

Modeling Poplar Growth

[HTTP://poplarmodel.org](http://poplarmodel.org)

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Dept. Land, Air and Water Resources



Feedstock



Conversion



Sustainability



Education



Extension

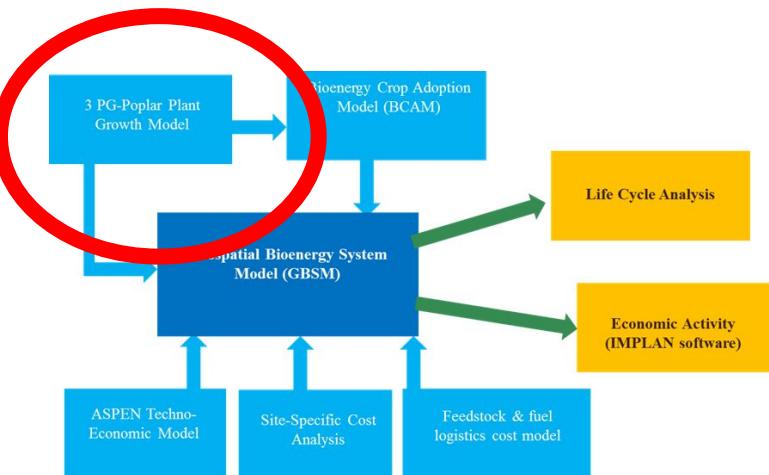
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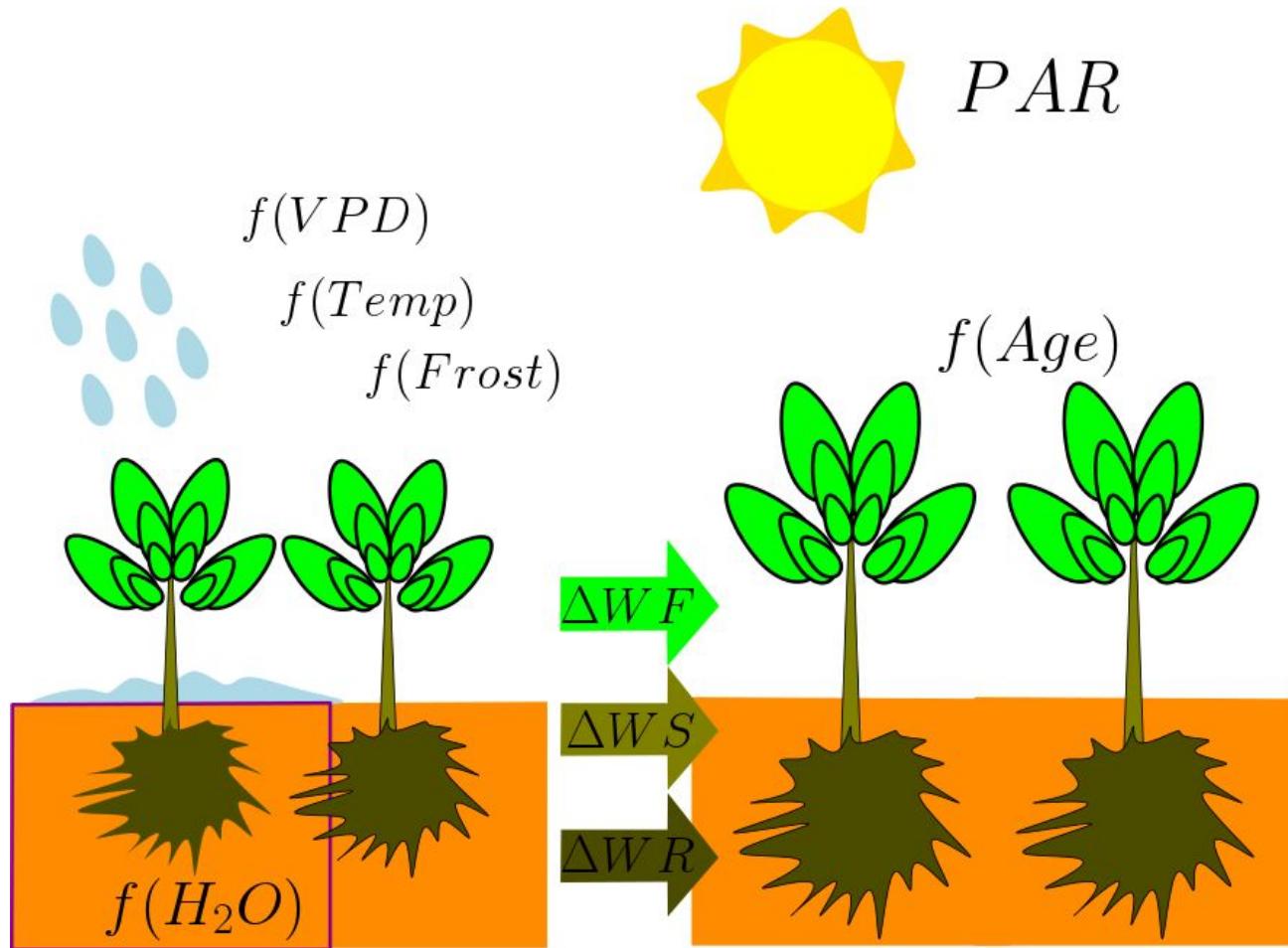
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Economic sustainability investigations require poplar yield estimates.



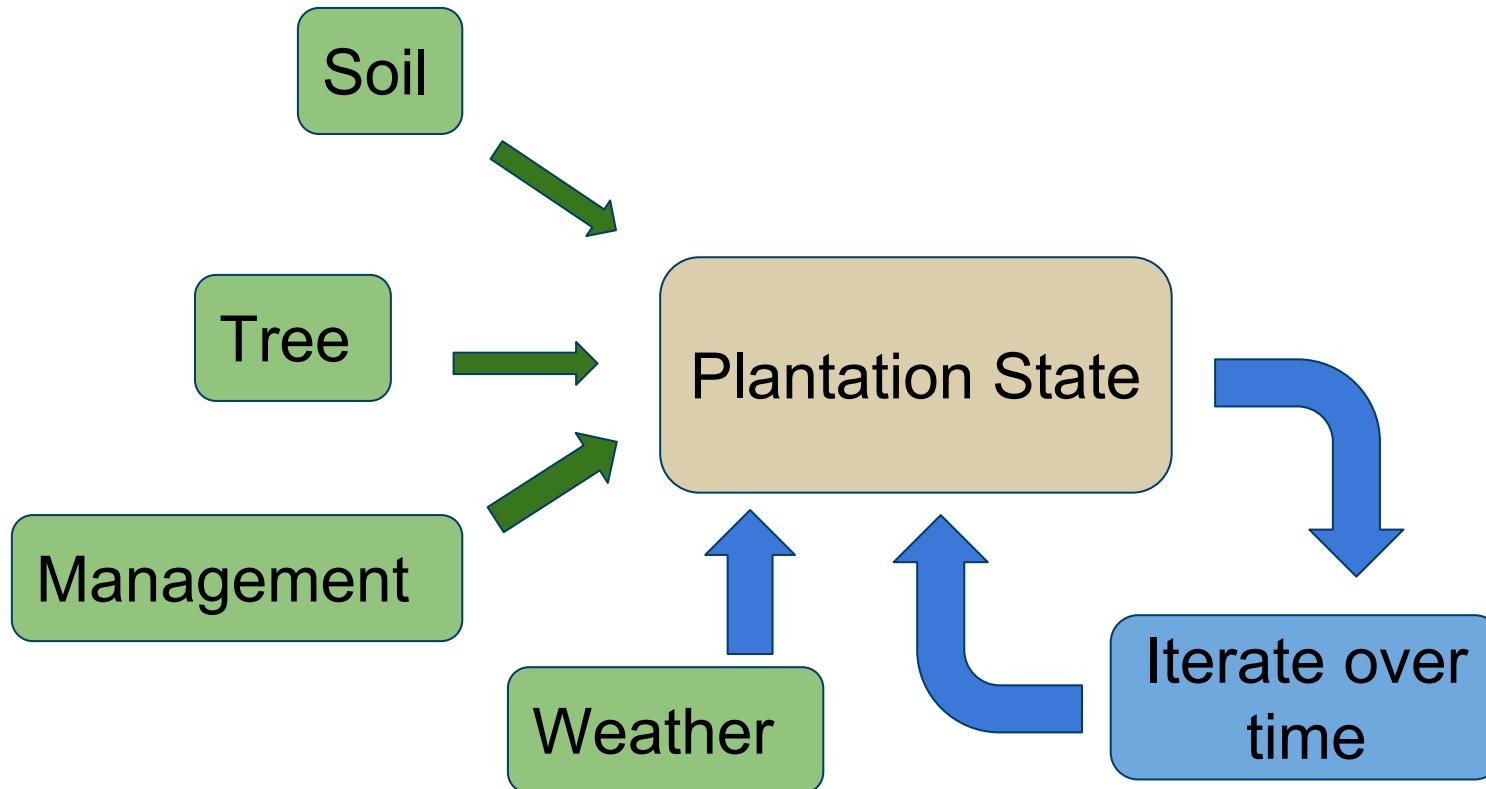
Poplar Growth Model

Physiological Processes Predicting Growth (3-PG)



Poplar Growth Model

Physiological Processes Predicting Growth (3-PG)



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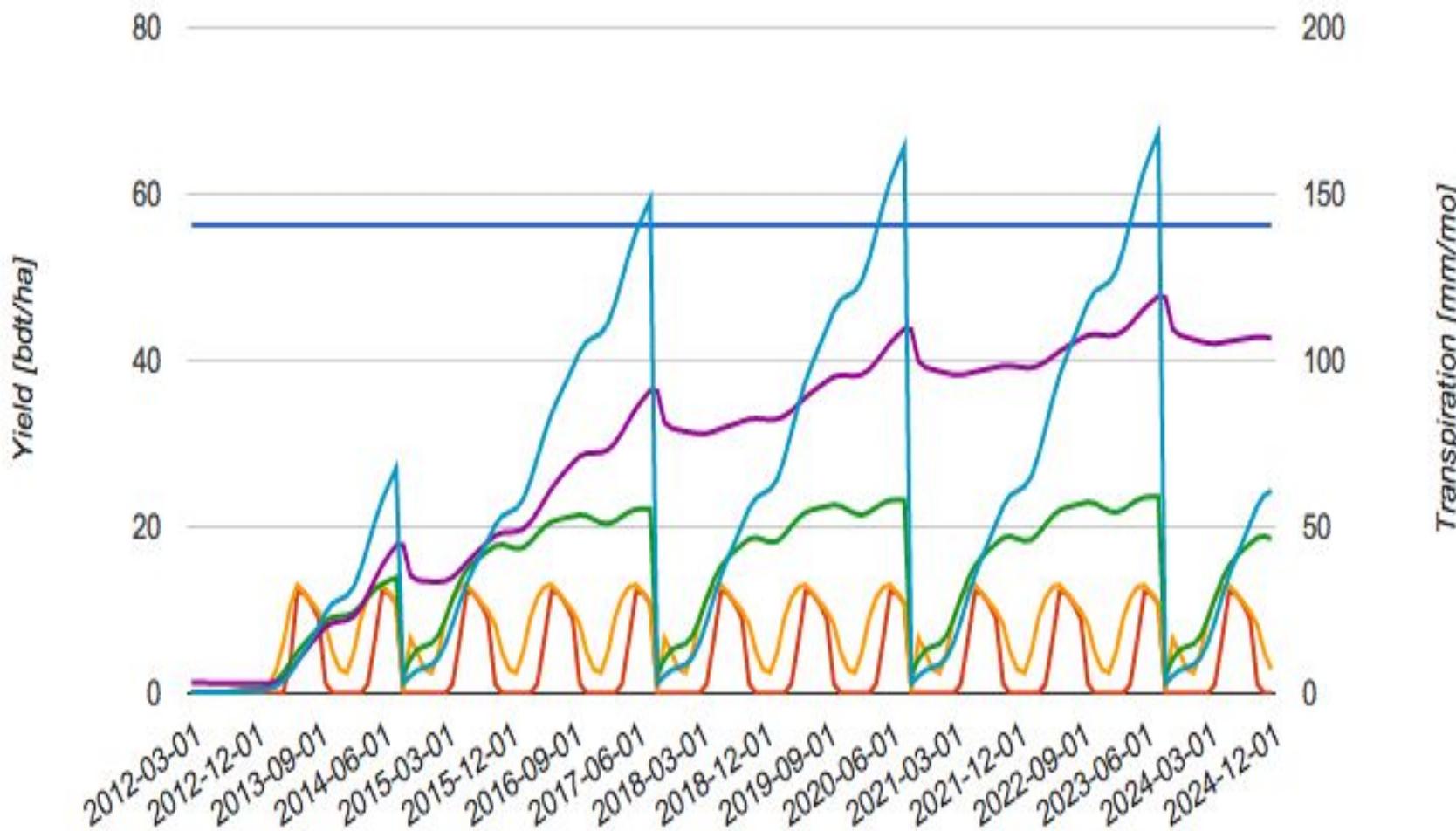
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Poplar Yields

Available Soil Water Required Irrigation Canopy Monthly Transpir...

◀ 1/2 ▶



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3PG Web App - Inputs

Select Location

The screenshot shows the 'Select Location' interface of the 3PG Web App. It features a map of Northern California with a red marker indicating a location near Redding. Below the map is a table of weather data for 12 months, with the first few rows shown below:

month	tmin	tmax	tdmean	ppt	rad	daylight
1	-5.48	4.68	-5.01	45.34	6.77133157	9.44376182
2	-5.59	5.74	-4.94	35.3	10.6699526	10.4583492
3	-3.6	9.6	-3.68	34.04	16.7616894	11.7975950
4	-1.92	11.35	-2.62	34.36	20.6496894	13.1871032
5	2.02	17	-0.3	44.31	23.6737789	14.3301172
6	4.55	22.24	0.83	22.57	27.5617789	14.8926963
7	8.31	28.71	2.17	8.5	28.0153789	14.5715694
8	6.38	28.3	0.96	5.7	24.8184	13.5125770
9	3.74	24.14	-0.8	8.64	19.6885789	12.1721868

Sets weather and soil parameters for location.

The screenshot shows the 'Inputs' interface of the 3PG Web App with the 'Tree' tab selected. The 'fullCanAge' input field is highlighted with a red circle and contains the value '1.5'. The 'fullCanAge' label is also circled with a red arrow. The interface includes tabs for Tree, Plantation, Soil, Weather, Constants, Manage, and Setup, and a 'Default Tree' dropdown menu.

These specify growth parameters specific to the species of tree.

k - Radiation Extinction Coefficient.

fullCanAge - Year where tree reaches full Canopy Cover.

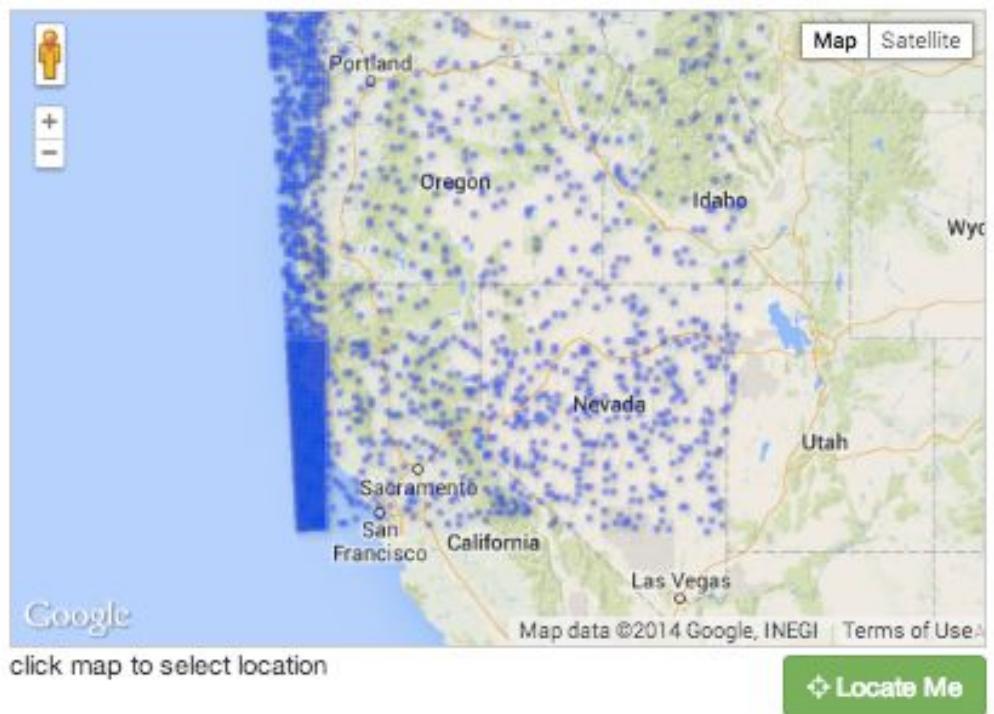
kG - Determines the response of the canopy conductance to the vapor pressure deficit.

alpha - Canopy quantum efficiency.

Edit default tree parameters

3PG Web App - Setting Location

Select Location



Cancel

Select Location



Cancel

3PG Web App - Model Runs

Inputs

Location

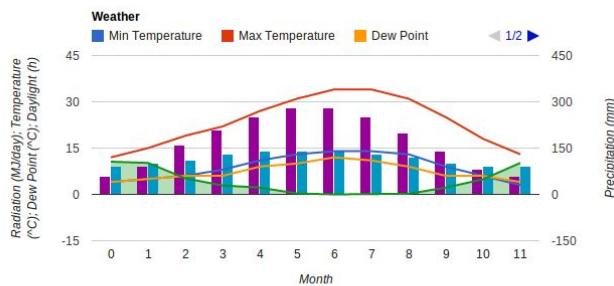
Tree Plantation Soil Weather Constants Manage Setup

Averages Actual

Upload

Select location to set the average weather data

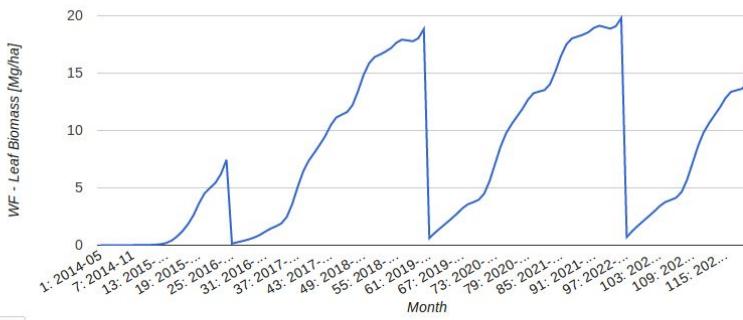
month	tmin	tmax	tdmean	ppt	rad	daylight
1	4.13	12.96	4.93	106.93	6.1840926754	9.6577272415
2	5.41	15.57	5.64	102.14	9.5755560000C	10.584639548
3	6.78	19.65	6.24	52.76	16.473222818	11.813981056
4	8.1	22.46	6.61	29.47	21.740109469	13.090333938
5	11.33	27.44	9.06	22.52	25.258268483	14.136204719
6	13.56	31.42	10.59	3.83	28.441792601	14.648213386
7	14.62	34.38	12.08	0.18	28.16031830C	14.356233596
8	14.19	34.03	11.56	1.34	25.035703175	13.388724327
9	13.14	31.82	9.76	2.62	20.393404917	12.158249855
10	9.82	25.84	6.92	22.97	14.574858312	10.886029243
11	6.52	18.19	6.28	49.25	8.8032305427	9.8185014725
12	3.88	13	4.5	102.7	6.4661356281	9.3347291946



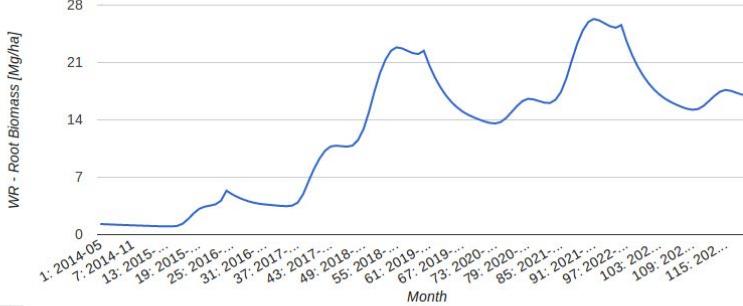
Charts

+ Add Basic Interactive

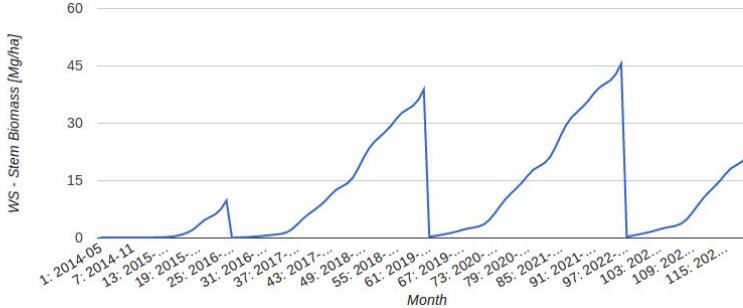
x WF



x WR

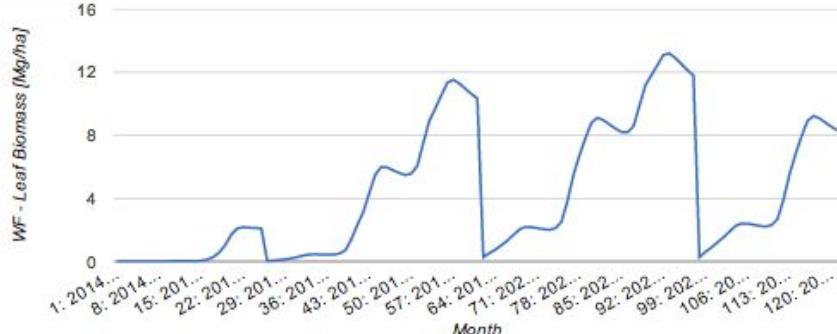


x WS

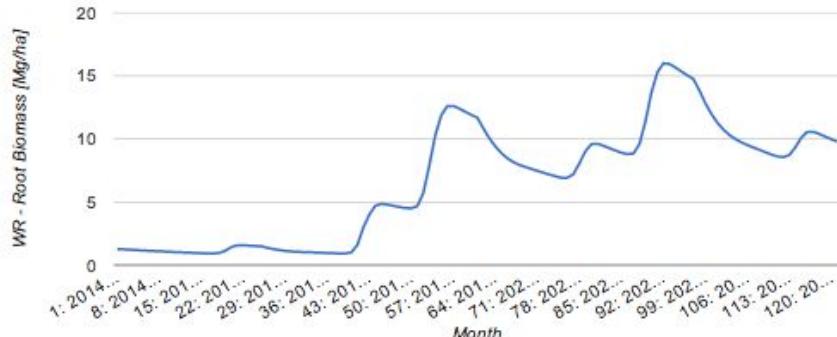


3PG Web App - Chart Results

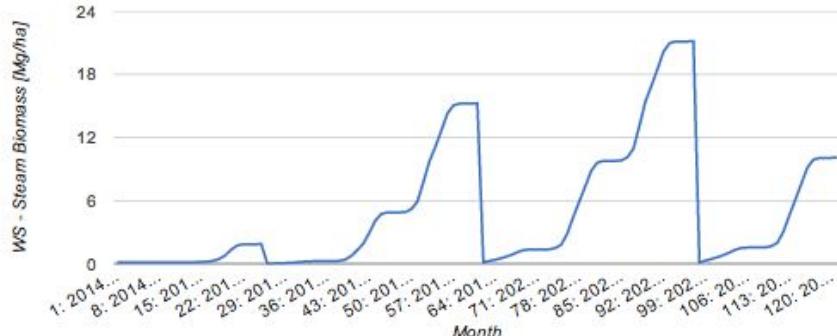
x WF



x WR



x WS



Select variable(s) to chart

Select All | Unselect All

- fVPD** - Mean Vapor Pressure Deficit [kPa]
 the difference (deficit) between the amount of moisture in the air and how much moisture the air can hold when it is saturated fn()
- fT** - Temperature Modifier [unitless]
 A environmental factor growth modifier fn()
- xPP** - Maximum Potential Primary Production [Metric Tons Dry Matter/ha] fn()
- ASW** - Available Soil Water [mm] fn()
- Irrig** - Required Irrigation [mm/month] fn()
- LAI** - Leaf Area Index [m² / m²]
 The one-sided green leaf area per unit ground surface area
- Transp** - Canopy Monthly Transpiration [mm/month]
 Water movement through a plant and its evaporation from aerial parts fn()
- fAge** - Stand age [unitless]
 A environmental factor growth modifier
- pR**
 Along with a Physiological parameter, specifies the amount of new growth allocated to the root system, and the turnover rate. fn()

3PG Web App - Comparisons

Inputs

Location

Tree Plantation Soil Weather Constants Manage Setup

Crop Management Parameters

IrrigFrac - Irrigation fraction: 1 = fully irrigated, 0 = no irrigation. Any values between 0 and 1 are acceptable
0,0.5,1

fertility - Soil fertility

DatePlanted - Date the crop was planted

DateCoppiced - Date of the first coppice

CoppiceInterval - How often the crop is coppiced after the first coppice

DateFinalHarvest - Date when the crop is completely harvested

Charts

+ Add

Basic

Interactive

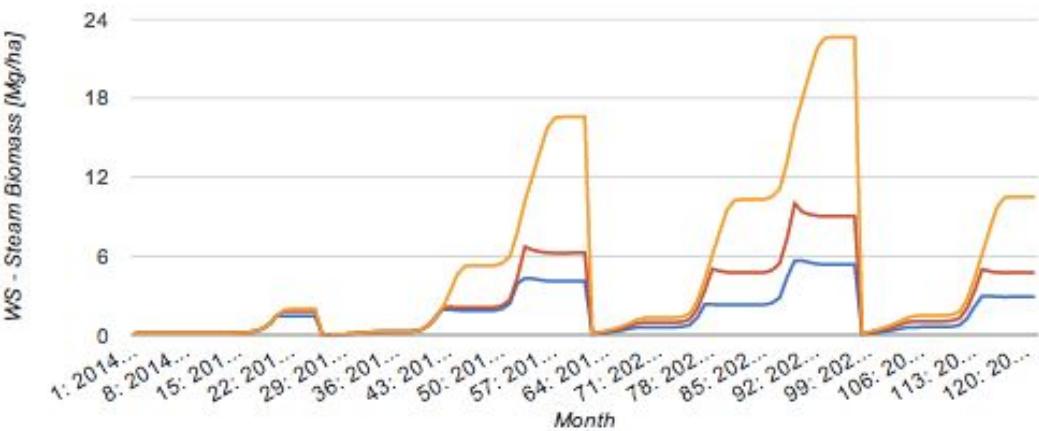
Legend

manage.irrigFrac=0

manage.irrigFrac=1

manage.irrigFrac=0.5

x WS



3PG Web App - Export

The diagram illustrates the export process from a 3PG Web App interface to Google Drive. It consists of four main components:

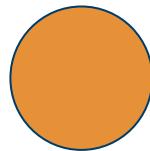
- Raw Output:** A screenshot of the 3PG Web App showing a table of data. A red arrow points from this screen to the "Export CSV" button.
- Export CSV to Google Drive:** A screenshot of a modal window titled "Export CSV to Google Drive". It shows a progress bar labeled "Creating WS.csv..." and a "Name" field containing "3PG Model Results (2014-04-02 23:00:18)". A red arrow points from the "Exporting..." button in this window to the Google Drive interface.
- WS.csv:** A screenshot of a Google Sheets spreadsheet titled "WS.csv". The data matches the "Raw Output" table. A red arrow points from the "WS.csv" tab in the Google Sheets interface to the Google Drive interface.
- Google Drive:** A screenshot of the Google Drive interface showing a folder named "3PG Model Results (2014-04-02 ...)" containing files: "TITLE", "WS.csv", "WR.csv", "WF.csv", and "config.txt". A red arrow points from the "3PG Model Results" folder in the Google Drive interface back to the "Raw Output" screen.

The data shown in the "Raw Output" table is as follows:

Month	Date	manage.irrigFrac=1	manage.irrigFrac=0.5	manage.irrigFrac=0.2
1	2013-12	0	0	0
2	2014-01	0.0028148805356909474	0.0028148805356909474	0.0028148805356909474
3	2014-02	0.005577481349571272	0.005577481349571272	0.005577481349571272
4	2014-03	0.010223974103533671	0.010223974103533671	0.010223974103533671

Export results to Google Spreadsheet, analyze or download as CSV or Excel.

Parameters affecting water use



Incoming
Radiation



Dew point
Temperature

Canopy
Cover



Leafy
Biomass

Planting
Density

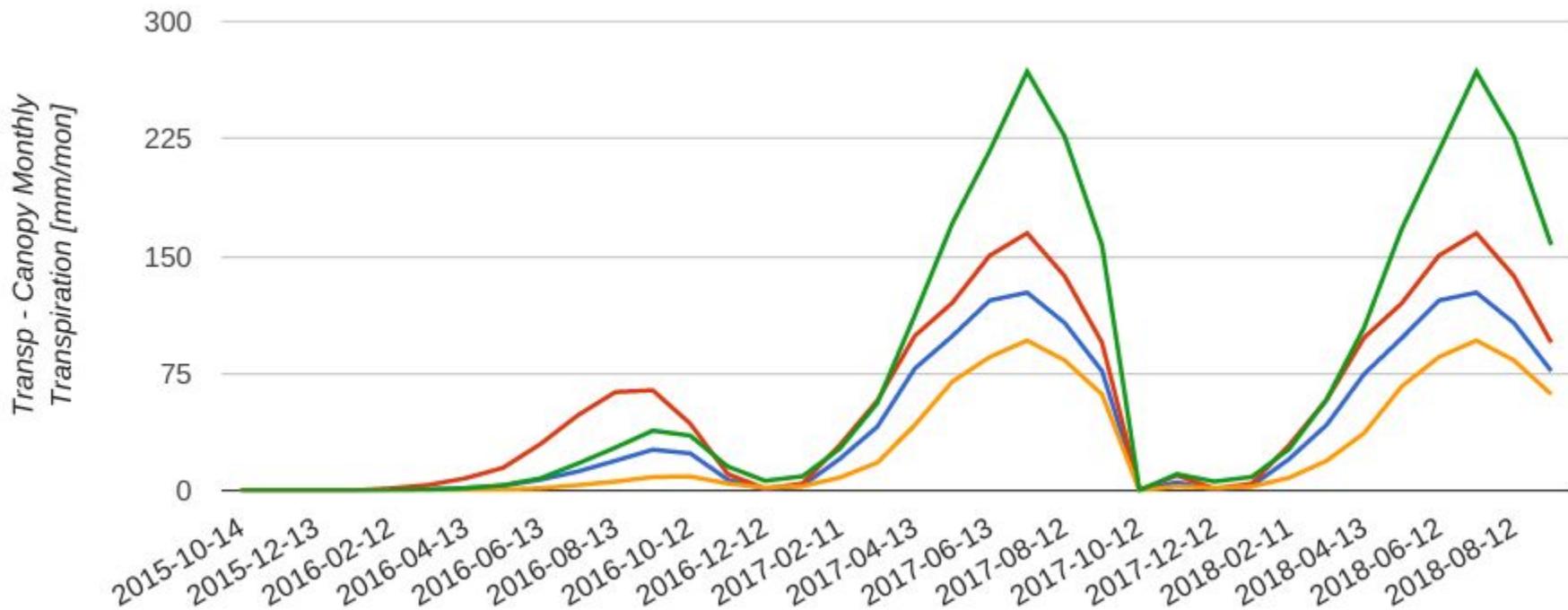


Boundary
Conductance

Canopy
Conductance



Variation of Transpiration Parameters



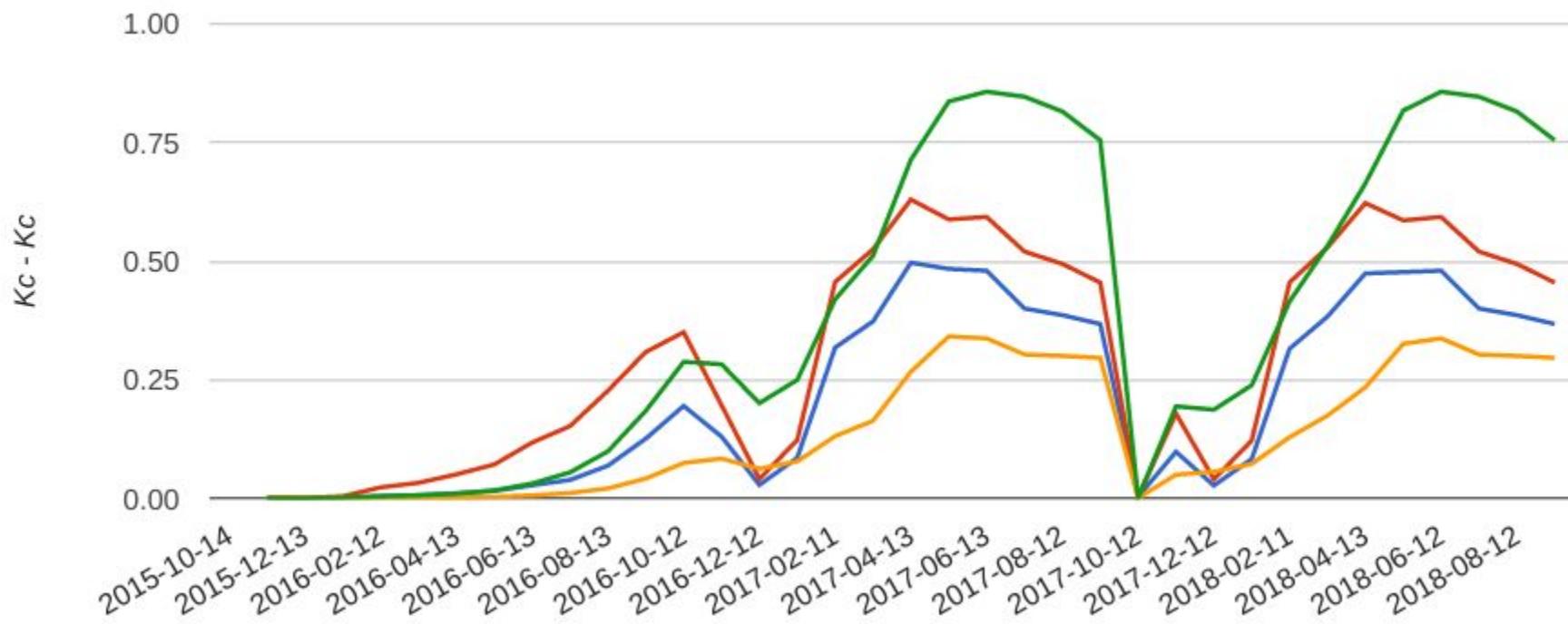
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Variation of Transpiration Parameters



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Poplar Growth Model - Future Work

- User Interface
 - Better Access to Scenarios
 - More variation in Examples
- Variables
 - Organize / Simplify
 - Better Documentation



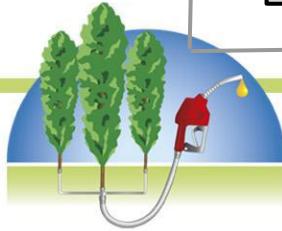
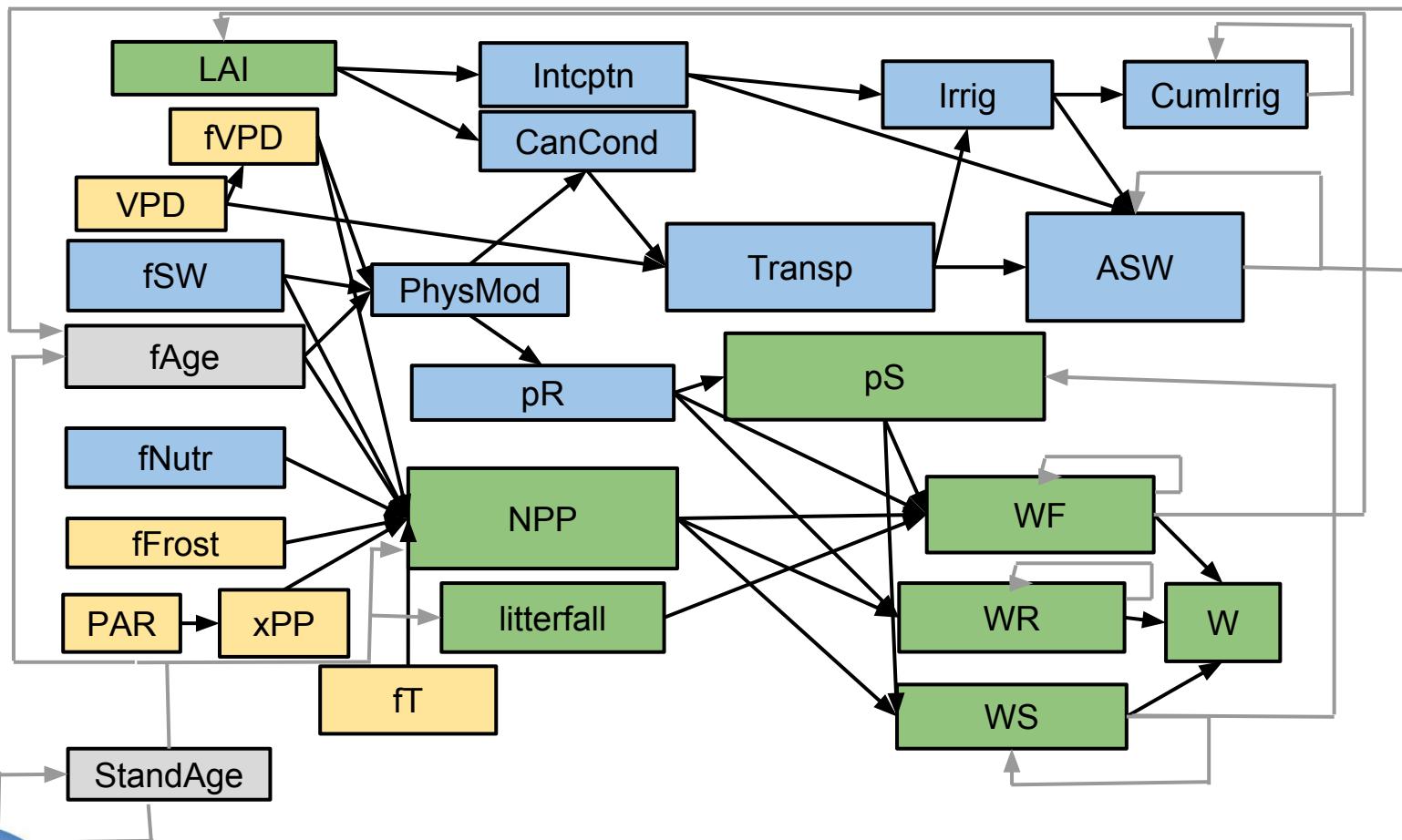
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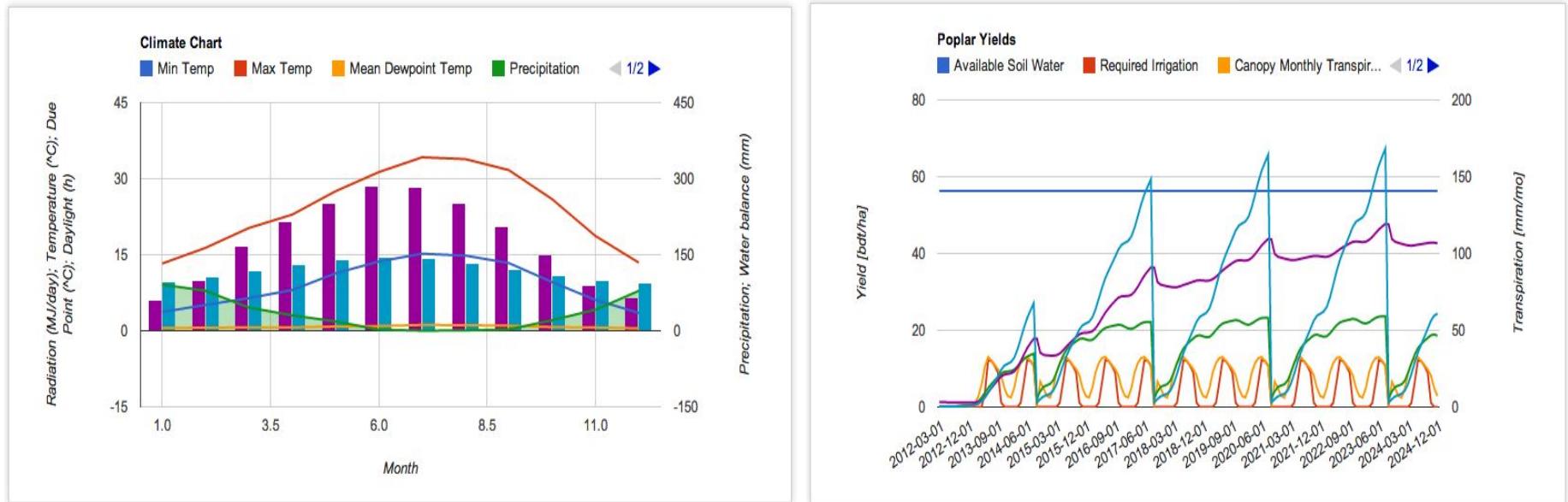
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Future Work



Poplar Growth Model - Results

- ❖ All inputs and outputs available to researchers to visualize and download
- ❖ Tool allows researchers to rerun models at specific points with new parameters



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