

# CS 475/575 -- Spring Quarter 2025

## Project #2

### Functional Decomposition

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#### 1. What was your own-choice quantity and how does it fit into the simulation?

The quantity I chose to introduce into the simulation was the wolf population. The wolf population affects the simulation by preying on the deer population, thus directly influencing the availability of food for the deer and the growth of the deer population. This dynamic creates an ecological balance between the grain, deer, and wolf populations, mimicking real-world predator-prey relationships.

How it fits into the simulation:

- **Wolf Growth:** The wolf population grows based on the number of deer. Specifically, when there are more than or equal to 4 deer, the wolf population increases by 1. When there are fewer than 4 deer, the wolf population decreases by 1, with a minimum of 1 wolf at all times.
- **Wolf Mortality:** If the number of wolves exceeds the number of deer, the wolf population will start to die off due to starvation. The rate of mortality is proportional to the imbalance between wolves and deer, and wolves are removed at a rate determined by the difference between the two populations.
- **Deer Population:** The wolves reduce the deer population by eating a percentage of them each month. This predation limits the number of deer that can survive, thus influencing the dynamics of the entire system.

#### 2. Table Showing Values

Here's a sample of how the table should look showing the simulation output for temperature, precipitation, grain height, deer population, and wolf population for each month. All values are in Celsius

and centimeters as per the requirement. The deer and wolf populations are in numbers, temperature in °C, and precipitation and grain height in cm.

Months	Temp(C)	Precip(cm)	Height(cm)	Deers	Wolves
0	8.60291	20.6513	24.4276	3	1
1	10.8444	31.5885	24.4266	4	2
2	10.8489	35.2259	18.4517	6	3
3	15.9622	33.049	0	5	5
4	21.9099	28.6925	0	1	4
5	27.796	23.9321	0	0	2
6	22.3059	14.9224	6.45E-07	0	1
7	18.0379	4.39142	0.039456	0	1
8	14.6166	2.05288	0.0548307	0	1
9	8.56635	0	6.97929	0	1
10	7.84251	10.4491	19.291	2	1

11	6.3514	14.0824	35.1734	3	1
12	4.75175	26.5278	49.7672	5	2
13	5.39344	31.3133	85.2759	6	4
14	11.5712	36.4786	89.2273	7	5
15	16.0237	31.0017	58.9051	7	7
16	18.6318	33.1215	41.1264	7	8
17	22.8682	23.3828	5.60732	7	10
18	30.624	12.3003	0	2	11
19	18.5698	2.12712	0	0	9
20	15.5233	7.84093	0.00020809	0	8
21	17.1488	6.62464	0.449039	0	6
22	6.31222	9.64782	24.1327	1	5
23	4.96233	15.5397	47.5819	1	3
24	4.13013	26.1118	64.9425	3	2

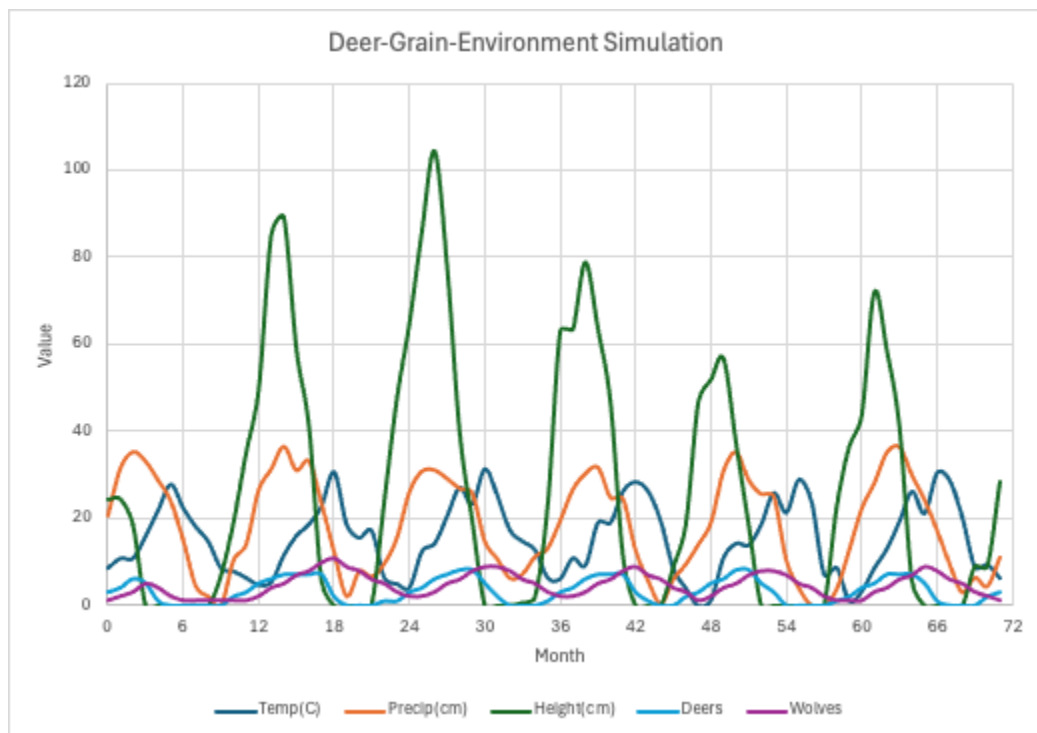
25	12.4856	30.8012	86.1867	4	2
26	14.2351	31.0178	104.387	6	3
27	20.5187	29.107	77.7537	7	5
28	27.0701	26.8325	39.7342	8	6
29	23.2766	25.7211	19.4145	8	8
30	31.3599	14.7362	0	5	9
31	25.1601	10.6479	0	2	9
32	17.3028	6.25732	0.0814407	0	8
33	14.7267	7.23477	0.676054	0	6
34	12.7016	11.2722	2.07508	0	5
35	6.39061	13.1443	23.0758	1	3
36	6.15189	19.5	63.0922	3	2
37	10.8766	26.6001	63.4316	4	2
38	9.20793	30.2272	78.8718	6	3

39	19.0585	31.6524	63.6601	7	5
40	19.0031	24.7572	46.6775	7	6
41	26.2374	24.3708	11.1492	7	8
42	28.3375	12.6488	0	3	9
43	26.1875	5.66932	0	1	7
44	19.3701	0.462521	0	0	6
45	8.5184	6.04095	8.84234	0	4
46	3.96661	9.49362	18.8008	2	3
47	-0.148848	14.0547	46.9316	3	1
48	1.22539	19.0834	51.9151	5	2
49	11.0077	30.9201	56.7366	6	4
50	14.2293	35.1396	37.2311	8	5
51	13.9144	28.7913	18.5492	8	7
52	18.6335	25.5556	0	5	8

53	25.8594	24.9723	0	3	8
54	21.3096	10.3589	0	0	7
55	28.9678	3.99967	5.17E-08	0	5
56	23.9624	0	4.93E-05	0	4
57	7.17047	0	0.079978	0	2
58	8.74207	3.75627	22.6506	1	1
59	1.08006	12.7352	36.5835	2	1
60	3.25744	22.2577	43.8118	4	1
61	8.58137	28.0745	72.0229	5	3
62	13.0221	35.1148	58.6093	7	4
63	19.2866	36.3373	41.0936	7	6
64	26.1657	29.866	5.55371	7	7
65	21.1261	24.2421	0	5	9
66	30.4355	17.199	0	1	8

67	28.7393	9.4808	0	0	6
68	20.2856	3.03144	0.00413258	0	5
69	8.94611	6.41221	9.04408	0	3
70	9.36221	4.44384	9.11184	2	2
71	6.26171	11.0836	28.4734	3	1

### 3. Graph Showing Values



4. A commentary about the patterns in the graph and why they turned out that way. What evidence in the curves proves that your own quantity is actually affecting the simulation correctly?

The deer population and the wolf population should demonstrate an inverse relationship:

- As the wolf population increases, the deer population should decrease due to predation.
- If the wolf population becomes too large compared to the available deer, the wolf population will decrease due to starvation (mortality).
- The grain height will also fluctuate based on the available deer, as the grain grows better when there are fewer deer eating it.

This interaction is what makes the model dynamic and reflects the complex relationships between species in an ecosystem.