CS475: Project 4

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Functional Decomposition

Functional decomposition involves breaking an application down into it's functional parts. For this project OpenMP was used to break down a grain-growing simulation. The purpose of this project was to take advantage of OpenMP's section and task directives, while learning about barriers.

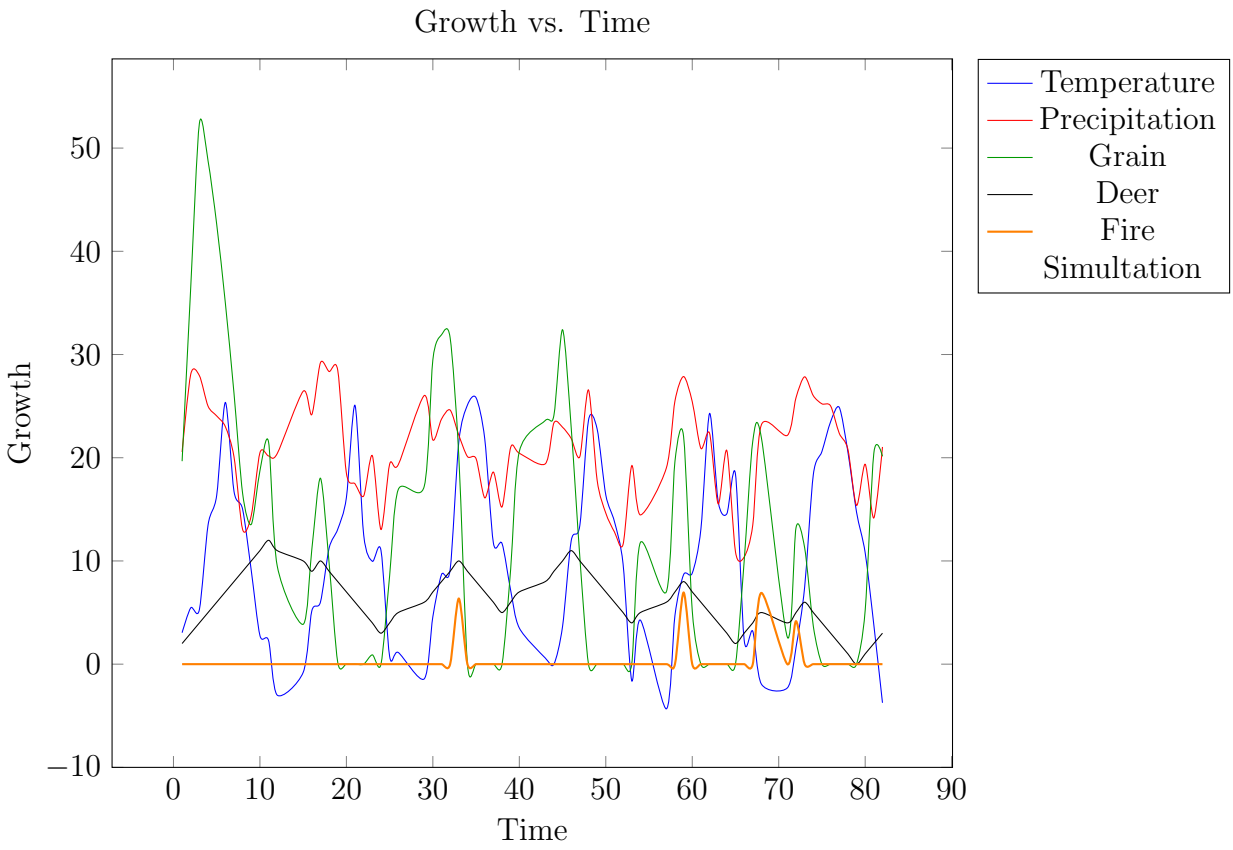
I added my own flair to the simulation by having an occasional brush-fire wipe out 20% of the grain. This was done by adding another thread which set the NowFire variable, which in turn was used by the new grain height computation function. The effects of this change can be seen in the graph below.

The program was compiled using *gcc -fopenmp -lm -O3* and ran on my personal laptop: a Lenovo ThinkPad W540 (8 CPUs - 4 cores per socket, 2 threads per core, and 1 socket).

My program used the following combination of parameters:

- Simulation Variables
  - Temperature
  - Precipitation
  - Grain
  - Fire
  - Deer

Graph



Patterns

As the grain increased, more deer were born and ate more. Each time a wildfire broke out the grain was reduced significantly, and as a result the deer started dying.

Tables

STEP	YEAR	MON	TEMP(C)	PRECIP(cm)	GRAIN(cm)	DEER	FIRE
1	2015	0	3.04735	20.5617	19.665	2	0
2	2015	1	5.45926	28.0944	36.5583	3	0
3	2015	2	5.29338	27.9521	52.3999	4	0
4	2015	3	13.4754	24.9973	48.766	5	0
5	2015	4	16.3543	24.0483	42.6205	6	0
6	2015	5	25.3569	23.0136	35.0005	7	0
7	2015	6	16.7503	20.092	26.2545	8	0
8	2015	7	14.9999	13.0422	16.5283	9	0
9	2015	8	9.06109	14.4067	13.5446	10	0
10	2015	9	2.77766	20.4822	18.7322	11	0
11	2015	10	2.28695	20.1733	21.513	12	0
12	2015	11	-2.99882	20.4027	9.52043	11	0
15	2016	0	-0.803809	26.4382	3.8608	10	0
16	2016	1	5.15834	24.1838	11.1022	9	0
17	2016	2	6.01566	29.2048	18.014	10	0
18	2016	3	11.2364	28.3534	9.81115	9	0
19	2016	4	13.0762	28.4773	0.172321	8	0
20	2016	5	16.1331	18.5077	0	7	0
21	2016	6	25.0684	17.47	0	6	0
22	2016	7	12.5237	16.2981	0	5	0
23	2016	8	9.96777	20.1947	0.901289	4	0
24	2016	9	11.0233	13.0424	0	3	0
25	2016	10	0.756671	19.372	8.55234	4	0
26	2016	11	1.13109	19.3263	16.919	5	0
29	2017	0	-1.42542	26.0222	17.2192	6	0
30	2017	1	4.59828	21.7205	29.482	7	0
31	2017	2	8.67955	23.744	31.9081	8	0
32	2017	3	9.16437	24.6184	31.6118	9	0
33	2017	4	21.5145	22.1883	20.1833	10	6.35696
34	2017	5	25.1033	20.1145	0	9	0
35	2017	6	25.8044	19.9058	0	8	0
36	2017	7	21.842	16.1138	0	7	0
37	2017	8	11.7473	18.6111	0	6	0
38	2017	9	11.6906	15.2352	0	5	0
39	2017	10	7.14606	20.9964	9.21569	6	0
40	2017	11	3.50151	20.4386	20.5996	7	0
43	2018	0	0.596341	19.4104	23.6058	8	0
44	2018	1	0.00390159	23.374	24.1044	9	0
45	2018	2	3.65238	22.9534	32.4017	10	0
46	2018	3	11.948	21.8701	22.9174	11	0
47	2018	4	13.4475	20.113	10.3553	10	0
48	2018	5	23.6267	26.5599	0	9	0
49	2018	6	22.7819	17.8184	0	8	0
50	2018	7	16.3974	14.6366	0	7	0
51	2018	8	13.8145	12.8163	0	6	0
52	2018	9	9.70366	11.6079	0	5	0
53	2018	10	-1.58894	19.2178	0	4	0
54	2018	11	4.26865	14.4589	11.7819	5	0
57	2019	0	-4.33017	18.9938	7.00555	6	0
58	2019	1	4.72831	25.5028	19.6522	7	0
59	2019	2	8.67377	27.8658	22.0378	8	6.94104
60	2019	3	8.81913	25.4322	5.17785	7	0
61	2019	4	13.0779	20.9114	0	6	0
62	2019	5	24.2845	22.3797	0	5	0
63	2019	6	15.7541	15.5285	0	4	0
64	2019	7	14.5715	20.6898	0	3	0
65	2019	8	18.4069	10.8823	0	2	0
66	2019	9	2.37233	10.3754	9.92089	3	0
67	2019	10	3.18651	13.4805	21.5997	4	0
68	2019	11	-1.93595	23.2016	21.9129	5	6.90169
71	2020	0	-2.29812	22.168	2.61598	4	0
72	2020	1	1.61632	25.816	13.213	5	4.16156
73	2020	2	7.46655	27.841	11.2687	6	0
74	2020	3	18.345	26.0089	3.68752	5	0
75	2020	4	20.6102	25.2218	0	4	0
76	2020	5	23.4859	25.0205	0	3	0
77	2020	6	24.88	22.3685	0	2	0
78	2020	7	20.5658	20.8261	0	1	0
79	2020	8	14.73	15.3852	0	0	0
80	2020	9	10.791	19.3648	5.20752	1	0
81	2020	10	3.80667	14.168	20.4296	2	0
82	2020	11	-3.7421	21.0435	20.1392	3	0

Table 1: Grain Deer Simulation