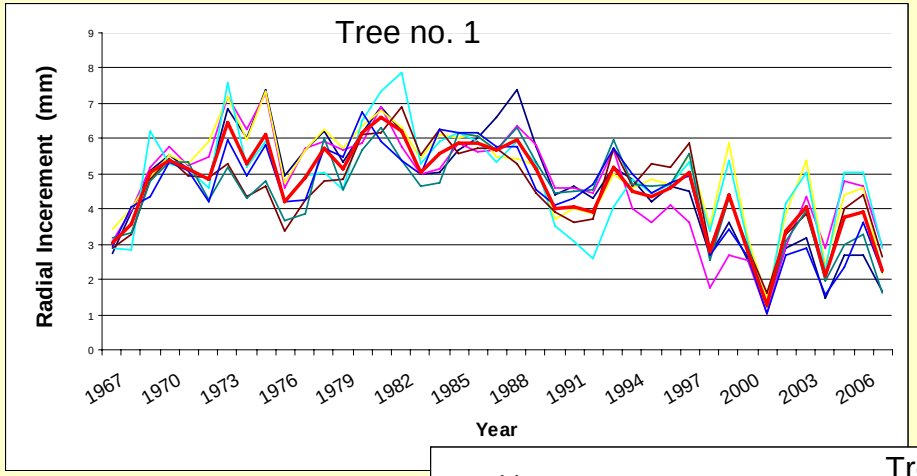


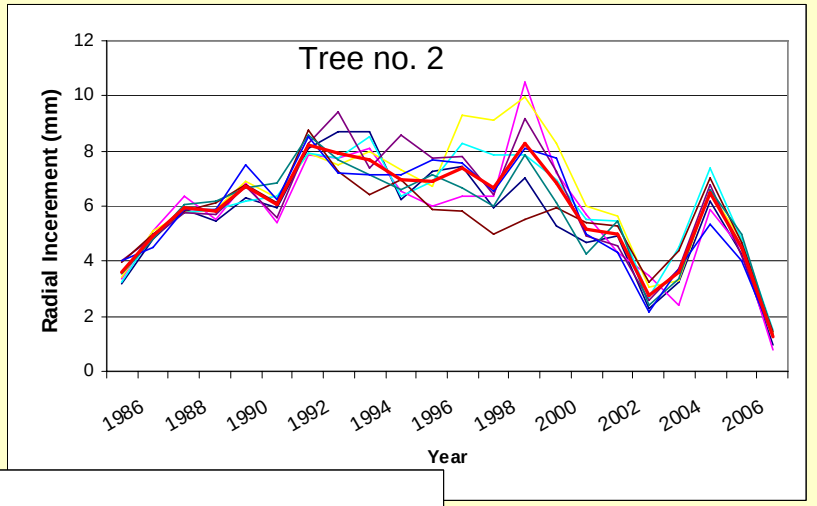


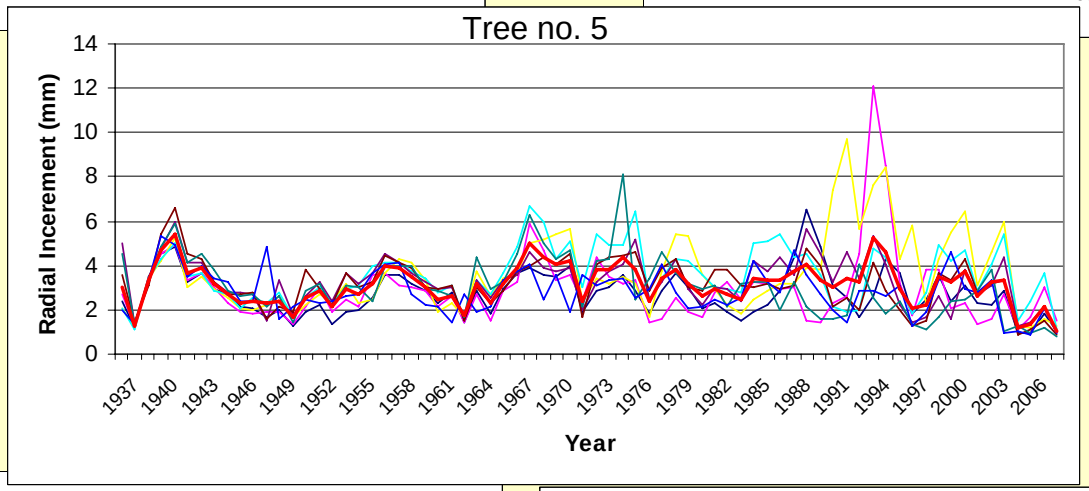
Geographical location of the sampled trees

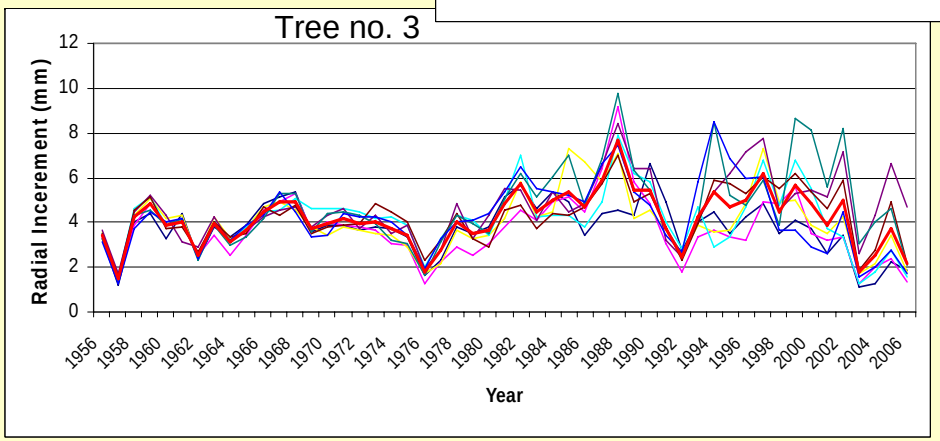


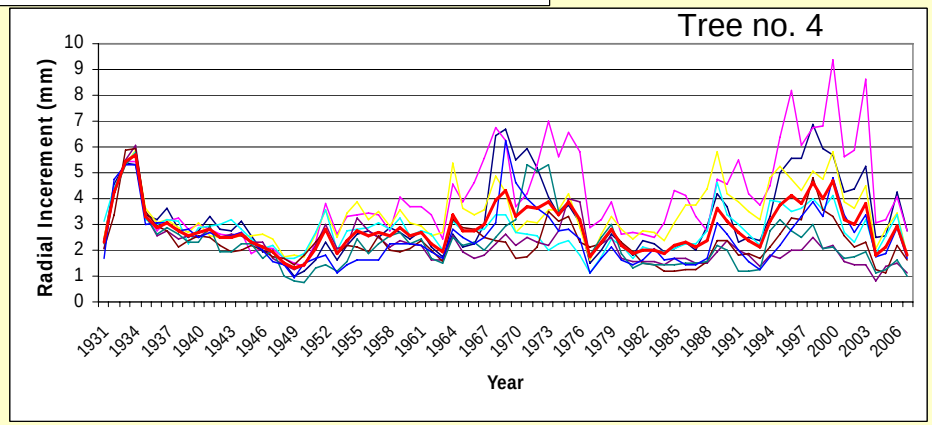
Results 1: Intra-tree variability in radial incerement



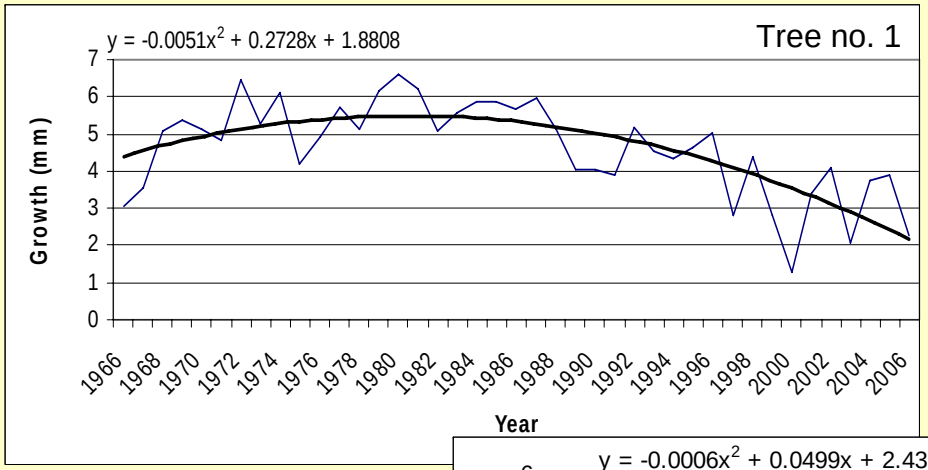


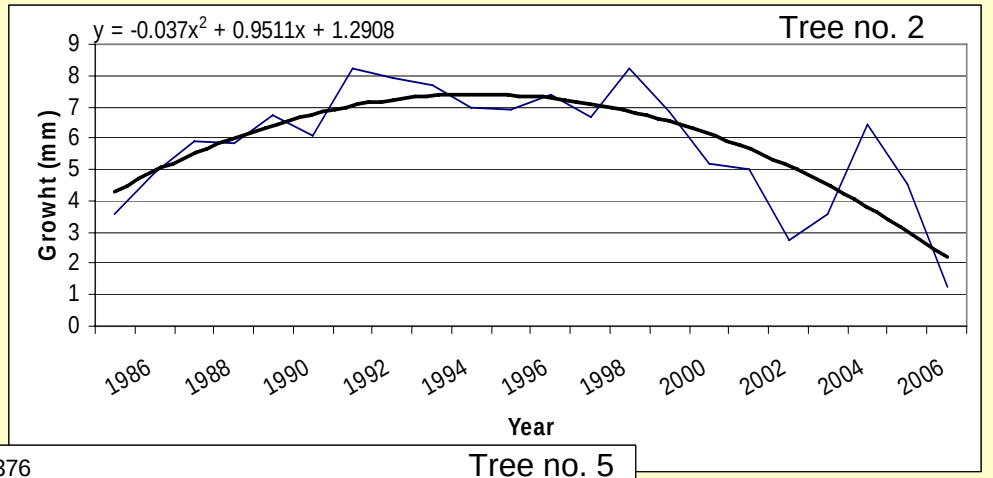


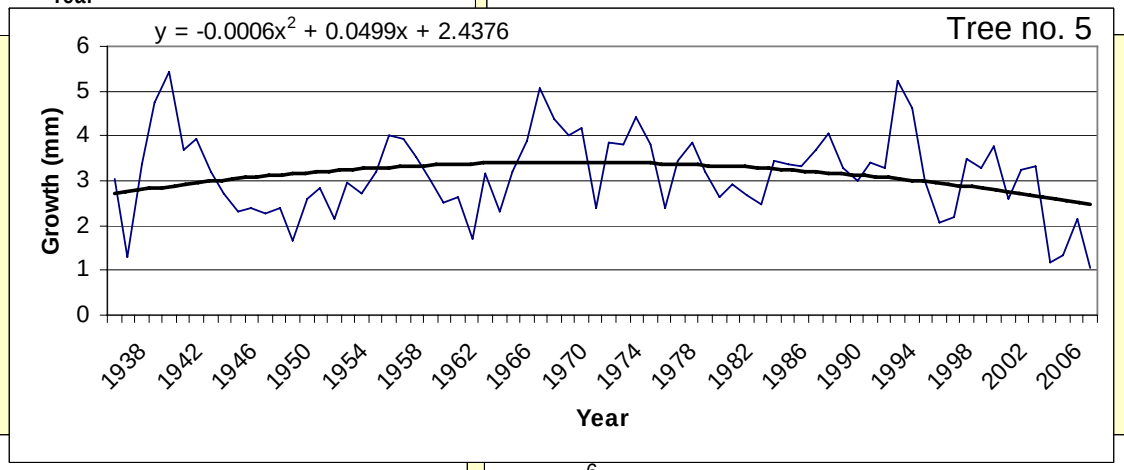


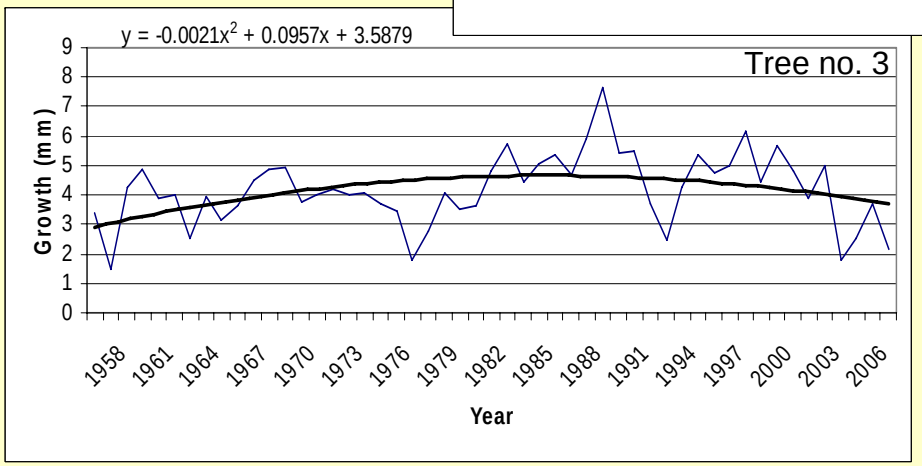


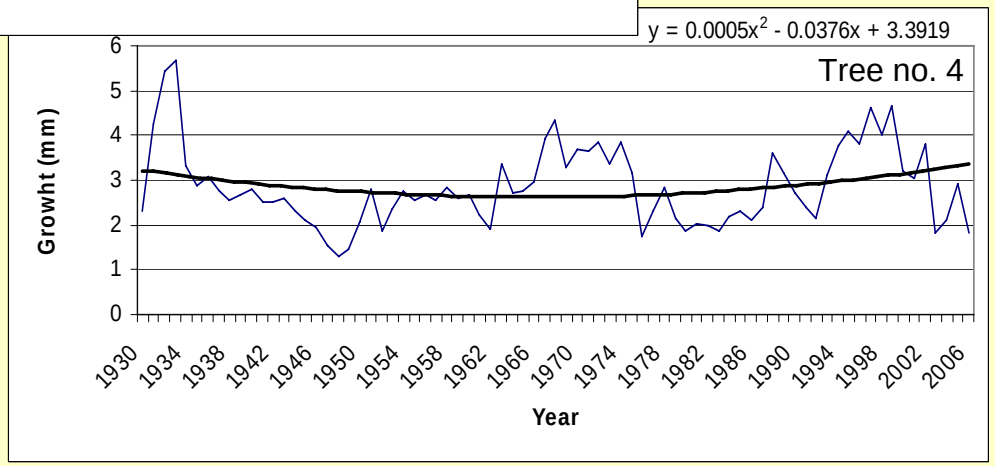
Results 2: Standardization (estimating growth trend)



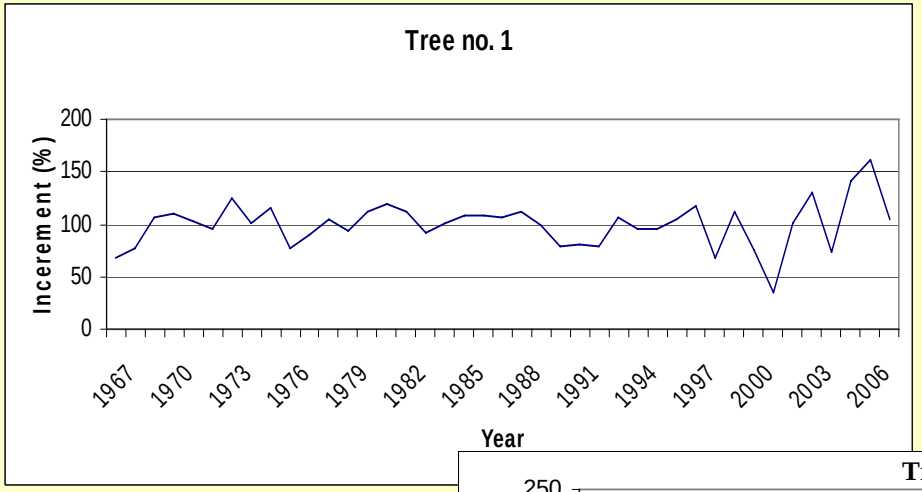


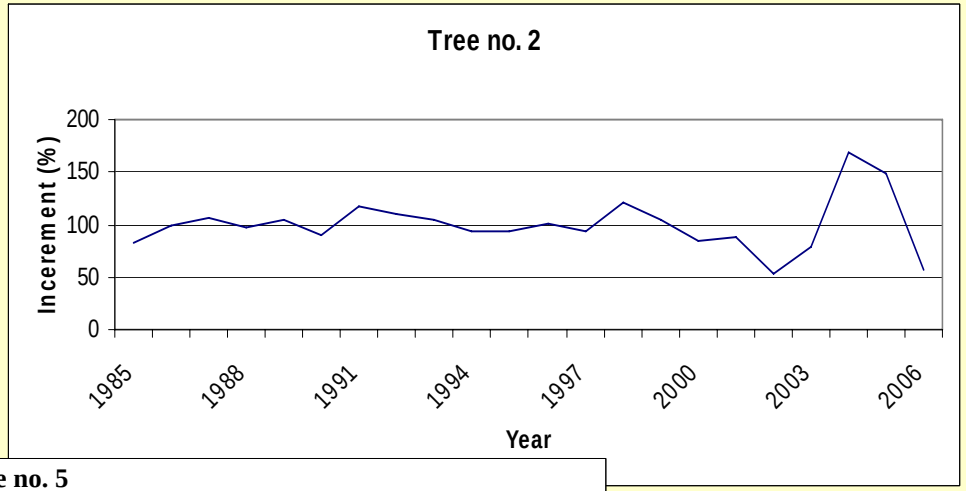


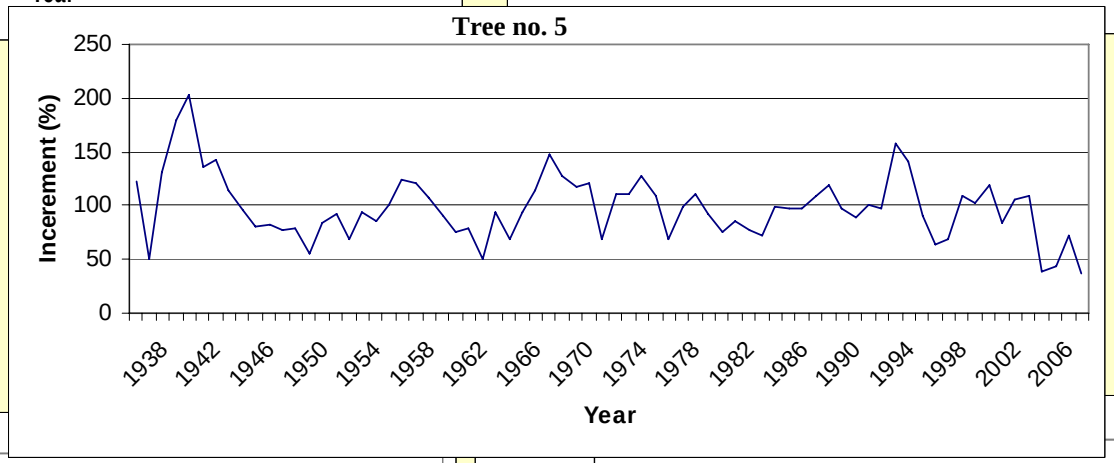


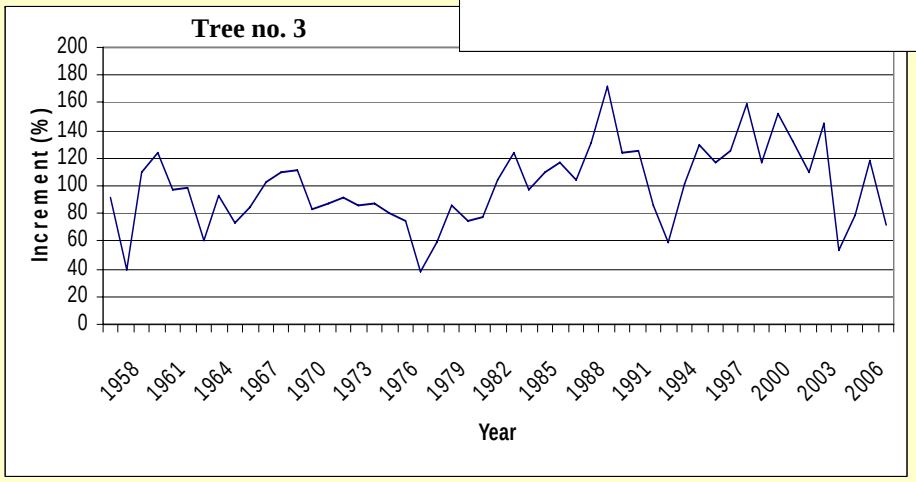


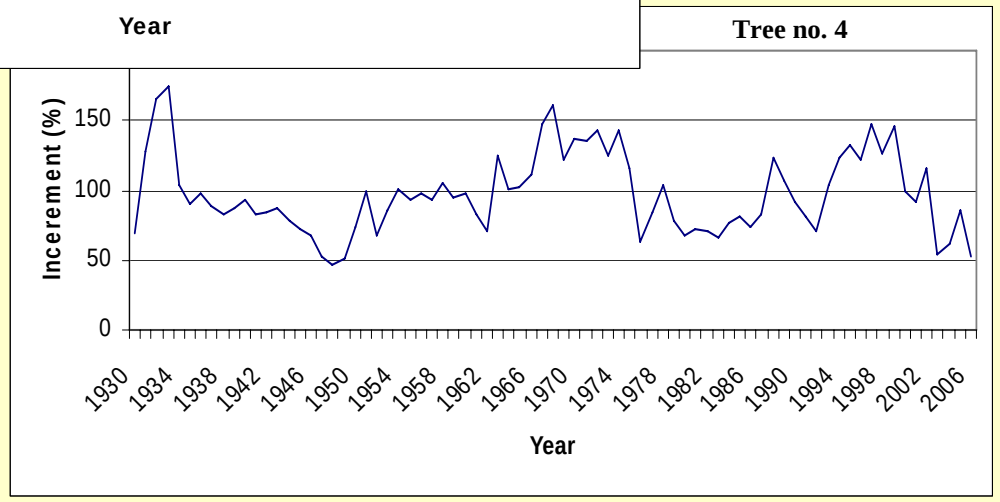
Result 3: Radial Increment Index (IR-index)

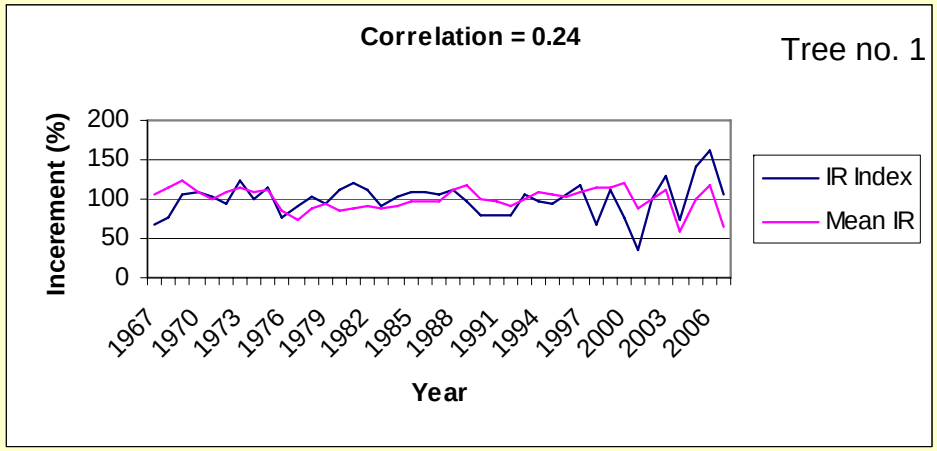


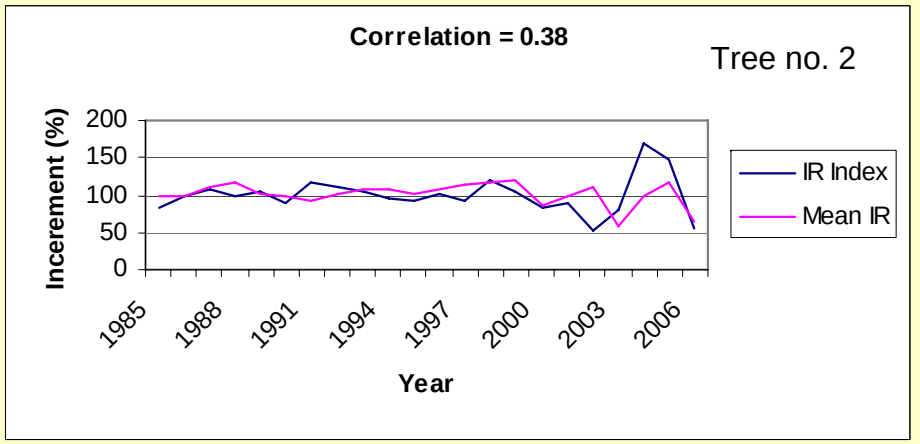


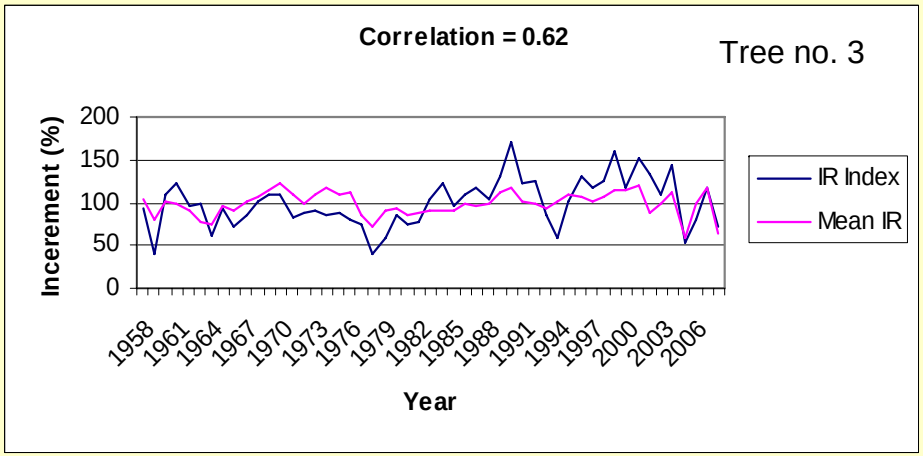


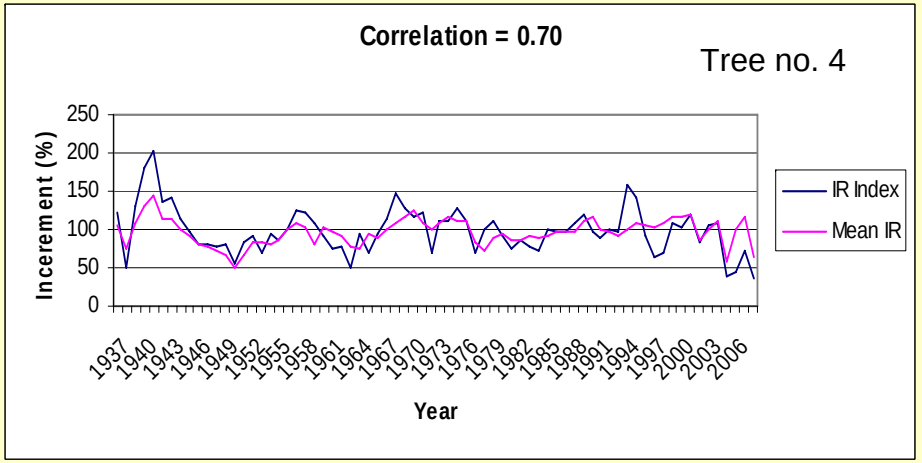


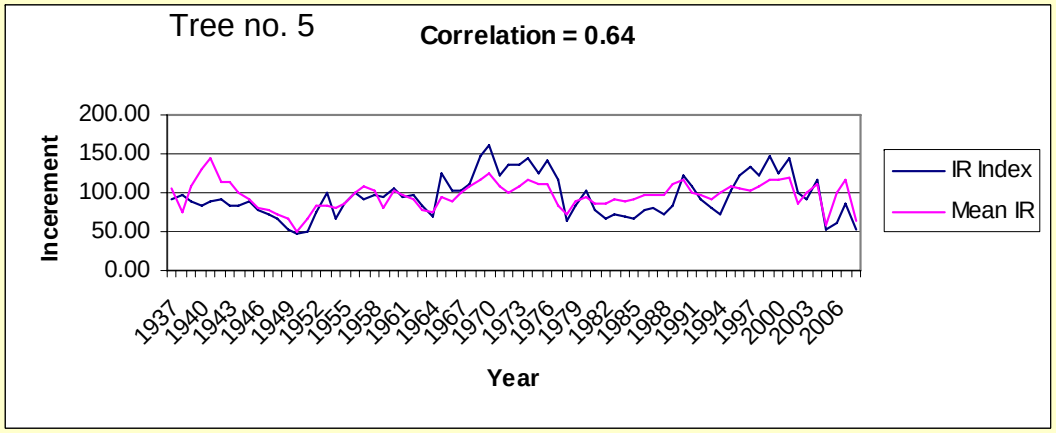



Correlation = 0.24
Tree no. 1
Incerement (%)
200
150
100
50
0
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
Year
IR Index
Mean IR

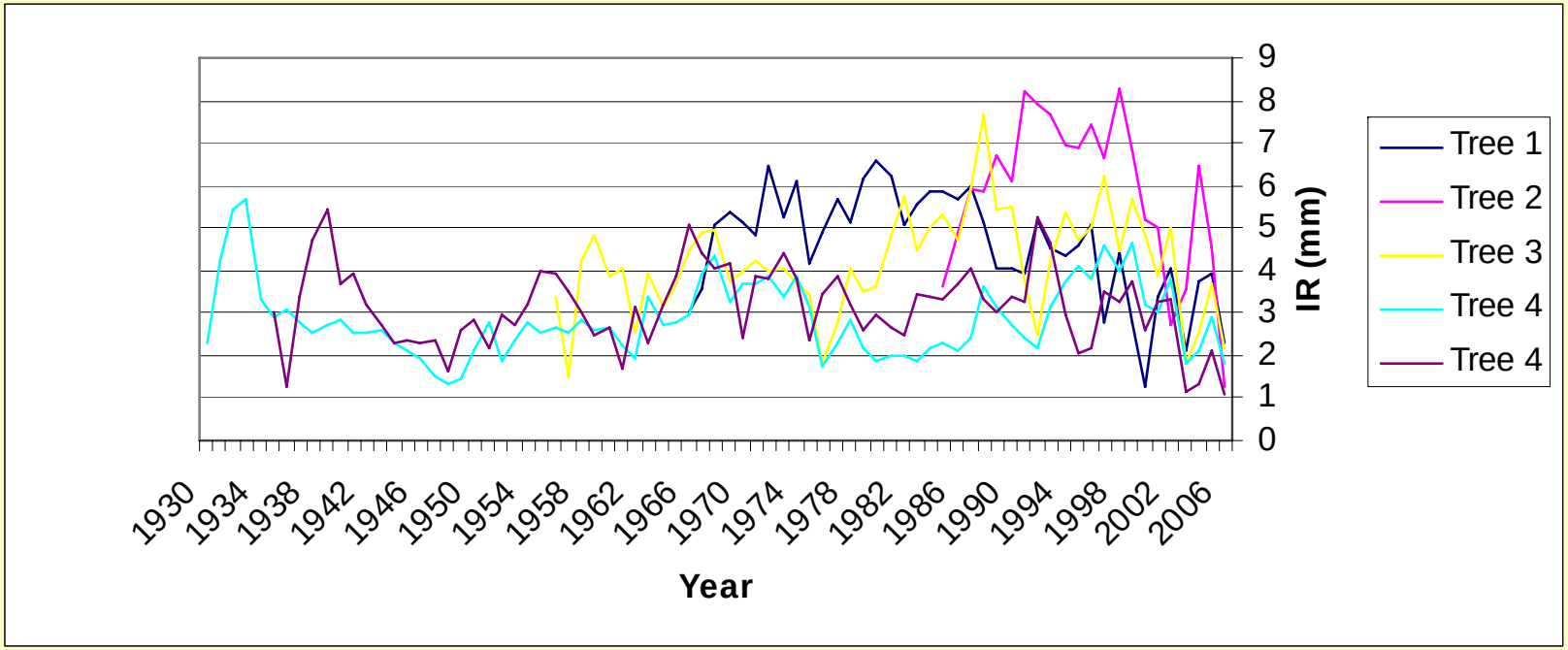

Correlation = 0.38
Tree no. 2
Incerement (%)
200
150
100
50
0
1985
1988
1991
1994
1997
2000
2003
2006
Year
IR Index
Mean IR

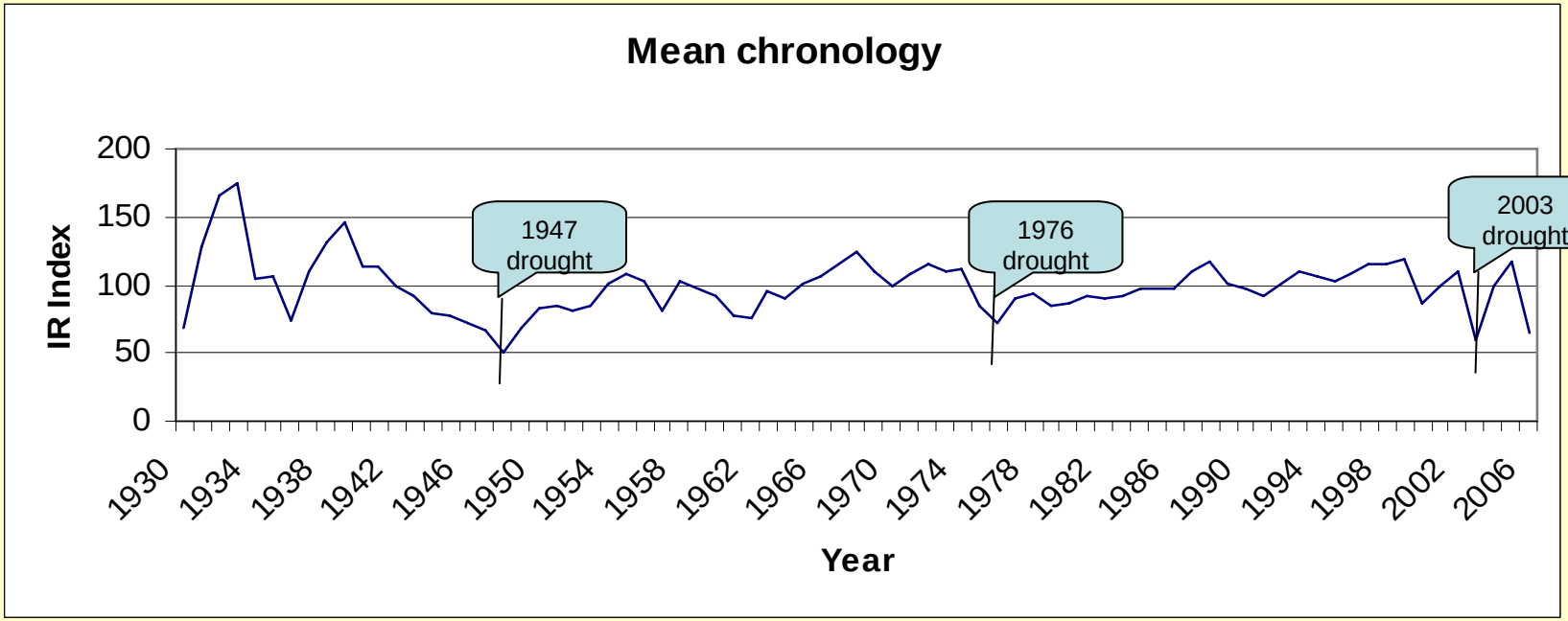

Correlation = 0.62
Tree no. 3
Incerement (%)
200
150
100
50
0
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
Year
IR Index
Mean IR


Correlation = 0.70
Tree no. 4
Incerement (%)
250
200
150
100
50
0
1937
1940
1943
1946
1949
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
Year
IR Index
Mean IR

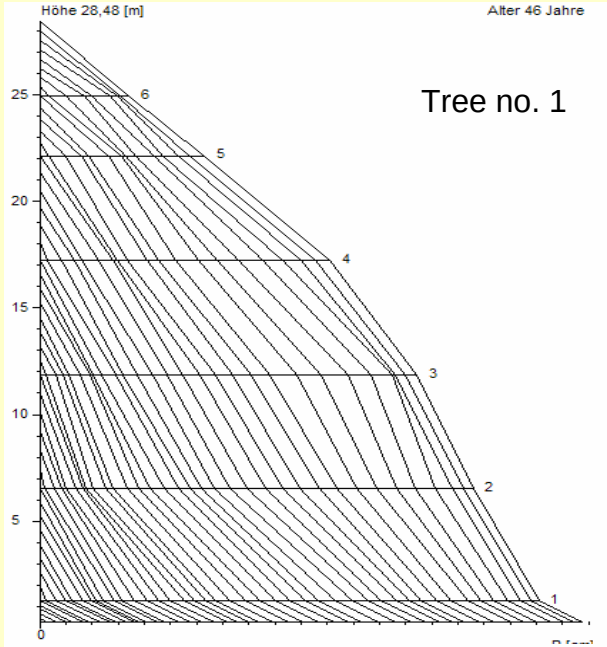

Tree no. 5
Correlation = 0.64
Incerement
200.00
150.00
100.00
50.00
0.00
1937
1940
1943
1946
1949
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
Year
IR Index
Mean IR

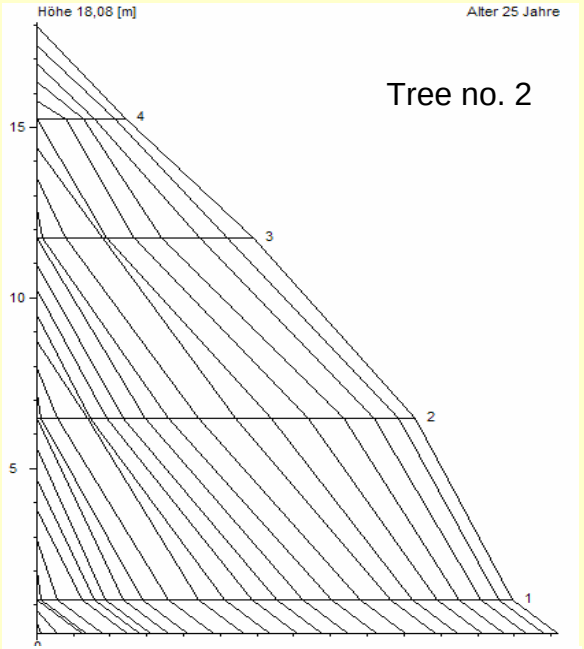
Result 4: Environmental impact on radial growth

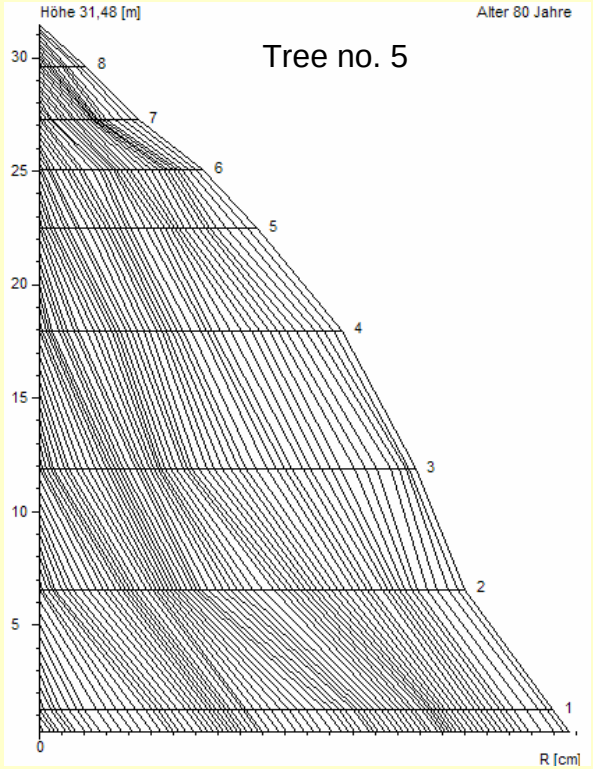


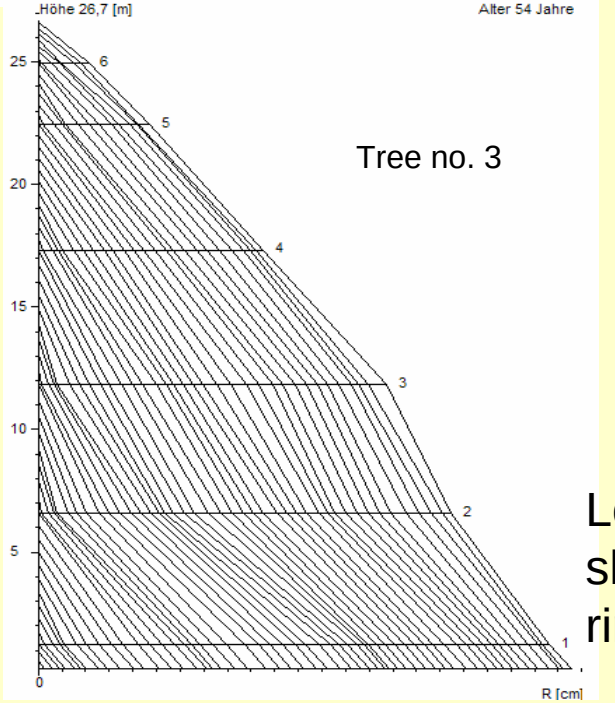


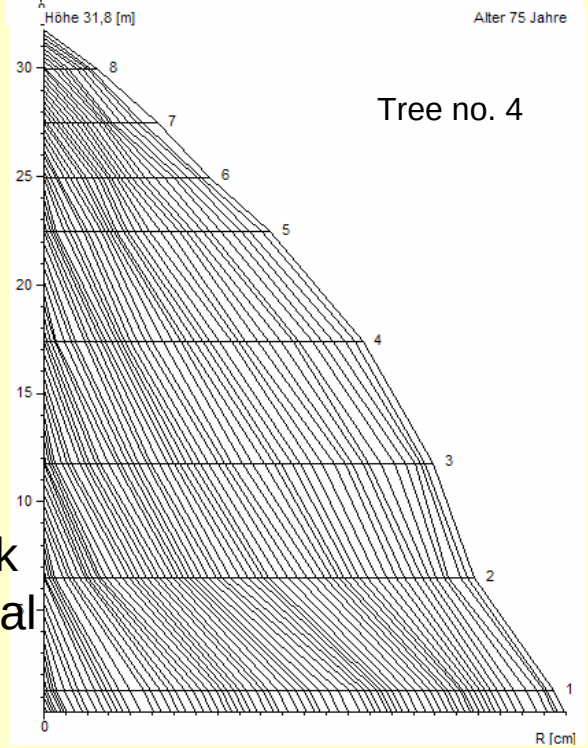
Results 5: Annual rings pattern





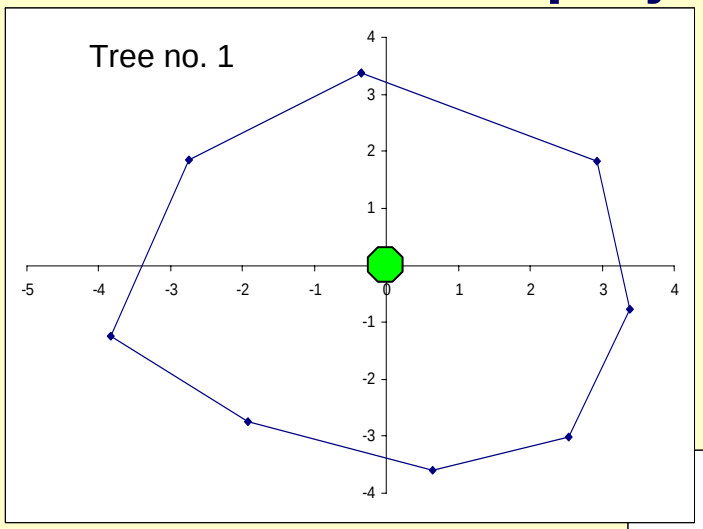


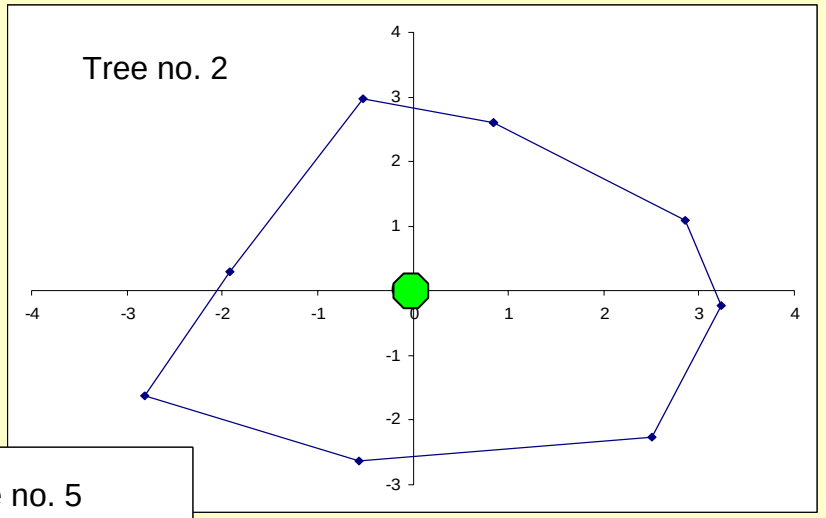


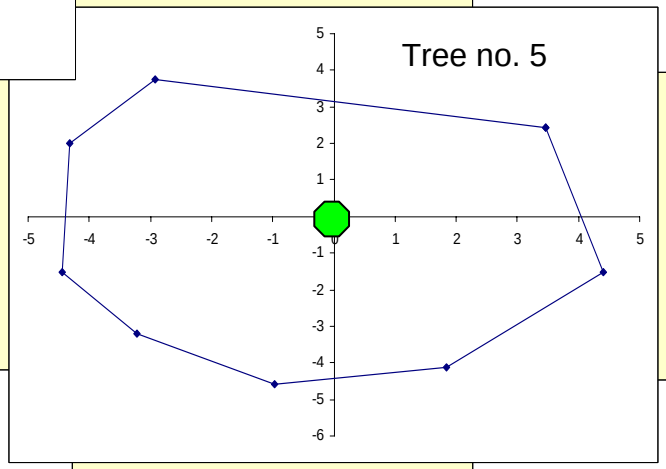


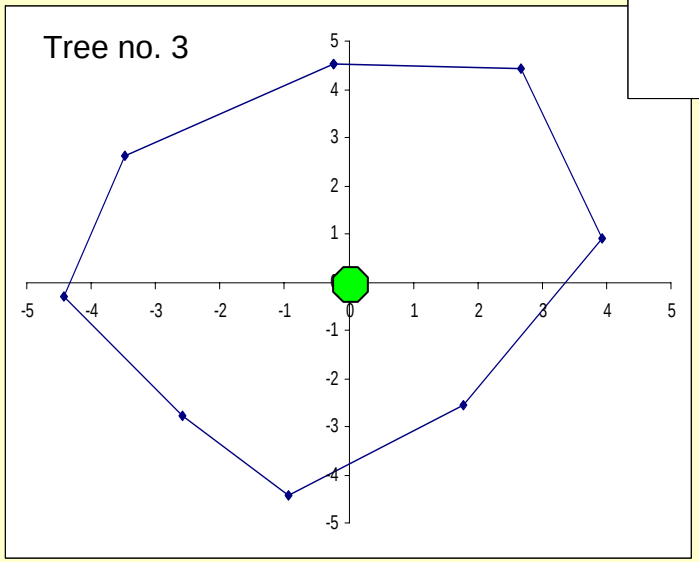
Longitudinal section of the trunk showing the widths of the annual ring profiles with height

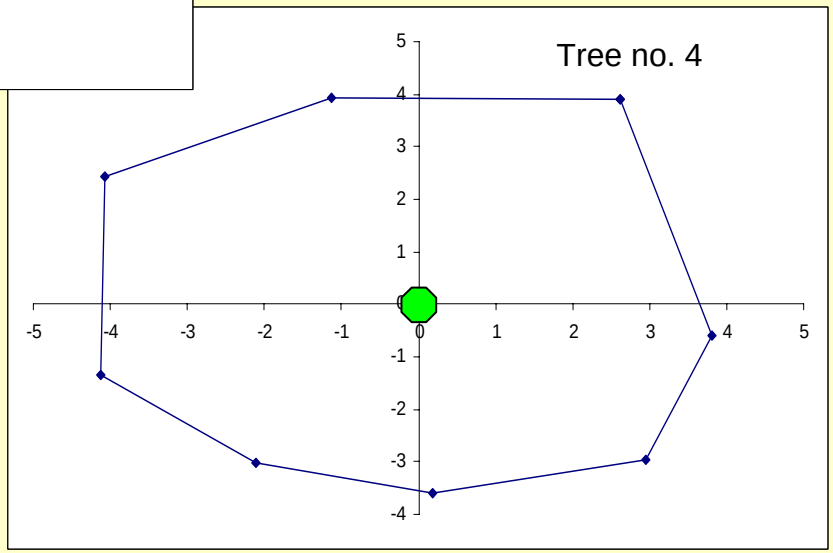
Results 6: Crown projection



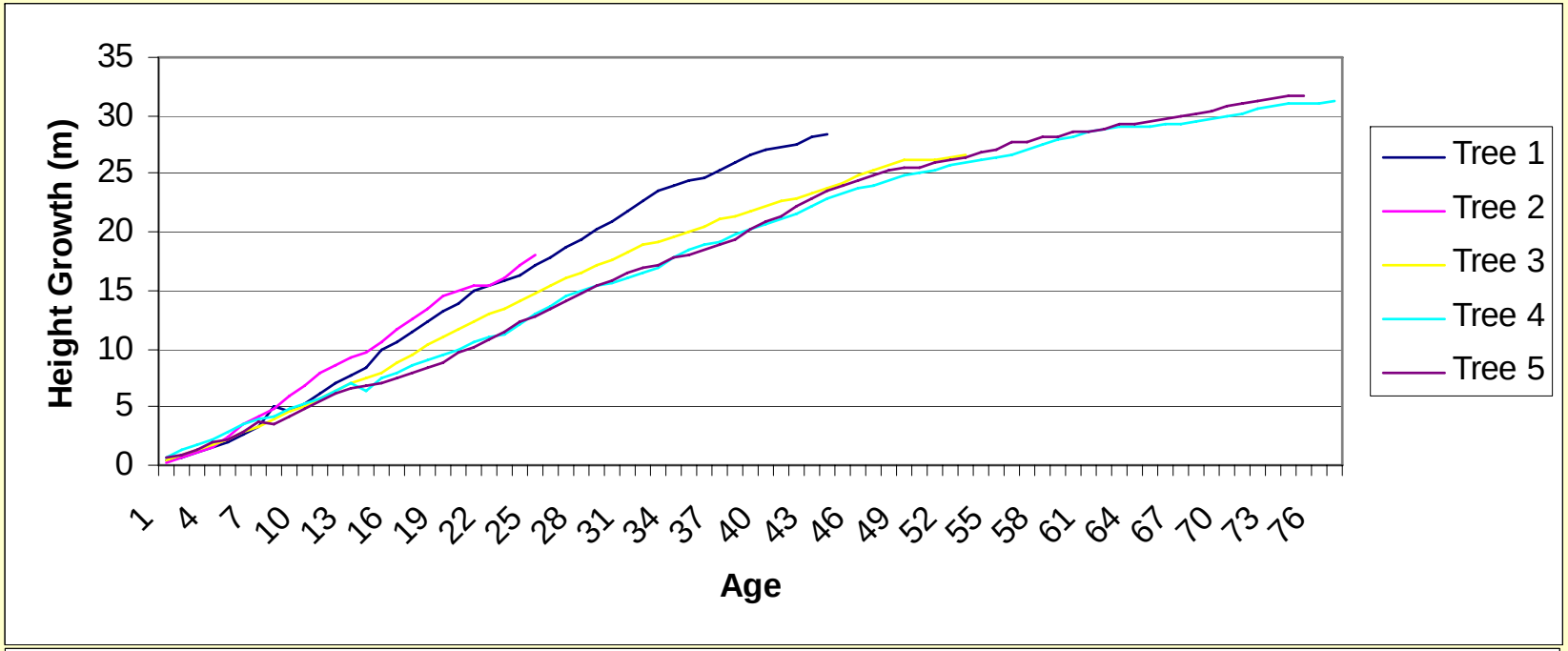


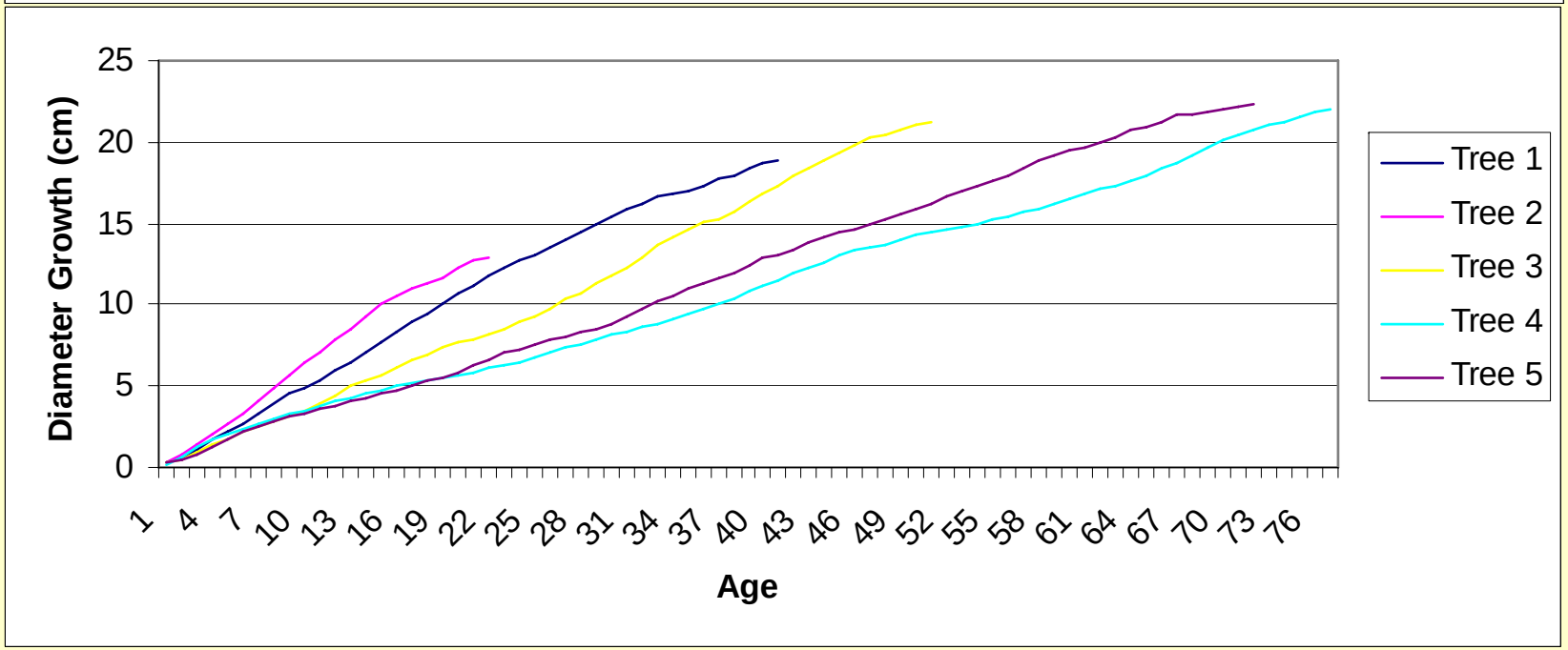




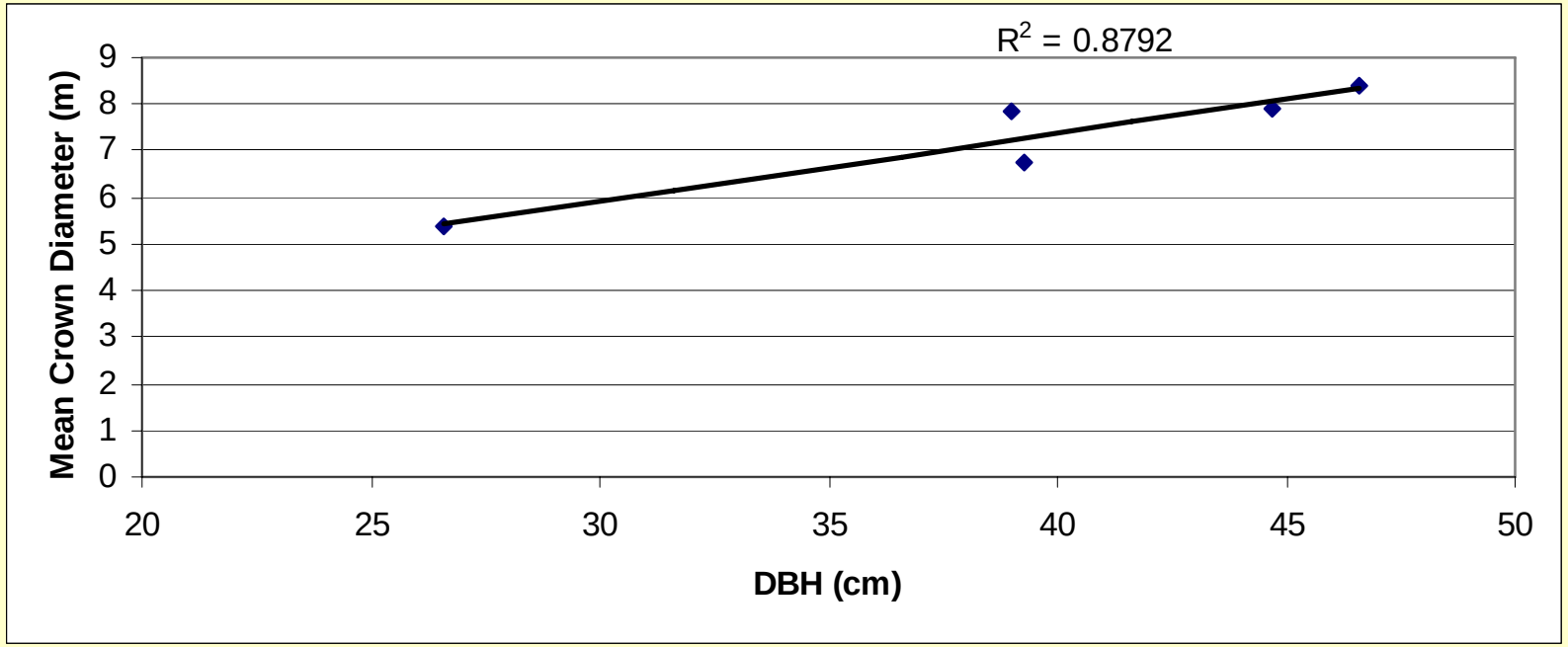


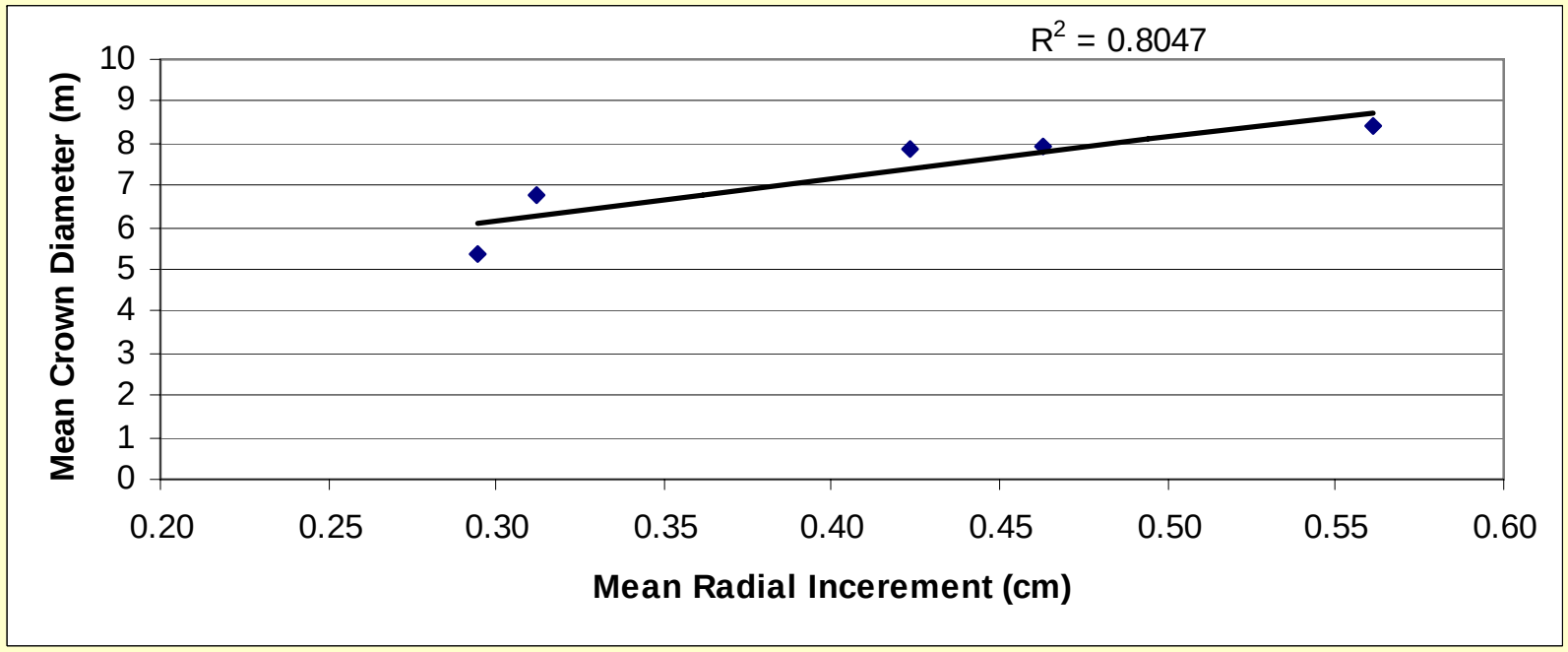
Results 7: Growth and age





Results 8: Crown diameter and DBH/IR





Summary

- Intra- and inter-tree growth variability has been observed. This variability is greatest at the base of the stem and smallest in the crown section (not shown);

- I found a synchronity in annual radial increment. I interpret this as a weather signal.

- The pattern of diameter and height growth and canopy architecture varies among trees. Thus Ring-width chronologies from trees should take into account for management practices;

- A larger crown is related to the higher radial increment and a bigger diameter;

Conclusion

- ✓ The study shows site/tree dependent radial growth trends;
- ✓ Severe decrease in radial growth in drought years (1947, 1949, 1976, 2003);
- ✓ Higher correlation has been observed between crown diameter and DBH/IR;
- ✓ Higher correlation has been observed between IR index of individual tree and mean IR of the all trees;
- ✓ Radial increment is higher at young age;
- ✓ Annual ring profile analysis shows that ring width increases but basal area increment decreases with increasing stem height;
- ✓ The rate of height growth decline with age where as the diameter continues to grow.

Acknowledgement

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Mr. Felix Baab
Ms. Isabella Katz
Mr. Albert Fehrenbach

AND…….


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