*Date of study*

Started in 2019, ongoing

*Date of Public Archiving:*

Data are mainly Carl Bogdanoff’s, so need to discuss with him

*Last modified*:

June 22nd 2022

*Goal*

1. Build a predictive winter hardiness model
2. Build and publish a winter hardiness dashboard for communication with growers

*Contributors*

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Note; see a separate where data code live documents for info on teh cold hardiness dashboard

*General Files*

| **File** | **Where** | **What** |
| --- | --- | --- |
| Docs folder | Github: [docs](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/docs) | Notes from meetings, reading, or ideas that relates to cold hardiness |
| DoseResponse\_writeup.pdf/tex | Github: [docs/writing](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/docs/writing) | Faith’s notes on the methods and results from the Dose Response Model |
| SubmissionLetter\_ecology.pdf | Github: [docs/writing](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/docs/writing) | Most recent (June 2022) cover letter for submission to Journal of Ecology |
| DoseResponse\_Manuscript.Rnw/pdf | Github: [docs/writing](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/docs/writing) | Main manuscript text. |
| DoseResponse\_Manuscript\_supp-concordance.Rnw/pdf | Github: [docs/writing](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/docs/writing) | Supplementary manuscript text |

*Code used in the manuscript*

| **File** | **Where** | **What** |
| --- | --- | --- |
| FreezeDayModel.R  (Manuscript code) | Github:[analyses/ClimateAnalysis](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/ClimateAnalysis) | The main code used in the manuscript that makes the maps and does all analysis on them. Maps of number so ffreeze days per grid cell. |
| ProcessingTmin.R | Github:[analyses/ClimateAnalysis](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/ClimateAnalysis) | Reading in cropped tmin rasters and making some nice maps and plots |
| cleanTmin.R | Github:[analyses/ClimateAnalysis](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/ClimateAnalysis) | Code that crops all the rasters to the okanagan valley. This code was run on Midge.  Map layers downloaded cropped were from http://hydrology.princeton.edu/home.phpcitation Sheffield, J., Goteti, G. & Wood, E.F. (2006) Development of a 50-year high-resolution global dataset  of meteorological forcings for land surface modeling. Journal of Climate 19, 3088–3111. They are too big for github so stored on Midge. |
| ScrapeingBCClimateData.R | Github:[analyses/ClimateAnalysis](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/ClimateAnalysis) | Faith scraped some climate data from Penticton, Summerland and Osoyoos weather stations and plotting it. |
| DRC\_flagged.R  (manuscript code) | Github: [analyses/DoseResponsModel](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/ClimateAnalysis) | This is VERY IMPORTANT code. It is the code needed to run the final model, save the output, and create all we need for the hardiness manuscript. STan files referenced: doseResponseDBVarSite\_ncp.stan |
| DoseResponsePara2.R | Github: [analyses/DoseResponsModel](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/ClimateAnalysis) | Faith was having trouble getting her model to fit, so reached out to discourse. https://www.biorxiv.org/content/10.1101/2020.03.16.993162v1. This R code (and associated Stan code) is her attempt to get the suggestions to work. In the end they did not improve fit so were not incorporated into the final model. Stan files referenced : doseResponse2\_priorCheck.stan, doseResponsedPar2.stan |
| DoseResponceParaabc.R | Github: [analyses/DoseResponsModel](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/ClimateAnalysis) | ANother re parameterization based on the Discourse post. In the end they did not improve fit so were not incorporated into the final model. Stan files referenced : doseResponse\_abcParam.stan |
| DoseResponce\_PrincetonData.R | Github: [analyses/DoseResponsModel](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/ClimateAnalysis) | Trying our DRC model using Princeton weather data. Faith did this to check the influence of our choice of climate data on final results. Stan files referenced: doseResponseDBVarSite\_ncp.stan |
| DoseResponse\_sim.R | Github: [analyses/DoseResponsModel](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/ClimateAnalysis) | his is quite along script where Faith went through the whole process of building the model, from laying out observational space, to simulating data, running a few different parameterisations, and checking model fit. Stan files referenced: doseResponse\_priorCheck.stan, doseResponseSimple2.stan, doseResponse\_priorCheck\_vars.stan, doseResponsedVar\_ncp.stan, doseResponsedVar.stan, doseResponsedVar\_ncp.stan, doseResponse\_priorCheck\_varsSites.stan, doseResponsedVarSite\_ncp.stan, doseResponse\_priorCheck\_varsSitesDB.stan, doseResponseDBVarSite\_ncp.stan, doseResponseDBVarSite\_ncp\_predict.stan |
| LTEvsSampleDatePlot.R | Github: [analyses/DoseResponsModel](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/ClimateAnalysis) | Code Faith made for Lizzie to make a nice hardiness plot for a presentation. |
| *Stan* folder | Github: [analyses/DoseResponsModel](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/ClimateAnalysis) | the Stan files used in the DRC R scripts mentioned above |
|  |  |  |

*Data and Code*

Give info on how to track down all locations given in table below (even if link fails). Two good examples given below -- delete these for your file!

**Github** [https://github.com/lizzieinvancouver/bcvin/hardiness](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness)

# Data

| **File** | **Where** | **What** |
| --- | --- | --- |

| Nov25-26\_2020 Hardiness\_Variety\_Growers EM-1.pdf | Github:  f[romCarl/Hardiness2020Data](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/fromCarl/Hardines2020Data) | A data spreadsheet sent from Carl’s lab of recorded LTE 50 for varieties on Nov 25-26 2020 |
| --- | --- | --- |
| \_2012-2022 Okanagan Bud Hardiness Data.xlsx | Github: [fromCarl](https://github.com/lizzieinvancouver/bcvin/blob/master/hardiness/fromCarl/_2012-2022%20Okanagan%20Bud%20Hardiness%20Data.xlsx) | A spreadsheet sent from Carl for the hardiness data between 2012 and 2022. |
| germplasm DTA.xlsx | Github: [hardiness/fromJasonLondo](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/fromJasonLondo) | Data Shared by Jason Londo after a meeting about Hardiness. Data is the LTE data from Jason and Al’s 2017 AJEV paper. Mostly wild material. XLSX version exactly as sent by Jason. |
| LondoHardiness\_2017\_AJEV\_paper.csv | Github: h[ardiness/fromJasonLondo](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/fromJasonLondo) | Data shared by Jason Londo after a meeting about Hardiness. Data is the LTE data from Jason and Al’s 2017 AJEV paper. Mostly wild material. CSV version. |
| fromJasonLondo Readme | Github: h[ardiness/fromJasonLondo](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/fromJasonLondo) | Text that was in the email Jason attached the data to. |
| 2012-2018\_PENTICTON\_WEATHER\_EM.csv | Github: [analyses/input](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/input) | Weather data from the Penticton agCanada weather station between 2012-2018 that Carl used to build his hardiness model. Missing Penticton weather data was usually filled in with Env Canada Summerland weather data. You might already have thi |
| Budhardiness2012to13.csv to budhardiness2020to2021.csv | Github: [analyses/input](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/input) | Bud cold hardiness provided by Carl from 2012 to 2021 in separate csv files for each winter season. They mostly come from 'Bud Hardiness Chardonnay Model FINAL FINAL-v16.xlsx' under the `Hardiness Tables 2012-18' tab, then under:  2012 - 2013 Winter Grape Bud Hardiness Okanagan. Valley BC. Newer data comes from \_2012-2022 Okanagan Bud Hardiness Data.xlsx |
| climhist\_19812010.csv | Github: [analyses/input](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/input) | Historical climate data between 1980 and 2010 that Carl used as his historical baseline in his model |
| DummyTempChard.csv | Github: [analyses/input](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/input) | Simulated data for Chardonnay used for getting Carl’s hardiness model working |
| envcanada\_penticton.csv | Github: [analyses/input](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/input) | The same as 2012-2018\_PENTICTON\_WEATHER\_EM.csv but a without missing data filled in. |
| WashingtonHardinessData\_Ferguson.csv | Github: [analyses/input](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/input) | Data Faith pulled from Ferguson et all 2014’s downloadable hardiness model spreadsheet. This data is for Cab Franc growing in Washington State. We don't have permission to use it, although it is in the public domain. |
| meanTemps2013toLastYear.csv | Github: [analyses/input](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/input) | Two day average temperatures used in Carl’s hardiness models |

# From Carl

| Newsletter Varietal Hardiness Ranking - new draft to edit 4\_16\_2020.pdf | Github: [fromCarl](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/fromCarl) | A document Carl sent us where he ranks cold hardiness of each variety according to his model. Really useful for referring back to our model! |
| --- | --- | --- |
| Jan 2020 - Climate Characteristics of Grape Production Regions (Bogdanoff Bowen Estergaard AAFC-Summerland).pdf | Github: [fromCarl](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/fromCarl) | The title says it all. A document laying out climate characteristics of Grape Growing Regions. |
| GDD\_email.pdf` | Github: [fromCarl](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/fromCarl) | Extra info on where GDD numbers come from in Car’s model |
| emailsCarlHardiness.txt | Github: [fromCarl](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/fromCarl) | Some ideas from Carl |
| CarlMeetingSep020.pdf/txt | Github: [fromCarl](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/fromCarl) | A document prepared by Faith to update Carl on where hardiness modeling was in mid 2020 |
| 2012-2018 PENTICTON WEATHER.xlsx / 2012-2018 PENTICTON WEATHER 1.xlsx / 2012-2018 PENTICTON WEATHER EM.xlsx | Github: [fromCarl](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/fromCarl) | Penticton historical data where Carl has done some of hist excel wizardy. |
| Nov2020CarlModels Folder | Github: [fromCarl/Nov2020CarlModels](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/fromCarl/Nov2020CarlModels) | As of November 2020, these are the most up to date models of winter Hardiness Carl has sent us. Everything happens on the Excel Spreadsheet. Carl did not send us written instructions for these models but teh instructions in older/Chardonnay Hardiness Model Instructions for v16-4.docx should be mostly relevant |
| Older Folder | Github: [fromCarl/older](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/fromCarl/older) | Various iterations of the Model’s Carl has been working on this year. There are written instructions to accompany the xlxs files. |

# Non-Manuscript Analysis

| *LinearModel* folder | Github: [analyses](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses) | This folder contains Faiths attempts (R and stand files) at a linear model for winter hardiness. She has since moved on to dose response curves. |
| --- | --- | --- |
| *CarlModelMay2020* folder | Github: [analyses](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses) | R code written by Adam to re-create the version of Carl’s Merlot model that Carl sent us in May 2020. See README.txt and howTheModelWorksMay2020.pdf for full details. This model was used to build Adam’s dashboard, but is now outdated |
| simulatingFerguson\_stab.R | Github: [analyses/FergusonModel](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/FergusonModel) | Here Faith simulated data based on the parameters provided by ferguson et al 2011. I also  wrote and ran a STAN model. but as yet it is not predicting the parameters very well.  (I scraped the temperature data from one of their plots.) |
| simulatingFerguson\_therData.R | Github: [analyses/FergusonModel](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/FergusonModel) | I got access to the temperature and hardiness data of Chardonay, and the updated model  parameters from Ferguson etal 2014. I am trying to simulate data from these, and then build  a model that predicts them. |
| hardiness\_stab.R | Github: [analyses/oldCarlModel](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/oldCarlModel) | This script replicates Carl's spreadsheet from the end of 2019, and needs the ColumnXX\_function.R scripts to run |
| ColumnCC\_function.R  ColumnCE\_function.R  ColumnCF\_function.R  ColumnCG\_function.R | Github: [analyses/oldCarlModel](https://github.com/lizzieinvancouver/bcvin/tree/master/hardiness/analyses/oldCarlModel) | These R files contain longwinded loops to replicate Carl's excel spreadsheet model  ColumnCC\_function.R  ColumnCE\_function.R  ColumnCF\_function.R  ColumnCG\_function.R - this one does the rest of the columns as well in one giant loop. |