**Research Notes**

**Tasks**

* Fit linear regression to this with dendro to see start of szn and end and total expansion during szn
* VPD divided by SWC as an equation to calculate the Water Stress index as per this paper from fes 341
  + A screenshot of a text

    Description automatically generated
* Go through rest of TOMST in TNP high elevation in the tree where leaf temp is higher than air temp
* Email TNP about issues with some of the graphs being weird; grow seas not working; confirming units; and also advice for ecomatik since TNP made for point dendros and also unsure of unit
* Email customer support for ecomatik conversions – goisser sales maanger appls scientist goisser@ecomatik.de cc chris
* When do slopes change start szn 🡪 end szn
* Histogram of sd/v
* Connie Harrington – phenology of cambial growth -> read her paper on determinants of start/stop stratify by site/sprage
  + First date of negative increment of growth
    - Indicator of stress issues
* "We defined a heatwave periods where *daily maximum air temperature* was greater than 1.5 standard deviations above the long-term mean for a period of 3 or more consecutive days. We used xxx as the long-term mean."
  + But long-term mean is usually 1-2 decades of data
  + take mean of tmax and then calc std from that
* Pay attention to which dendros come from which site – van = vanmet cen = cenmet look at where these are on a map
* Check chris’s papers in g drive
* Institute for applied ecology
* David smith post doc
* Mean temperatures at the sites in the field-based study from November through April
* Send 3PG report to chris
* Bigleaf maple dendro analysis

December 2, 2024

uplo7297 if we just started in april or maybe just may 1 bc of pre-may weirdness but if we have everything separated by tree i can have a spearate line of thinking and code individualized for each tree

for next week dec 2 look at ford paper and supplemental so that we can look at model together for initiation days to look at what model precicts should be look at other met stations for uplo for better analysis and modeling

histogram of ZO so we can see when in the year the stressors happen re:early vs late season stress to growth

tHINK ABOUT DOING A FILTER FOR SCREENING AND KEEPING ONLY TOP 10% FOR 646 FOR EXAMPLE also something like a low pass filter that only lets low values pass through also option for top 90th percentile

Run again and only have growing szn in another plots but KEEP EVERYTHING FIOR THESIS kEEP IN mind differences in species potentials

van is a higher elevation site and is a solid month behind others in terms of when growth starts

Next up: di other accumuulatioins like growing degree days (typical for initiating growth) look at email and papers bc in one of them maurice cabban spanniard they talk about temoerature for initiaiting growth and how it can be good modeled. look at other apers by connie harringtoni on modeled df growth; look at r routine that adam used to model bud burst and can do growth initiation - put this equation into r to predict start of growth and compare to what the dendros say instead kevin ford lead author on poth and connie senior authir pn all "will cahnges in ophenology track climate change? coastal df"

Global Change Biology (2016) 22, 3712–3723, doi: 10.1111/gcb.13328

equation 2 modeling growth initiation dates and plotted in figure 2 - READ THIS! THESE arew the kinds olf questions ill be asked in qualifying exams and such

good to show growth and relationship btv modeled initiation stuff ??? maybe we can make a similar equation for WH but maybe connie has done this so in january remind chris tro meet with her

make separate folders for each tree

**Relevant Literature Notes**

Ford et al paper doi: 10.1111/gcb.13328

* Reminder of relevant vocabulary
  + Forcing = Exposure to warm temperatures; typically triggers growth initiation, but many trees also require exposure to cool
  + Chilling = cool temperature requirement of many dormant trees to readily initiate growth in the spring.
* If warming increases forcing and decreases chilling, climate change could maintain, advance or delay growth initiation phenology relative to the onset of favorable conditions
  + advances in growth initiation could have negative consequences if they cause growth to begin before the risk of frost has passed
  + very low-chilling treatments (i.e., very warm winters)
* The decoupling of growth initiation with the onset of favorable climatic conditions could reduce the resilience of coast Douglas-fir to climate change at the warm edges of its distribution.
*  we estimated the minimum amount of chilling required for most trees to initiate growth. To do this, we fit a binomial model of the probability of a tree initiating growth as a function of chilling using data on the proportion of trees within a family (individuals grown from seed collected from the same parent tree) that successfully initiated growth: p where p is the probability of growth initiation, C is the amount of chilling received, c\* is a parameter indicating the number of chilling units at which p equals 0.5 and b is a parameter that affects the shape of the relationship between p and C. We included random effects for each unique treatment environment (to account for any phenologically relevant variability in the treatments not related to chilling and/or any variability in measurements across treatments) and for family (to account for genetic variability) by allowing c\* to vary with these variables.
*  This model defines the ‘possibility line’ (sensu Harrington et al., 2010) that characterizes the different combinations of chilling and forcing at which growth initiation is able to occur where F is the forcing required for height-growth initiation, C is amount of chilling experienced and a and b are parameters. We included random effects for unique pre-initiation environment (to account for any phenologically relevant variability in the environment not related to chilling or forcing, and/or any variability in measurements across site, year or treatment) and for family (to account for genetic variability).
* A math equations with black text

  Description automatically generated with medium confidence For the diameter-growth initiation model, we used the number of chilling and forcing units accumulated at the time of growth initiation for each tree. We modeled diametergrowth initiation at the individual instead of family level because we had fewer observations compared to heightgrowth initiation. However, the more frequent measurements used for observing diameter-growth initiation (stem diameter measurements once every 30 min, compared to the ~weekly observations for height) were likely to compensate to some degree for the smaller sample size in terms of accurately describing the relationship between required forcing and chilling. We modeled the relationship between required forcing and chilling using a Gaussian spline regression model with one knot that allowed the expected amount and variability of required forcing to vary nonlinearly with chilling where F is the forcing required for diameter-growth initiation, r is the standard deviation in F, C is the amount of chilling experienced and the rest of the letters are parameters. The function w allows the functions for F and r to transition smoothly from one linear equation for F (defined by a1 and b1) and one value of r (r1) to a second linear equation for F (defined by a2 and b2) and value of r (r2) between low and high values of C. We also included random effects for unique pre-initiation environment and individual

**Dendro Notes**

* TNP assumes dendro data is stem radius change
* In periods of probable frost (i.e. when the temperature < `lowtemp`) the threshold for outlier detection is multiplied by `frost\_thr`.
* Knusel: Similarly, the thawing of the stem induces magnified stem expansion rates and may occur up to several degrees Celsius above zero depending on the rate of the temperature increase after a frost. These exceptionally large shrinkage and expansion patterns were found to be caused by the steep water potential gradients induced by ice in parts of the stem tissues, moving intracellular water in or out of the living cells [[**7**](https://www.mdpi.com/1999-4907/12/6/765#B7-forests-12-00765),[**36**](https://www.mdpi.com/1999-4907/12/6/765#B36-forests-12-00765),[**37**](https://www.mdpi.com/1999-4907/12/6/765#B37-forests-12-00765)]. To prevent the classification of these patterns as outliers, a user-defined temperature threshold (*frost\_thr*) flags such periods (referred to as *frost period*).
* The horizontal cyan line indicates the potential frost period, i.e. temperatures fall below 5 °C (defined with frost\_thr

**Climate notes**

* Vwc is usually bt 0-0.4; normalize water content
* Instead of putting th

**HJA and Misc Notes**

* My work matters to inform adaptive management as I try to understand and weigh different drivers of tree growth
* Slope analyses in r (rate of change)
* Start of season vs end phenology analyses

Functions to model growth based on TNP output we could then model growth and feed vars we think control it at what points

On avg or location or date whatever what is the avg start day of growth vs end day -> table

Root weighted profile avg for soil moisture

Normalization is to have a relative 0-1 scale based on highest value being the 1

Temp v phase plot (not important) look at canopy v Tair 2022 PNAS paper from chris ,

Historesis pck shows how in phase/lag elliptical things are (not important)

How far back in the chronology do we want to go for tree cores

Blue light reflectance can give procy for density and may be corrected – there’s a paper on blue light reflectancefor a heat wave study

Ask mark about existing core data/cores

2 cores per tree – pith isn’t necessary

20 trees should be good per side

Earlywood/latewood differences can give more info about ratio climate surrogates

We expect for 2021 to see a thin/faint latewood band and a shorter overall band

Peter bedlos coast to crest dendros

After mounting 1 dot = 1 decade

Mounting then sanding can happen in an afternoon and computer stuff can be done in a weekend or so

After collection on site put in straws then mount

Be cazreful to core across slope to be mindful of tension and compression wood

Fab aspiurated is good to takew bias away from heating

Not all primet and dscmet columns in metadata are in the actual files – see INCOMPLETE examples in paper notes

11 sited with dendoes but only ecomatic at 5 sites captured heat waves thru July 2023 fire. Across the elevation gradient the lowest elevation ot the worst wrom fire so this may be interesting to see through a larger sample of cores.

Connect with cole Doolittle who is also doing dendro work

Scorch varies but is worse with vpd and canopy temp is high

Most dendros are df and wh but some wrc

Epa has some papers comparies manual dendros and cores

2015 was a hot and dry yeae and 17 was wet but hot so these would be good to compare

2021 was the worst

Manual dendros re usua;;y ,easired weekly

Sometimes a first rain can cause a spike in swelling and this is partially why spring fluctuations can be hard to assess real growth and dendrows can over exaggerate rain bumps and you should be careful having tnp smooth these bumps. Also be careful to discount data on the day of the installations.

“waring rule 3pg 5 deg c”

Dendros are mostly n facing and or shaded to reduce sunlight exposure that can affect data related to importance of fan aspirated data in low wind environments

 heat waves are 1.5 standard devs away from mean for three days in a row eg

so i could look at primemet data and see how that goes

long term mean is typically 1-2 decades of data

i ideally need daily tmax

reach out to julia and ask for long term air temp records the unadjusted Tair dataset from PRIMET

take mean of tmax and then calc std from that

r package to calculate heat waves i can install and itll do the 3 days  check tho if this is what i want bc it is marine heat waves

then i can say my calcs show that there were heat waves during X periods of time

<https://cran.r-project.org/web/packages/heatwaveR/readme/README.html#:~:text=The%20heatwaveR%20R%20package%20contains,introduced%20in%20Schlegel%20et%20al>

latewood vs earlywood

if theres time i can do XY

**From:** Still, Christopher <Chris.Still@oregonstate.edu>  
**Sent:** Friday, March 29, 2024 3:47 PM  
**To:** John, Gabhriel <gabhriel.john@oregonstate.edu>  
**Cc:** Schulze, Mark <Mark.Schulze@oregonstate.edu>  
**Subject:** useful review paper on plant growth

attached

Andrews and the epa

google earth as a skill

email with r and arc gis   
bill Hammond looking at temps and vapor pressure

Heat down response

Dendrometer data can be fed into r and can calculate tree water deficit and growth

Have chaney show me tree package

Western hemlock and doug fir there are. These atwo are great to look at because they are the two dominant species to look at despite being ecologically different. Hemlock is shade tolerant and understory. Hemlock may be less heat tolerant.

Get data from Andrews. Tree water deficit and growth.

Mark Schultz data did this and chris near metolias with ponderosa pine

Heat waves are coming more frequently and are more intense and might even be lasting longer. It is important to understand the degree to which . lots of info on drought responses but can be different.

Tree phys commentary from chris paper critiqueing heat vs drought

Hemlock might be more affected because smaller generally speaking and not used to sun and wind and drought

Talk to chaney mark’s Data will be circumference data which is different from point dendrometers

Adam Sisley

Hja is mediterrannean climate

One goal of work is to predict tree growth patterns and TWD

Vpd can be separated into temp v humidity. When used in conjunction w dendro, this can give insight on heat waves and their effects governmed by air h20 and can show how much h2o plant loses(from physfest Sean)

20-30 trees per site 2 cores per tree

See blue notebook for notes from committee meeting etc

Usgs soil type = soil fertility from the Andrews literature could probably come up with a “fudge factor” silt clay loam percentages –

Available soil water

3pg support

Some units are specific to a sensor

Ultimate setup is to find circumference change based on circumference at every time increment which can be converted to basal area increment

Maybe I want to cmpare smoothing and not smoothing

Measurable groqth plateau in august

First date of negative increment of growth

* Indicator of stress issues

Maybe can do smoothing but don’t include end of griqiunbg season or post groqing season so that rain induced expansion is eliminated

TOMST unit is radial increment / displacement at a single point (micrometers of expansion) to get to diameter or basal area we have to take; cm2/yr; pir^2b – pir^2a with the two rs being different and that’s how area increment is calculatured

Ecomatik data run through the excel file is output as circumference is so you can get to basal area increment

The hard part of both dendrometers is cleaning out bumps and resets – smoother if you can just get it out before running through –

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When finding bumps we could compare across other trees and also precipitation events to try and find qhether or not a bump is real or not . everything downstream will be easier if some manual cleraning is done before hand

Starting circumference we need to know for ecomatik – new ecomatik is carried forward – reset the plunger every year or two.

Go through excel file and check with mark to see if I did it right

1 hemlock, DT, and 1 small DF have both TOMST and ecomatik

Meditterannean climate and having a lot of rain in the fall is contributing to odd measurements in latewood expansion – another reason to only include growing szn

How to account for this? Punch cores – take a chunk of the tree and measure cells in phylogenesis. This can help us tease out instances of shrinkage due to water while tree is actually growing -! Without this how do we assign end of season expansion to actual growth during the growing seasons?

Most likely “wonky” record in provisional portal is precip – most other flags are pretty good. Especially if it looks like

To get good precip I kinda want to gap fill those blanks and look at other stations to help estimate – important because if I just NA out questionable values that can lose significant records and create a misleading story