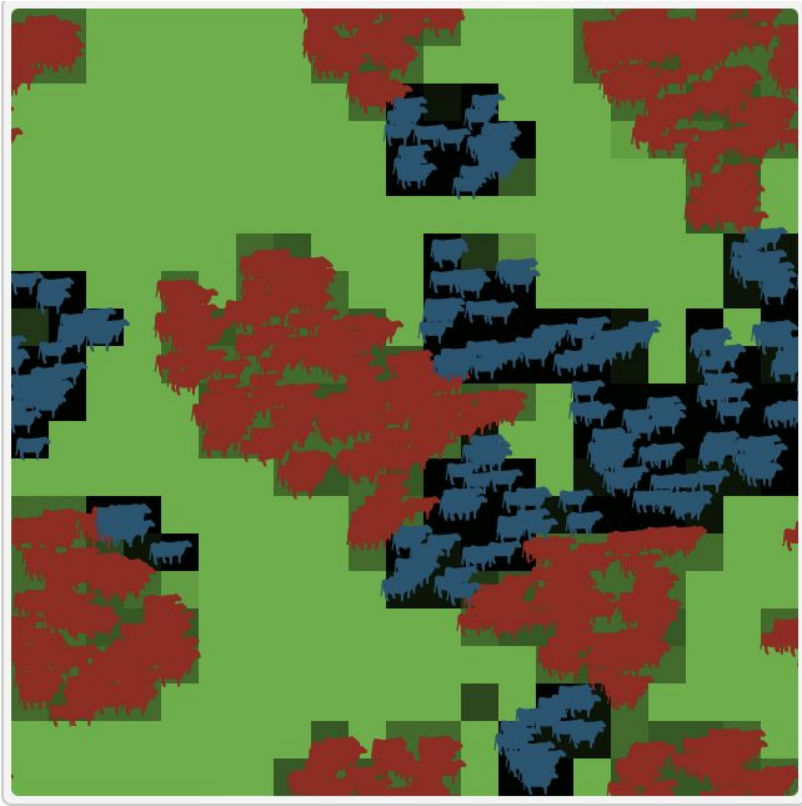# Assignment 14: NetLogo

Dylan Hayashi

Cooperation Model

The cooperation model is an evolutionary biology model in which cows eat and reproduce. At each iteration, cows eat a unit of grass in their surrounding area. Cows are categorized as either greedy or cooperative. Greedy cows eat grass regardless of its state in the growth cycle, whereas cooperative cows only eat grass late in the growth cycle. Grass grows fastest when it is later in the growth cycle, so cooperative cows choice allows for maximal communal eating. Cows also reproduce, and this is determined by how much energy they get from food (more food, more cows.) The variables in the model affect the behavior of cows (cooperativeness, metabolism) and the grass (growth rate, energy). The number of greedy and cooperative cows over time is tracked and analyzed.

Baseline Simulation

|	starting_count	final_count	min	max
greedy	11	779	11	779
cooperative	9	1360	9	1681

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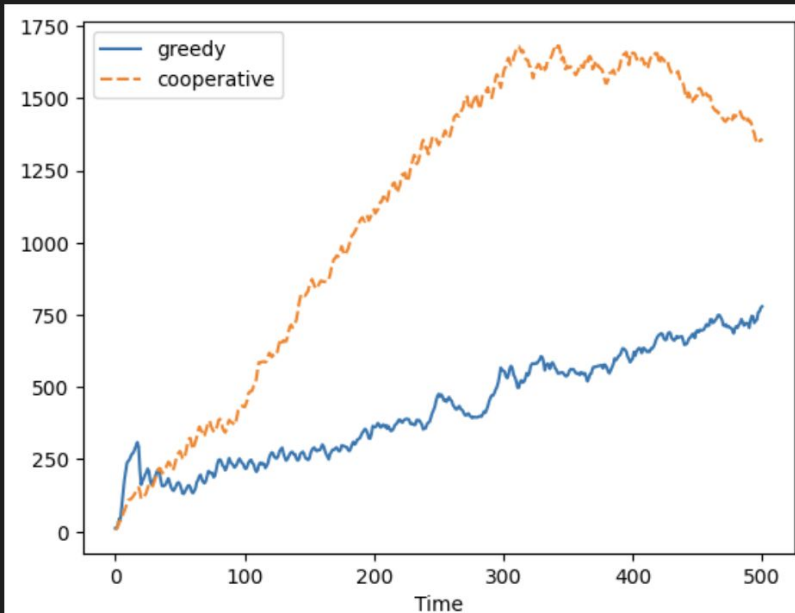

In the baseline simulation of this model, both cooperative and greedy cows increase in population over time. Overall, there were more cooperative (max 1681, final 1360) cows than greedy (max and final 779). The cooperative cow population formed a parabola, maximizing around the 400th iteration, whereas the greedy cow population appeared more linear.

Scenario 1 - Stride Length

The first parameter adjustments I made were of stride length (1, 1.5, and 2). As stride length increased, the overall population of cows decreased. Increases in stride length were positively correlated with greedy cow populations and negatively correlated with cooperative cow populations. It is notable that at stride lengths 1.5 and 2, cooperative cows died out within 200 iterations of the model.

| variable	stride_length	starting_count	final_count	min	max
greedy_1	1.0	7	1145	7	1186
cooperative_1	1.0	13	294	13	2010
greedy_2	1.5	9	1183	9	1345
cooperative_2	1.5	11	0	0	1335
greedy_3	2.0	13	1254	13	1768
cooperative_3	2.0	7	0	0	574

`<Axes: xlabel='Time'>`
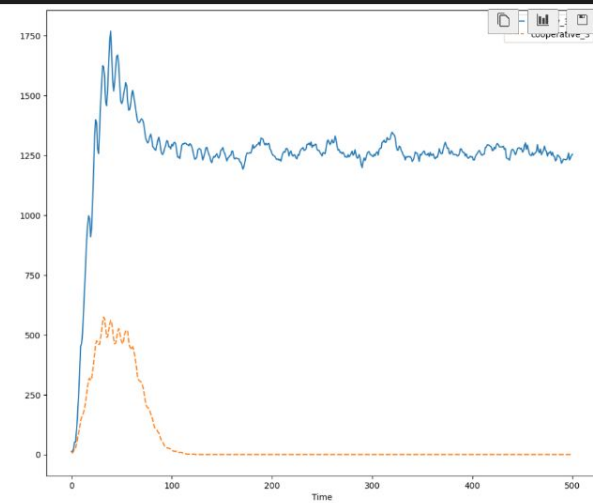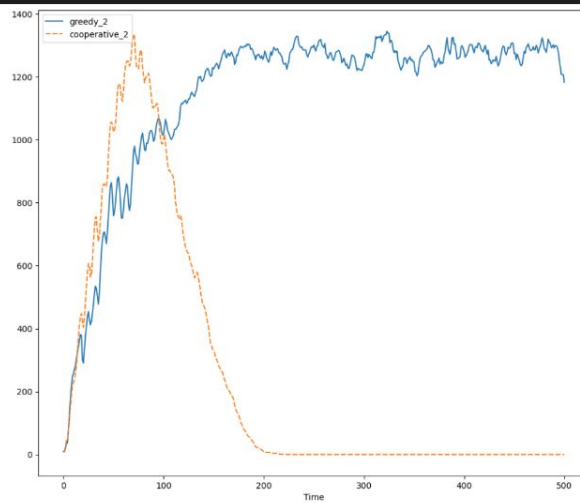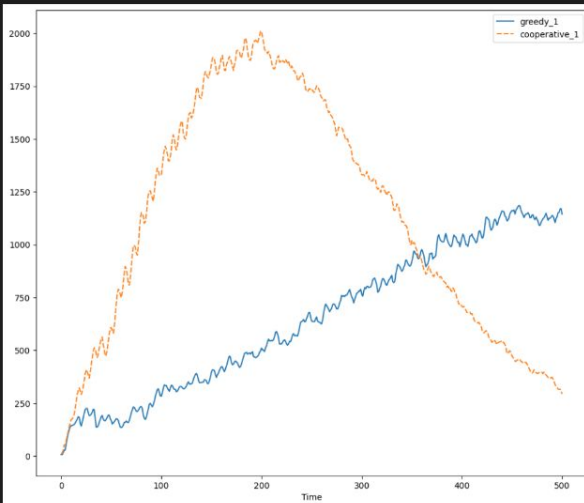
Scenario 2 - Cooperative Probability

The second parameter adjustments I made were for the probability of cooperative personalities (0.25, 0.5, and 0.75). As cooperative probability increased, overall cow populations did as well. As expected, increases in cooperative probability were positively correlated with cooperative cow populations and negatively correlated with greedy cow populations. In all three simulations, the overall populations of cooperative cows appeared parabolic, while the populations of greedy cows appeared more linear. This feature also appeared in the baseline simulation.

variable	cooperative_probability	starting_count	final_count	min	max
greedy_1	0.25	16.0	1106.0	16.0	1108.0
cooperative_1	0.25	4.0	379.0	4.0	571.0
greedy_2	0.50	13.0	954.0	13.0	1008.0
cooperative_2	0.50	7.0	668.0	7.0	952.0
greedy_3	0.75	6.0	772.0	6.0	837.0
cooperative_3	0.75	14.0	1211.0	14.0	2039.0

<Axes: xlabel='Time'>
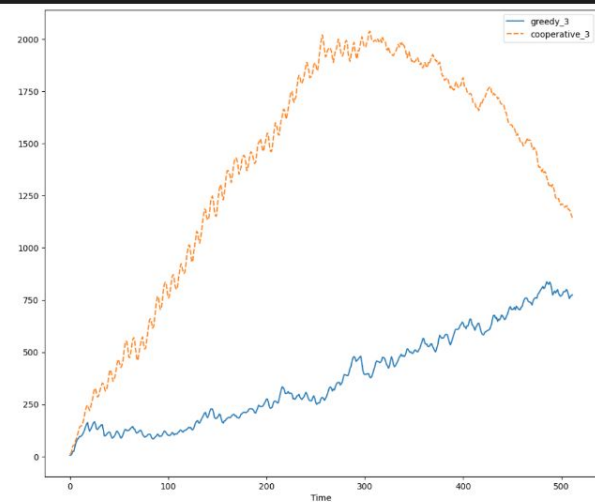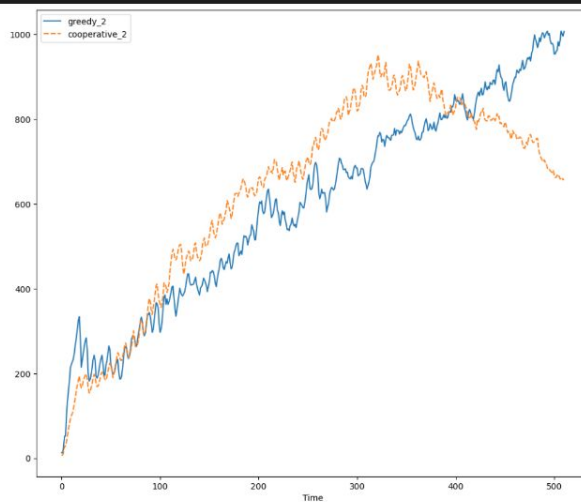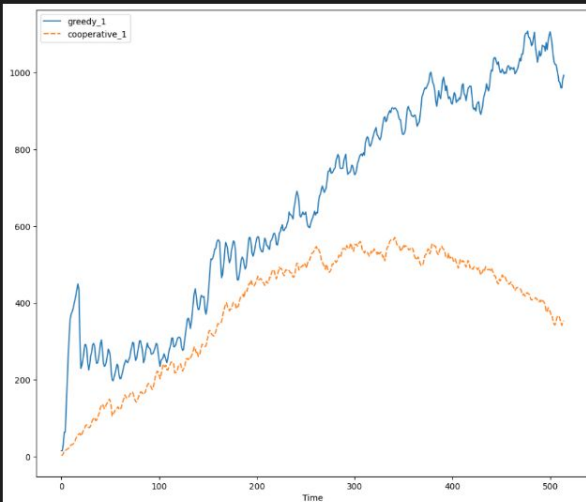
Scenario 3 - Metabolism

The final parameter adjustments I made were in the metabolism of cows (2, 6, and 10). Increases in metabolism resulted in increases in overall cow populations. Increases in metabolism were positively correlated with greedy cow populations and negatively correlated with cooperative cow populations. In the final simulation (metabolism equal to 10), the cooperative cow population died out around the 500th iteration.

variable	metabolism	starting_count	final_count	min	max
greedy_1	2	12	689	12	711
cooperative_1	2	8	1391	8	1546
greedy_2	6	6	772	6	837
cooperative_2	6	14	1211	14	2039
greedy_3	10	11	3711	11	3787
cooperative_3	10	9	20	9	3124

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<Axes: xlabel='Time'>
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