Creating Forage Growth Curves Using GPFARM-Range

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Fort Collins, CO

GPFARM-Range History

GPARM-Range is a systems model that simulates forage growth, soil water balance, carbon cycling, and livestock production.

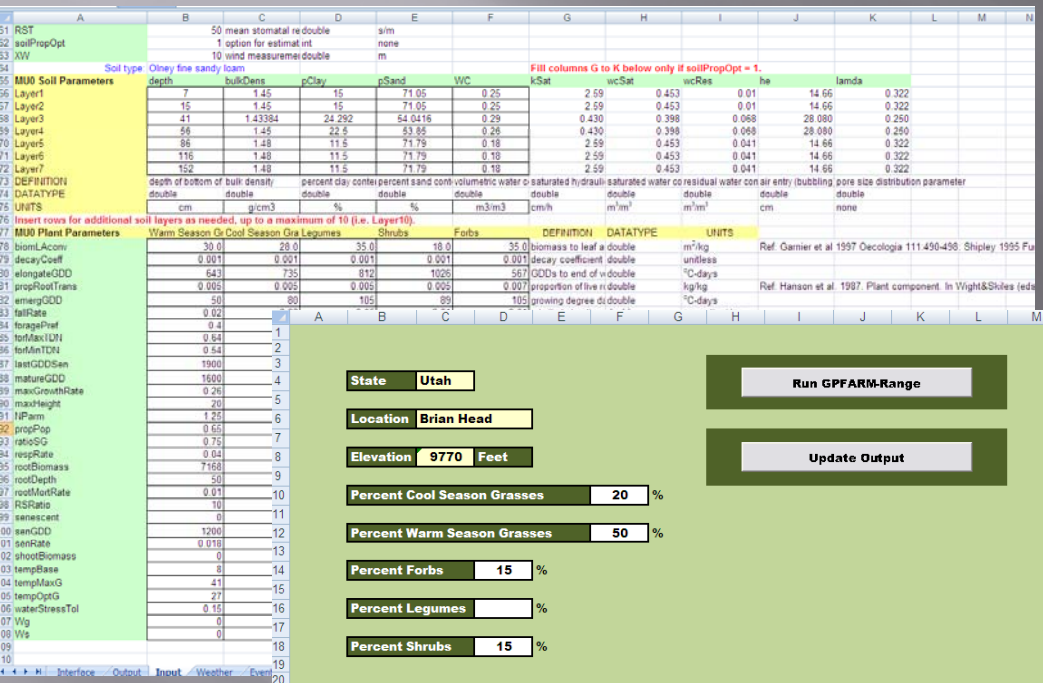
GPARM-Range was originally created in 1990 with components from SPUR.

During the past 20 years it has been improved significantly. Some of the changes include improved water stress, use of growing degree days, carbon – nitrogen cycling and others.

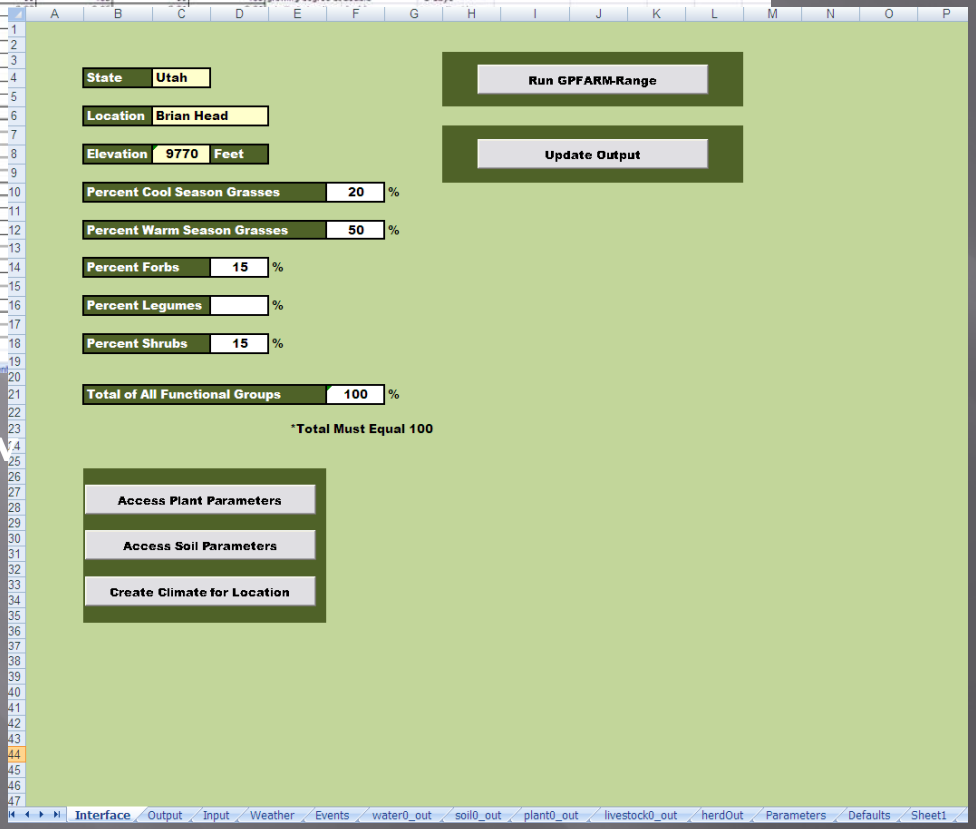
The forage growth curve generator takes the volumes of GPFARM-Range output and reduces it down to simple growth curves and percent production by month.

GPFARM-Range Interface

Old



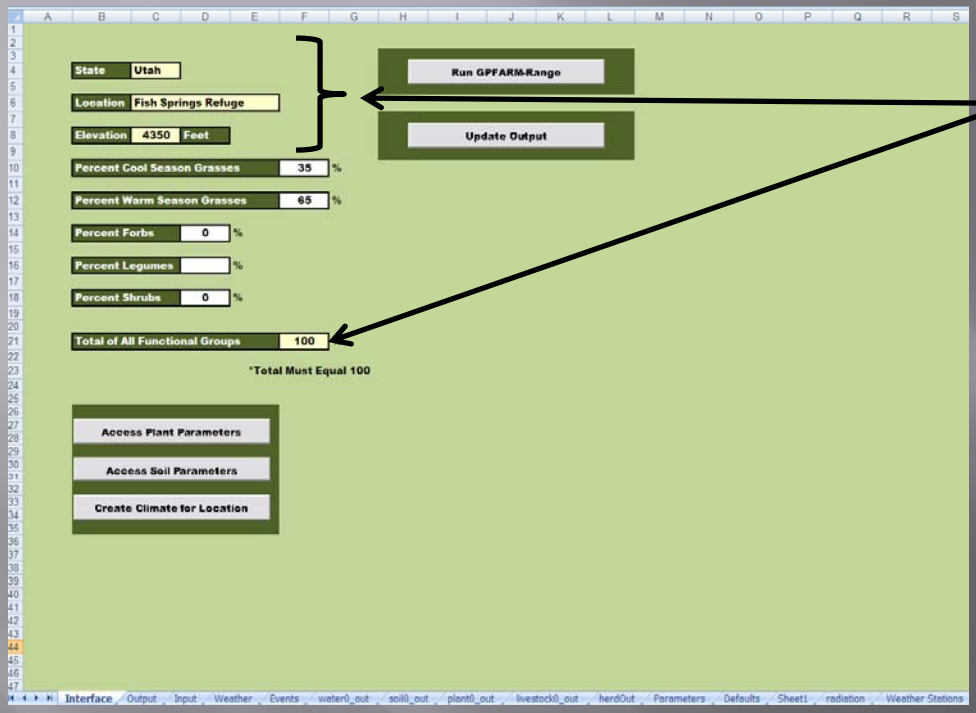
New



We have replaced GPFARM-Range's data intensive interface with a simpler version.

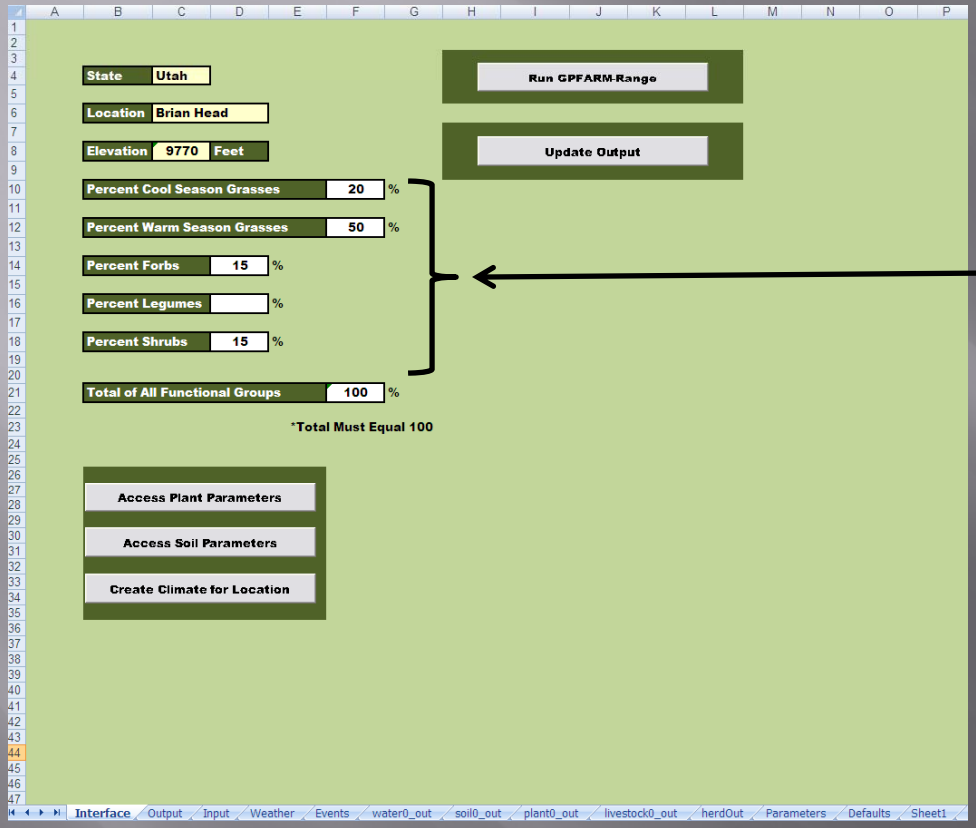
The new version only asks for easily obtainable data.

GPFARM-Range Interface



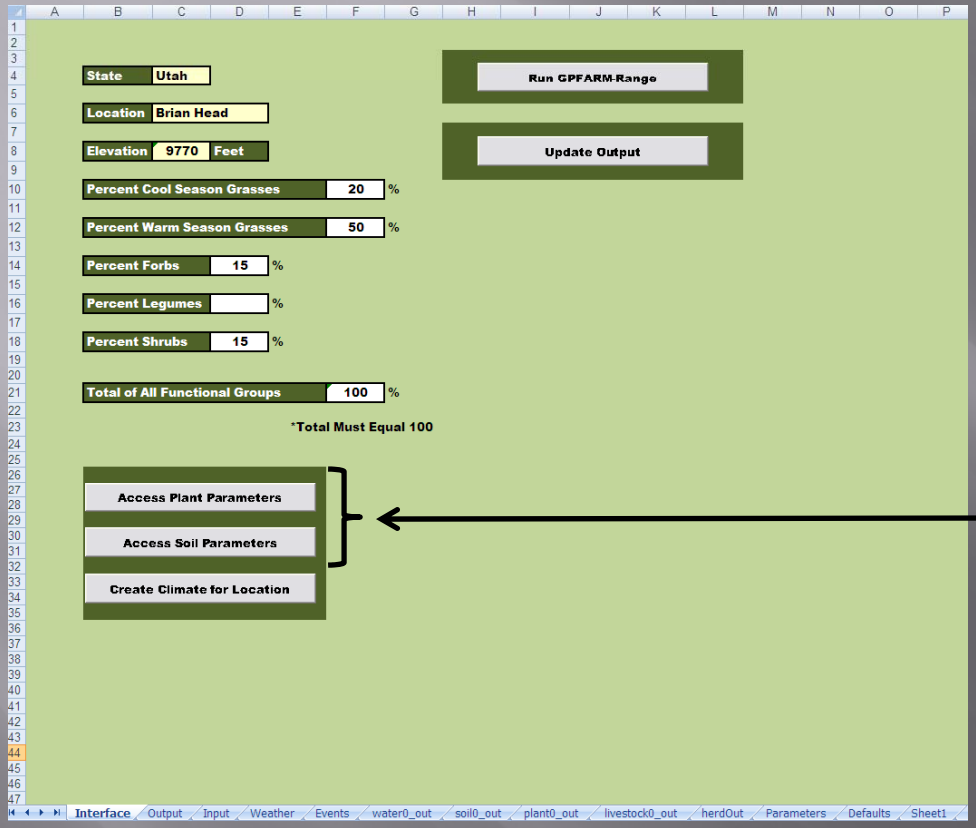
Information in yellow is automatically generated by GPFARM-Range.

GPFARM-Range Interface



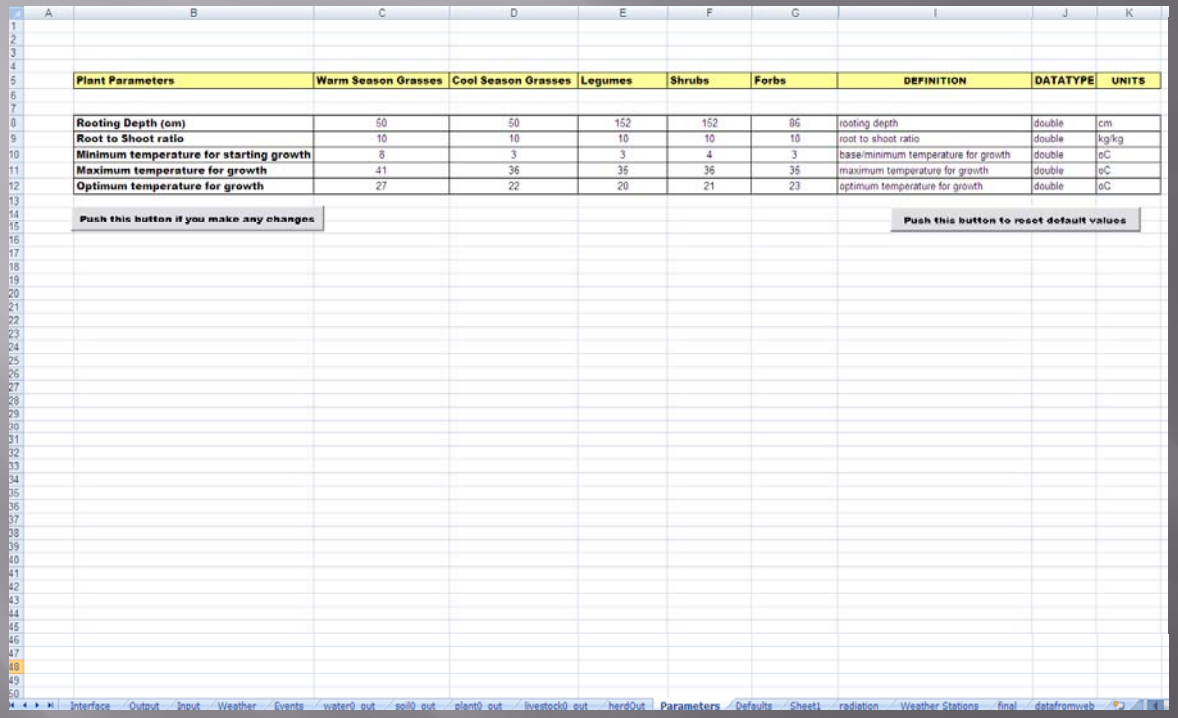
Cells in white require percent forage composition by functional group.

GPFARM-Range Interface



If needed the user can access some plant and soil parameters by pushing the appropriate button.

GPFARM-Range Plant Parameters



Plant Parameters	Warm Season Grasses	Cool Season Grasses	Legumes	Shrubs	Forbs	DEFINITION	DATATYPE	UNITS
Rooting Depth (cm)	50	50	152	152	86	rooting depth	double	cm
Root to Shoot ratio	10	10	10	10	10	root to shoot ratio	double	kg/kg
Minimum temperature for starting growth	8	3	3	4	3	base/minimum temperature for growth	double	oC
Maximum temperature for growth	41	36	35	36	35	maximum temperature for growth	double	oC
Optimum temperature for growth	27	22	20	21	23	optimum temperature for growth	double	oC

Push this button if you make any changes

Push this button to reset default values

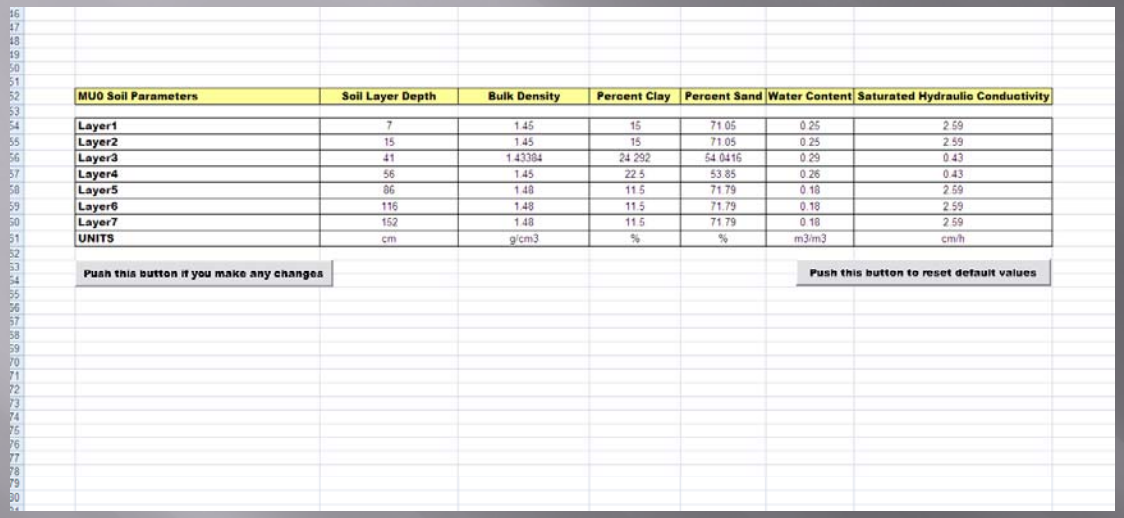
Default values are provided

Changeable plant parameters include:

- Rooting Depth
- Root to Shoot Ratio
- Minimum Growth Temp
- Maximum Growth Temp
- Optimum Growth Temp

The user doesn't need to change any parameter or can change just the ones that are known.

GPFARM-Range Soil Parameters



MU0 Soil Parameters	Soil Layer Depth	Bulk Density	Percent Clay	Percent Sand	Water Content	Saturated Hydraulic Conductivity
Layer1	7	1.45	15	71.05	0.25	2.59
Layer2	15	1.45	15	71.05	0.25	2.59
Layer3	41	1.43384	24.292	54.0416	0.29	0.43
Layer4	56	1.45	22.5	53.85	0.26	0.43
Layer5	86	1.48	11.5	71.79	0.18	2.59
Layer6	116	1.48	11.5	71.79	0.18	2.59
Layer7	152	1.48	11.5	71.79	0.18	2.59
UNITS	cm	g/cm3	%	%	m3/m3	cm/h

Push this button if you make any changes

Push this button to reset default values

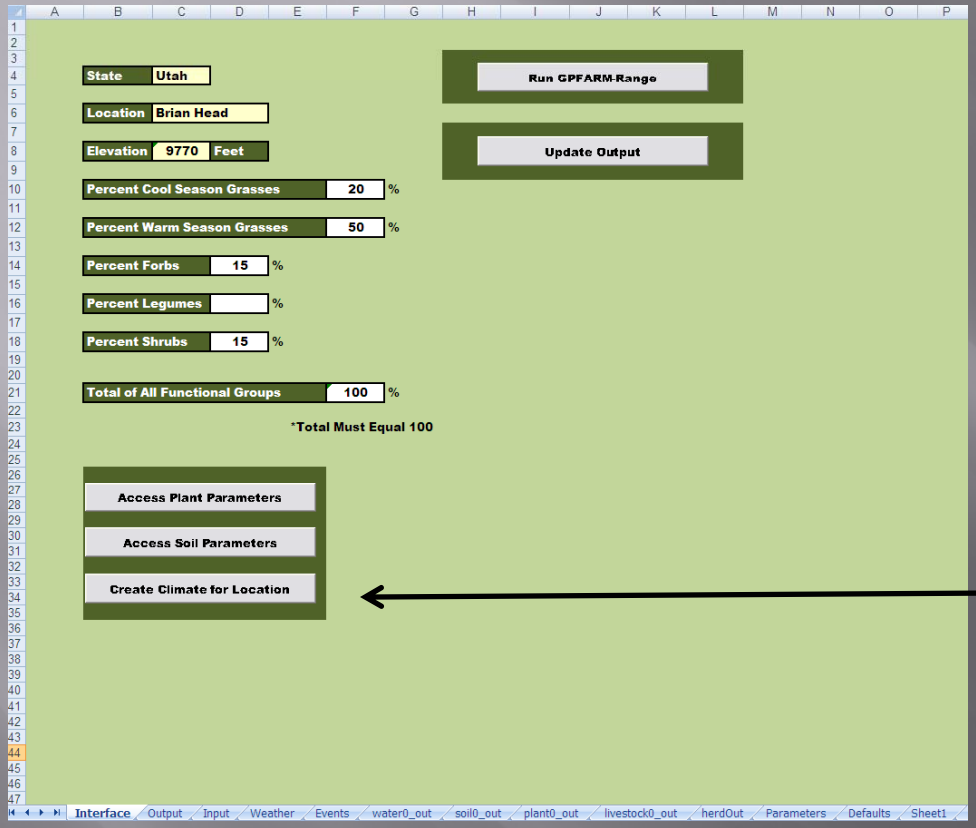
Default values are provided

Accommodates up to seven soil layers with parameters for each:

- Layer depth
- Bulk Density
- Percent Clay and Sand
- Water Content (ignore this one)
- Saturated Hydraulic Conductivity

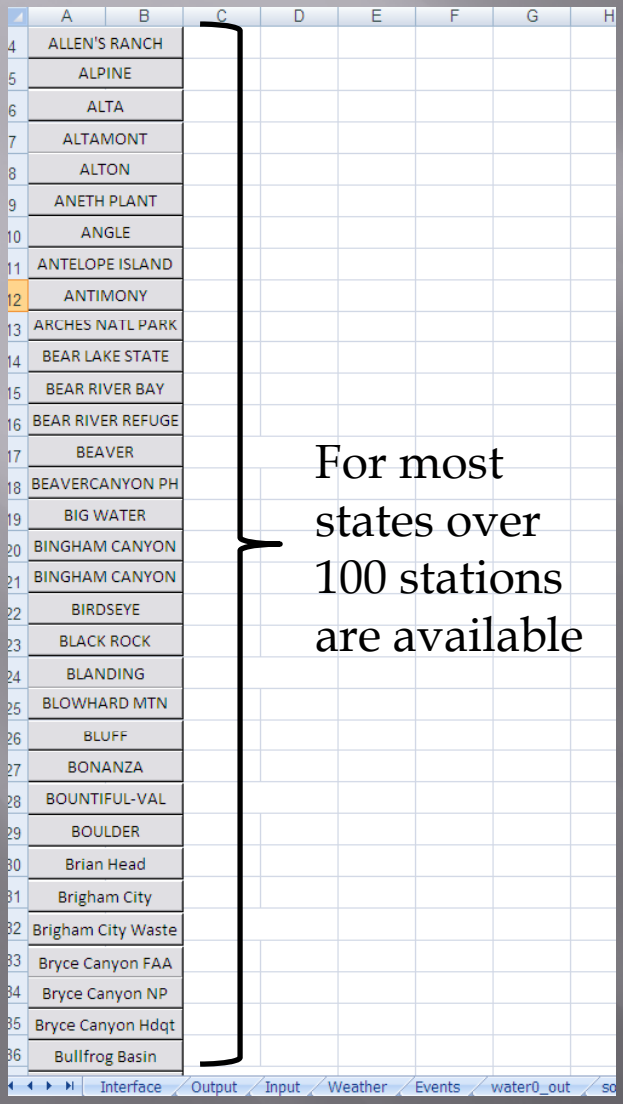
The user doesn't need to change any parameter or can change just the ones that are known.

GPFARM-Range Climate Generator



A climate file can be created for different weather stations throughout the state.

GPFARM-Range Climate Generator

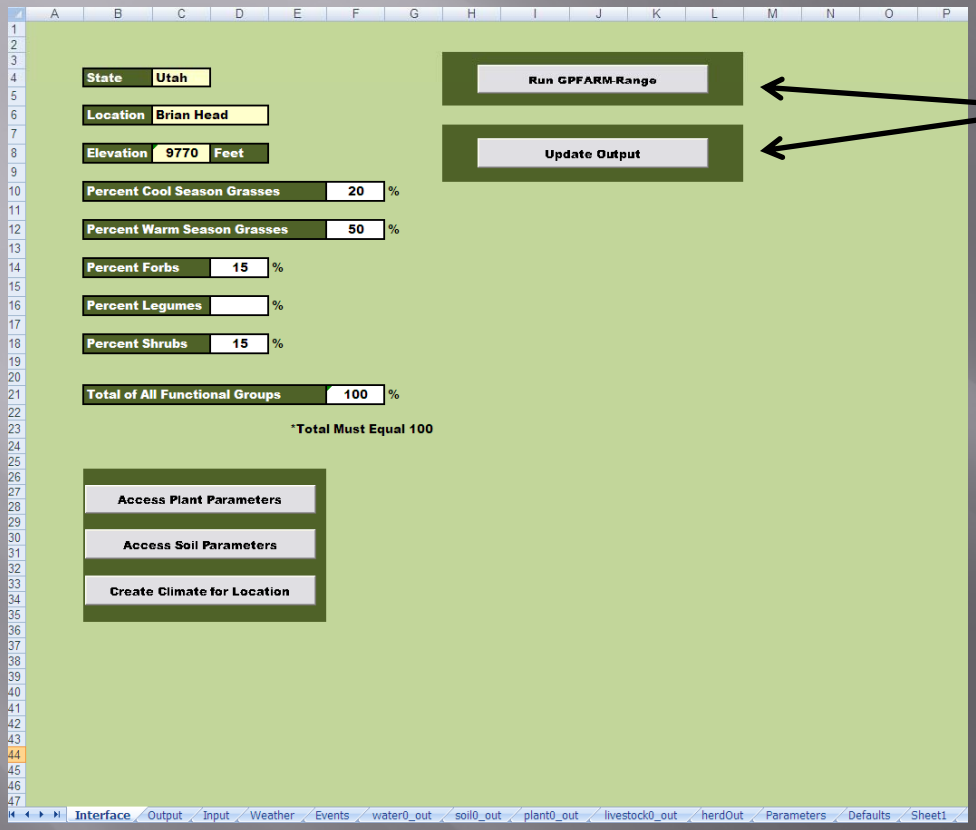


The user needs to have internet access.

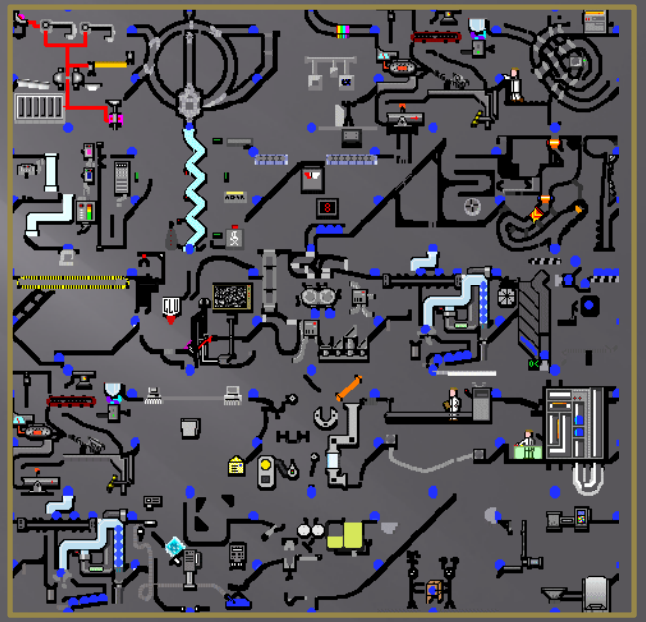
When a weather station button is pushed GPFARM-Range connects with the Western Regional Climate Center on-line and collects the long-term weather data for that weather station.

An average climate for the selected weather station is created.

GPFARM-Range Interface

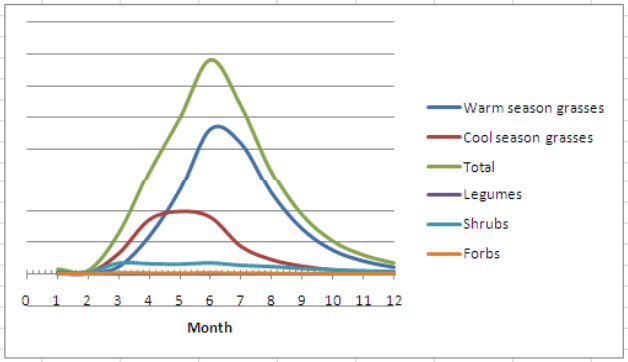


Once the data is entered two buttons run the program and produce the output



Growth Curve Output

	WSG % by month	CSG % by month	Legumes % by month	Shrubs % by month	Forbs % by month	Total % by month
January	0%	0%	0%	2%	2%	0%
February	0%	0%	0%	2%	1%	0%
March	1%	8%	0%	15%	16%	4%
April	7%	21%	0%	14%	14%	11%
May	15%	25%	0%	13%	13%	17%
June	25%	22%	0%	15%	15%	24%
July	23%	11%	0%	12%	12%	18%
August	14%	6%	0%	10%	9%	11%
Septembe	8%	3%	0%	7%	6%	6%
October	4%	2%	0%	5%	5%	4%
November	2%	1%	0%	4%	3%	2%
December	1%	0%	0%	3%	3%	1%
Sum	100%	100%	0%	100%	100%	100%



Growth curve output includes:

- Forage growth percentage for each month and each functional group plus a percentage for all groups combined and,
- Graphical output.

Some things You Need to Know

- GPFARM-Range is state specific (i.e. Utah) – climate stations need to be added for each state so that the climate generator has data. We use climate stations from the Western Regional Climate Center but can use any source of climate data that is available on-line.
- The climate created by GPFARM-Range is based on long-term averages and creates an "average" year climate. It doesn't do wet or dry years (but it could if that's important).
- User cannot enter their own climate data – at least not yet.
- User needs to know an estimate of the percentage of each forage functional group (i.e. warm season, cool season etc.).
- Changing soil parameters is very important, especially the number and depth of soil layers.
- Changing plant parameters is not as critical but it is helpful.

Where You Can Find Me

(when I get back from Afghanistan)

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