Project #4
Functional Decomposition ("Grainville")

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Due: May 10th

Written for: CS475 Spring 2016

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Code

Important Const Variables

```
const float GRAIN_GROWS_PER_MONTH = 10.0;
const float ONE_DEER_EATS_PER_MONTH = 0.5;
const float ONE_VELOCIRAPTOR_EATS_PER_MONTH = .25;
```

GrainDeer

```
void
GrainDeer() {

	while (NowYear <= ENDYEAR) {
		int tempNumDeer = NowNumDeer;
		tempNumDeer -= (int)((float)NowVelociraptors *
ONE_VELOCIRAPTOR_EATS_PER_MONTH);
		if (NowNumDeer*ONE_DEER_EATS_PER_MONTH > NowHeight) {
			int popDec = (int)((float)NowNumDeer*.05);
			if (popDec < 1)
				popDec = 1;
			tempNumDeer -= popDec;
		}
		if (NowNumDeer*ONE_DEER_EATS_PER_MONTH < NowHeight) {
			int popInc = (int)((float)NowNumDeer*.1);
			if (popInc < 1)
				popInc = 1;
			tempNumDeer += popInc;
		}
		if (tempNumDeer < 0)
			tempNumDeer = 0;
#pragma omp barrier
		NowNumDeer = tempNumDeer;
#pragma omp barrier
#pragma omp barrier
	}
}
```

MyAgent

```
void
MyAgent() {
	while (NowYear <= ENDYEAR) {
		int tempVelociraptor = NowVelociraptors;
		if (NowVelociraptors*ONE_VELOCIRAPTOR_EATS_PER_MONTH > NowNumDeer)
			tempVelociraptor--;
		if (NowNumDeer*ONE_VELOCIRAPTOR_EATS_PER_MONTH < NowNumDeer && NowMonth > 5
&& NowMonth < 8)
			tempVelociraptor++;
		if (tempVelociraptor < 0)
			tempVelociraptor = 0;
#pragma omp barrier
		NowVelociraptors = tempVelociraptor;
#pragma omp barrier
#pragma omp barrier
	}
}
```

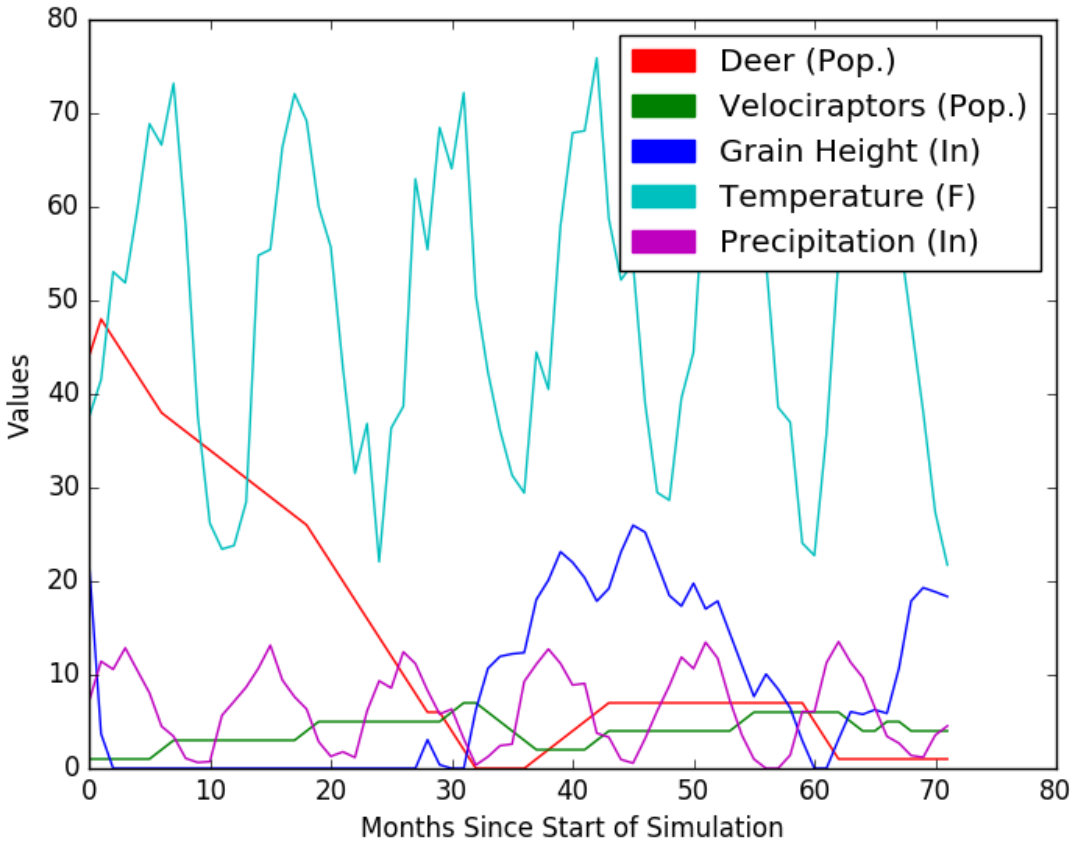
What I did

The main functions for this program, Grain, GrainDeer and MyAgent each control 1 aspect of the simulation. I used the given Grain function, but I did modify the GrainDeer function. I modified how the population increases and decreases. These are based upon the current population, rather than just adding or subtracting 1. The deer population is also dependent on the number of velociraptors because the velociraptors are eating deer.

The velociraptor population grows based upon the quantity of food, but these velociraptors only breed during certain months and therefore the growth period is limited to between the 5th and 8th month.

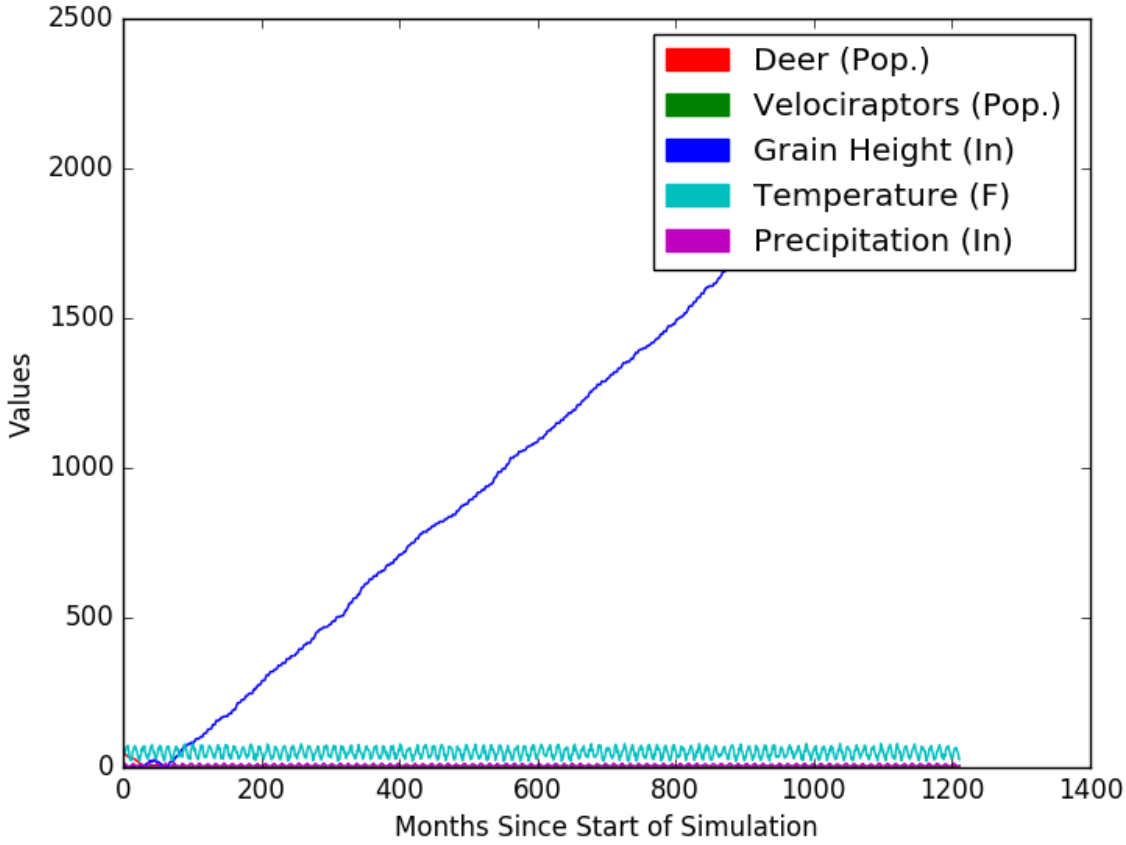
Results

2016-2021



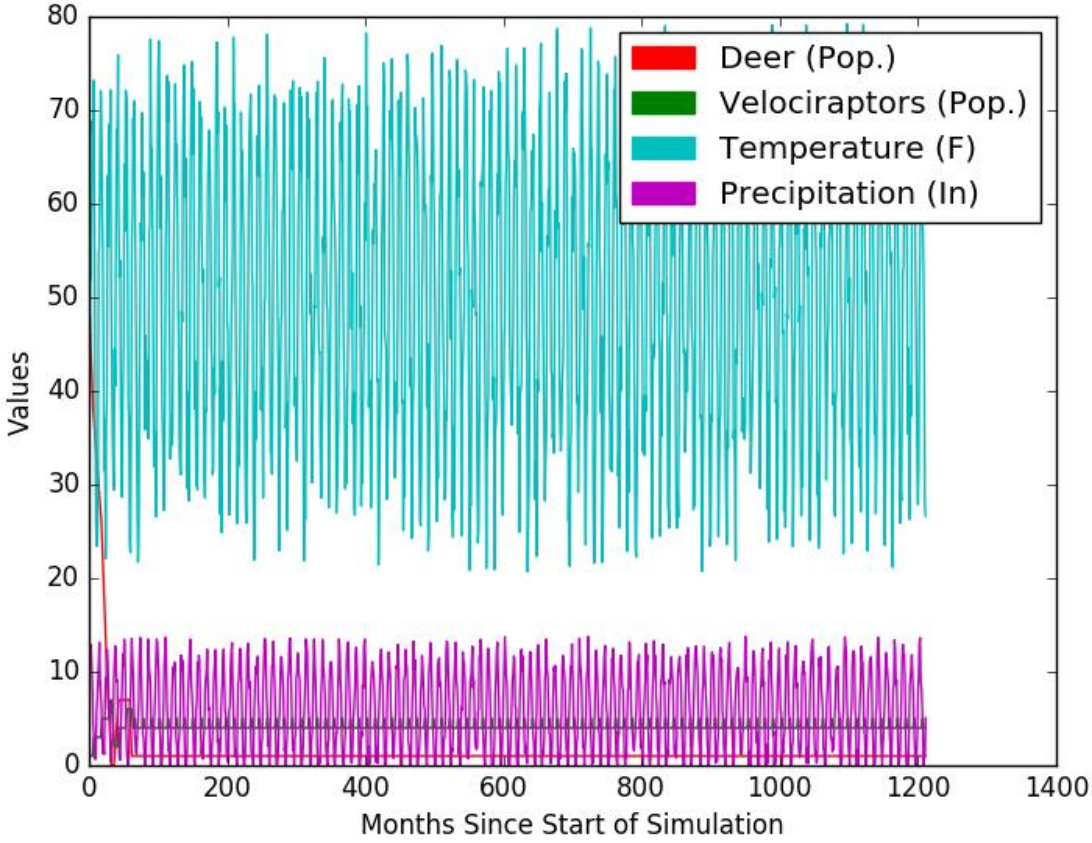
The deer population starts off at 4 and decreases rapidly because of a shortage of food. Around the 30th month, the grain can start to grow. Since the grain starts to grow, by the 36th month, the deer population can return and grow. This growth also allows the velociraptor population to grow after it's mini-collapse when it ran out of deer to eat.

2016-2116



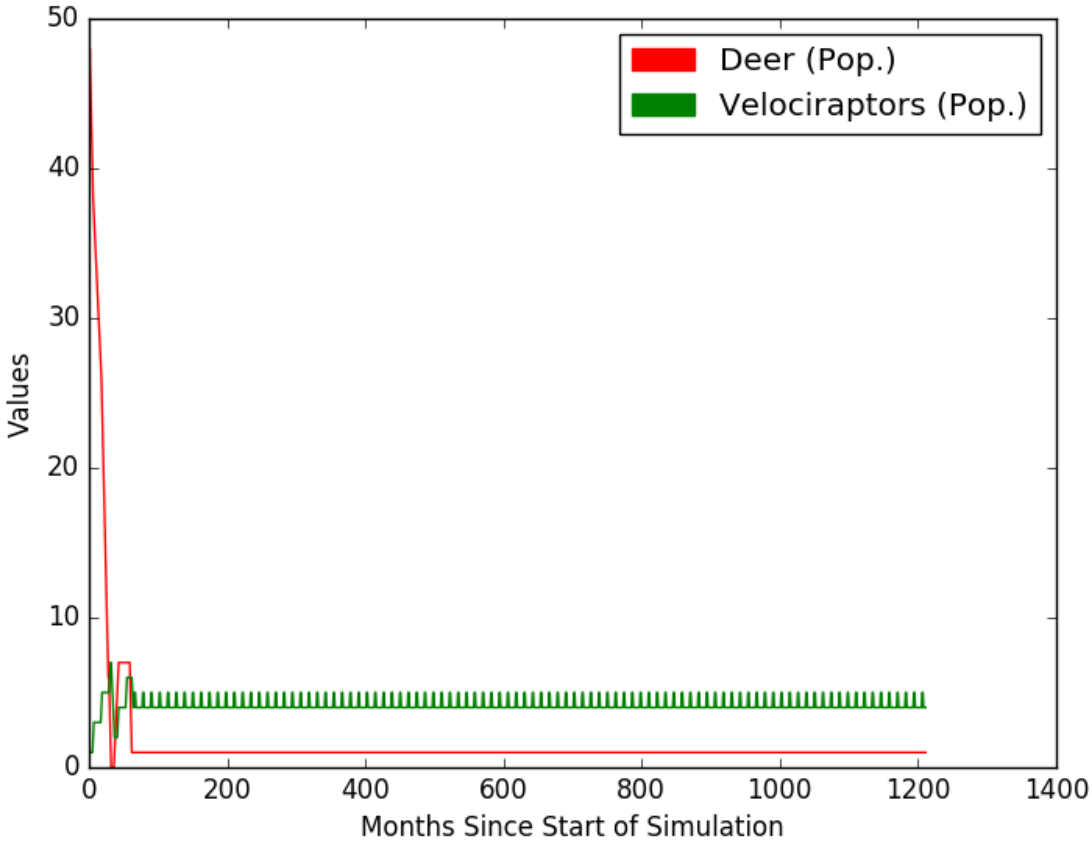
Over the 100 year time span, we can see that the grain height gets out of control. This is unrealistic but the velociraptor population keeps the deer population down so that the grain can grow.

2016-2116 Without Grain



This graph is actualy really hard to read, but we can see that the deer and velociraptor population never grow very large.

2016-2116 Only Populations



Once we get rid of all the overlapping data, we can see that the velociprator population is greater than the deer population. This is because it is set to have 1 velociraptor eat only .25 deer per month. This allows the velociraptor population be about 4x as high as the deer population.

Table with 6 years of data

Month	Year	Deer (Pop.)	Velociraptor (Pop.)	Grain (In)	Temperature (F)	Precipitation (In)
0	2016	44	1	22.061871	37.485237	7.130446
1	2016	48	1	3.687075	41.519848	11.4364
2	2016	46	1	0	53.056568	10.58576
3	2016	44	1	0	51.880836	12.868473
4	2016	42	1	0	59.697632	10.458521
5	2016	40	1	0	68.866463	8.068398
6	2016	38	2	0	66.614212	4.500689
7	2016	37	3	0	73.186729	3.42214
8	2016	36	3	0	57.890614	1.073633
9	2016	35	3	0	37.65567	0.632321
10	2016	34	3	0	26.18388	0.728906
11	2016	33	3	0	23.426113	5.663794
0	2017	32	3	0	23.815067	7.156692
1	2017	31	3	0	28.453674	8.677876
2	2017	30	3	0	54.802109	10.668583
3	2017	29	3	0	55.435028	13.152004
4	2017	28	3	0	66.394936	9.426767
5	2017	27	3	0	72.069565	7.650064
6	2017	26	4	0	69.190178	6.338185
7	2017	24	5	0	59.99247	2.842791
8	2017	22	5	0	55.711281	1.2841
9	2017	20	5	0	42.828194	1.770563
10	2017	18	5	0	31.524162	1.167192
11	2018	16	5	0	36.835976	6.123193
0	2018	14	5	0	22.07659	9.350223
1	2018	12	5	0	36.377769	8.586864
2	2018	10	5	0	38.667896	12.448462
3	2018	8	5	0	62.981033	11.191127
4	2018	6	5	3.058745	55.42556	8.322733
5	2018	6	5	0.388255	68.472557	5.805298
6	2018	4	6	0	64.084122	6.329622
7	2018	2	7	0	72.186295	3.161039
8	2018	0	7	6.259307	50.509697	0.363486
9	2018	0	6	10.687067	42.327759	1.24544
10	2018	0	5	11.965064	36.108574	2.428254
11	2018	0	4	12.236362	31.31361	2.604208
0	2019	0	3	12.367105	29.434237	9.280254
1	2019	1	2	18.032745	44.47406	11.12645

2	2019	2	2	20.108913	40.509487	12.749693
3	2019	3	2	23.143093	57.975956	11.21175
4	2019	4	2	22.016247	67.899361	8.906537
5	2019	5	2	20.357399	68.120613	9.073215
6	2019	6	3	17.868999	75.902542	3.768434
7	2019	7	4	19.221262	58.7215	3.330849
8	2019	7	4	23.110268	52.183582	0.951124
9	2019	7	4	25.971869	53.952984	0.559006
10	2019	7	4	25.230152	39.003948	3.192064
11	2019	7	4	21.878036	29.472679	6.142966
0	2020	7	4	18.474884	28.650217	8.811981
1	2020	7	4	17.343781	39.542236	11.886529
2	2020	7	4	19.774269	44.473434	10.658855
3	2020	7	4	17.039591	64.181427	13.476068
4	2020	7	4	17.873964	57.095337	11.76689
5	2020	7	4	14.447083	72.140129	7.280728
6	2020	7	5	11.031681	71.710449	3.571323
7	2020	7	6	7.682186	69.862175	0.987191
8	2020	7	6	10.071173	54.11705	0
9	2020	7	6	8.462191	38.574284	0
10	2020	7	6	6.453539	36.986744	1.423364
11	2020	7	6	2.965582	24.073624	6.074303
0	2021	5	6	0	22.744907	6.057216
1	2021	3	6	0	35.766747	11.284541
2	2021	1	6	3.120738	54.518654	13.535571
3	2021	1	5	6.05137	58.86528	11.328308
4	2021	1	4	5.774934	69.13755	9.717295
5	2021	1	4	6.264327	65.201729	6.481961
6	2021	1	5	5.877684	71.008286	3.424736
7	2021	1	5	10.720779	57.18993	2.685954
8	2021	1	4	17.87636	47.685879	1.378326
9	2021	1	4	19.303358	38.105659	1.184731
10	2021	1	4	18.859047	27.348465	3.557775
11	2021	1	4	18.36236	21.732067	4.53334