Avian Bird Flu

New Mexico
Supercomputing Challenge
Final Report
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Team Number: 85
Rio Rancho High School

Team Members:
- Matthew Conover
- Jacquelyn Holguin
- Robert Marlow

Teacher:
- Janet Penevolpe

Project Mentor:
- Mrs. Lee

-Table of Contents-

-Executive Summary-

The spread of the Avian Bird Flu is the current international dilemma. The intent of the research is to create a simulation of the spread and to determine if the infected can recover or the virus disappears. Our hypothesis states that the virus will die off over time. A Starlogo software program was created with gray turtles representing the healthy birds, recovered birds are pink, orange represents infected birds, and the dark blue represents the birds that have the flu but are not infected. The data collected determined that the virus does die off in our program with limited numbers and space. In real life, millions of birds die from this disease, causing the virus to become attracted to humans. In actuality there isn't a cure but one is being made. It is a semi-potent on our market today but experts predict there will be a wide spread loss of the drug.

-Introduction-

The spread of the Avian Bird Flu is a current international dilemma among domestic birds. The intent of our research is to create a simulation of the bird flu spreading and to determine if the infected can recover or if the virus disappears all together. The Avian Bird Flu is a contagious virus that infects birds more than humans. However, it is possible to contract the virus if you are in close proximity with infected birds. The virus has two levels of severity; the low and the highly pathogenic virus. The low pathogenic virus (LPAI) has symptoms of ruffled feathers and a decrease in egg production. The highly pathogenic virus (HPAI) can enter the body undetected and infect a whole flock. It also damages the organs and most domestic birds will die within 24 hours of contracting the virus. However, the low pathogenic virus has the potential to advance into highly pathogenic viruses. This has been recorded in some poultry outbreaks.

-Purpose-

The purpose in choosing the Avian Bird Flu was to determine if it would become universal among birds or just die off after some time. Wanting to see if it would become the next plague was another reason for

our purpose. The problem needs to be taken seriously now that importing of goods and livestock has increased. Modeling it would raise some awareness. No one really knows if it will carry over to the United States or stay put in the eastern part of the world.

-Background-

The three types of influenza viruses are A, B, and C. Wild birds are the main host for all of the subtypes of influenza A viruses. Although, wild birds do not become sick when they are infected with avian influenza A, domestic poultry become very sick and will die from it. Influenza type B is usually only found in humans and are not classified according to subtype. Influenza type C viruses cause mild illness in humans and are not classified into subtypes. The problem is that the virus is very contagious through saliva and feces. Although all birds carry the virus in there internal body organs, it still exits the body in the form of contagious saliva and feces.

-Description-

We had some limits in creating our program. Some of the confines that we have are space and number of variables. It could go on longer than

we anticipated so time was another issue. We also couldn't find a math equation that was understandable. So having them as random could change the results. Some materials that we used was the program Starlogo and some information from the internet.

-Conclusion-

In conclusion, the data collected determined that the virus does die off in our program. We learned that there is a possibility that it could completely disappear over time. Under more specific circumstances, results could have been different. There is also a possibility that the virus can befall humans, although it is rare. Right now there isn't a cure for it. However, there is a semi-potent drug on the market today. Our most significant achievement was being able to have the program run the right way so that we could collect data.

-Recommendations-

We would recommend taking this project further because there could have been many other variables. Variables that could have been included could be the terrain, the rate at which the virus spreads, and if it can spread overseas. There is a possibility that our results aren't that

accurate. Several factors could have contributed to the results we received. The program itself could have been better. Everything was set to random instead of having an actual equation so that could be another factor to having received the results we did.

-Acknowledgements-

We would like to thank Ms. Penevolpe because she kept us on track and helped us with our program. We would also like to thank Mrs. Lee for giving us some information. To everyone who gave us advice and helped us out, we thank you.

-References-

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-Appendixes-

Appendix A: Turtle Procedures

```
turtles-own [energy sick?]

to fill

setxy random screen-width random screen-height


end


to wiggle

lt random 90

rt random 90

end


to eat

if breed = infectedboids

        [
```

```
            if pc = green - 2
                [
                stamp brown
                ]
        set energy energy + 3
        ]
if breed = avianboids
        [
            if pc = green - 2
                [
                stamp brown
                ]
        set energy energy - 3
        ]


if breed = recoverdboids
        [
            if pc = green - 2
                [
                stamp brown
```

```
                ]
        ]

if breed = healthyboids
        [
                if pc = green - 2
                        [
                        stamp brown
                        ]
                ]
end

to infect
if breed = avianboids
        [
        grab one-of-healthyboids-here
                [
                ask-turtle partner [set breed infectedboids setshape infected-
shape]
```

```
            ]
        ]
end

to recover
if breed = infectedboids
        [
        if energy >= 500
            [
            set breed recoverdboids
            setshape recoveredboids-shape
            ]
        ]

if breed = avianboids
        [
        if energy <= -800
            [
            die
            ]
```

```
        ]
end


to move
eat
wiggle
fd 1
end
```

Appendix B: Observer Procedures

```
breeds [avianboids healthyboids infectedboids recoverdboids]


to setup
clearplots
ct
create-healthyboids-and-do numh [setbreed healthyboids setshape
healthyboids-shape]
create-healthyboids-and-do numa [setbreed avianboids setshape avianboids-
shape]
```

```
ask-turtles
        [
        fill
        ]
ask-turtles
        [
        set energy 0
        ]
end

to start
starteatbutton
startmovebutton
startrecoverbutton
startinfectbutton
startgrowbutton
end

to halt
```

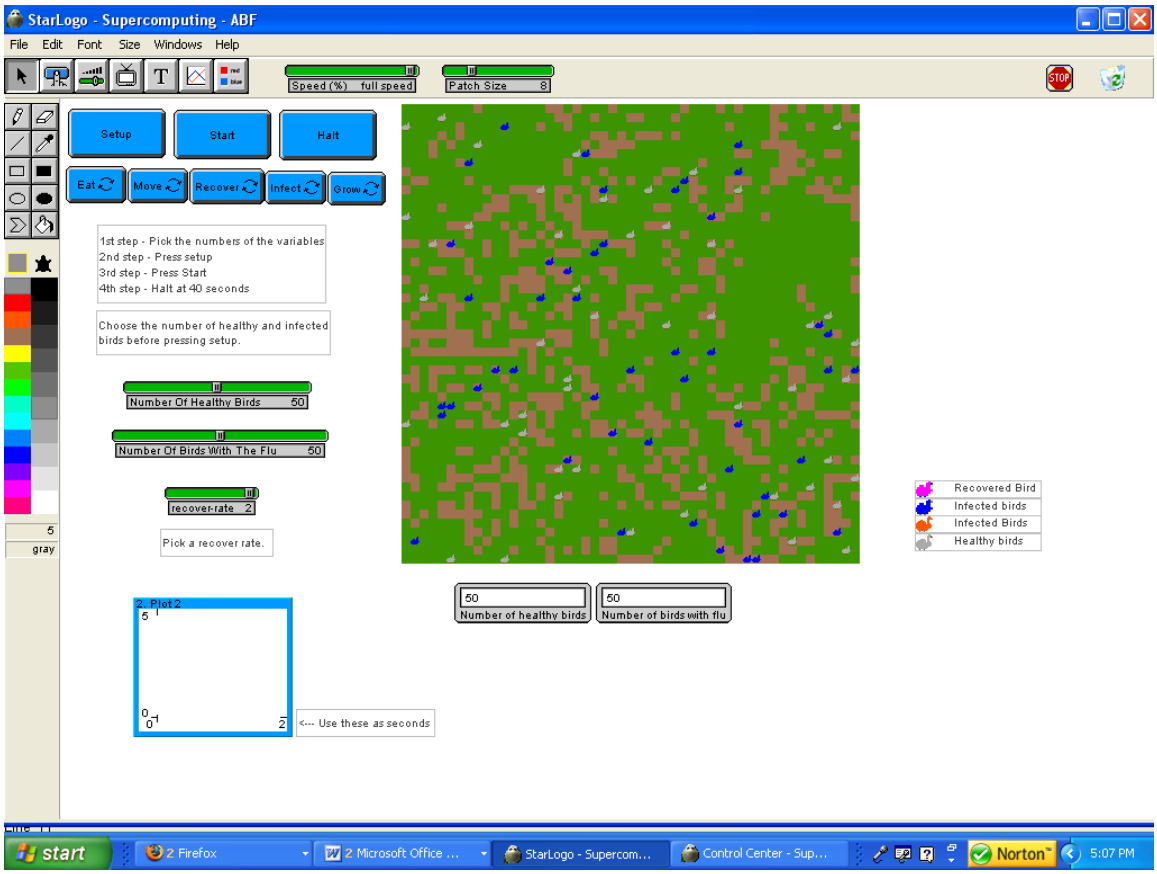
```
stopeatbutton
stopmovebutton
stoprecoverbutton
stopinfectbutton
stopgrowbutton
end


to grow
ask-turtles [move]
crt 3
ask-turtles
        [
        if breed = 0
                [
                setxy (random screen-width) (random screen-height)
                ht
                if pc = brown
                        [
                        stamp 53
                        ]
```

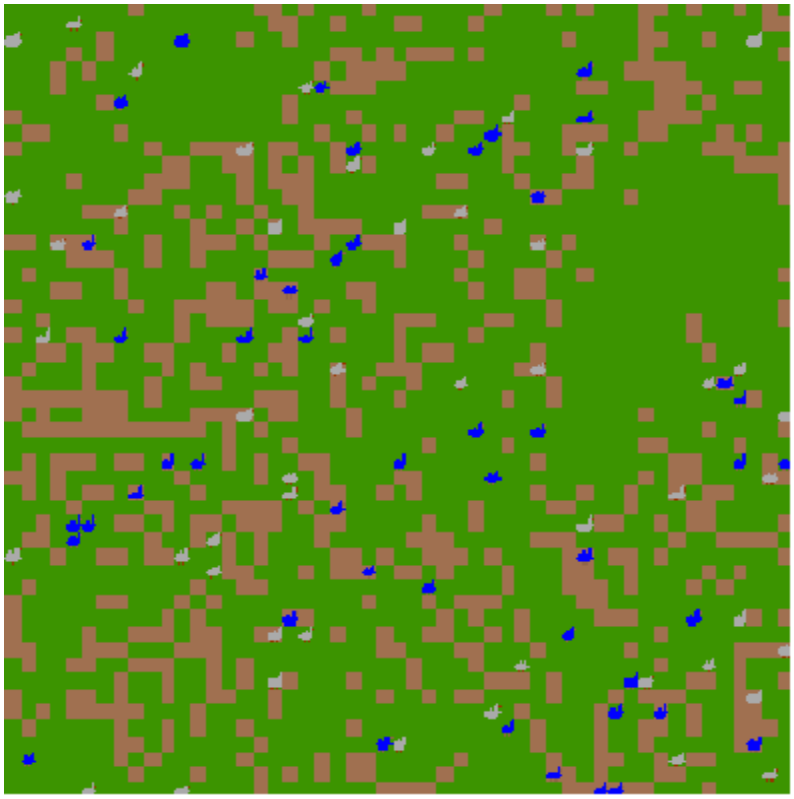
```
        seth random 360
        fd 1
        ]

    ]
end
```

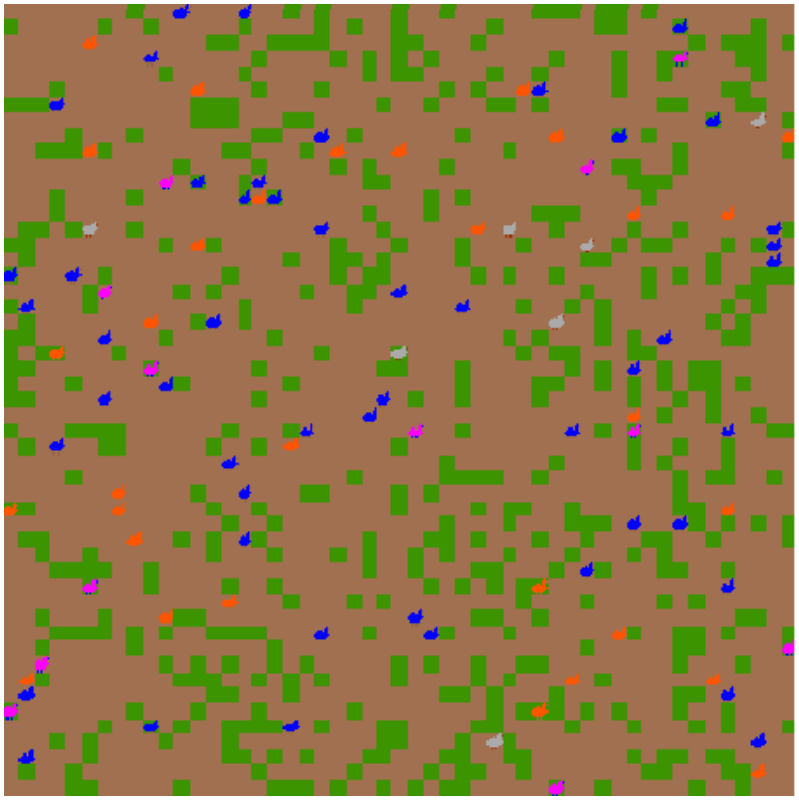
Appendix C: Layout of program



Setup



Run after about 4 seconds



Run after about 8 seconds