Challenge Final Report Submission Information

Team ID-

Meles 41

School Name-

Melrose Elementary

Project's Area of Science-

Agriculture applied chemestry

Computer language(s) used in your project

NetLogo

Team members grade levels in school (comma separated)-

All Sixth Grade

Team member's email addresses (comma separated)-

None Supplied by School

Crop dust? We must!!!

New Mexico

Supercomputing Challenge

Final Report

April 2, 2018

Team Number 41

Melrose Elementary School

Team members

Lily Macfarlane

Heidi Macfarlane

Eoghen Knight

Teacher

Mr. Alan Daugherty

Project mentor

Mr. Seaver Tate

Executive Summary

Our project is about crop dusting, which is utilizing a specially fitted airplane to spray plants and crops with agricultural chemicals rather than using a tractor that must drive through the field. Crop dusting is useful because it allows for faster and more targeted application of sprays, and doesn't cause any of the crop damage that might result from using other types of ground based equipment. However, it poses a problem, the sprays are often seen as a danger to those in the nearby vicinity, and therefore many people oppose its use near their homes or other public spaces.

Because our team and our families are often exposed to crop dusting in our rural farming environment, and because we personally know a local crop-duster, we thought it would be an interesting project to study. Our aim was to see if crop dusting can be done in more of a safe manner, and to prevent harmful overspray of the often dangerous agricultural chemicals.

We made a NetLogo model shows these basic aspects of the crop dusting scenario:

A. A map of a representative area. This map represents the crop fields, the surrounding pastureland, the amount of houses, and public areas that exist
B. Agents that move and perform the needed actions. In our case, this includes the crop dusting airplane, and the spray that is released.
C. Variables that affect the process. We have narrowed these down to 'Wind Speed', 'Wind Direction', 'Spraying Altitude', and 'Chemical Type'.
D. Data that we collected is a count of how much spray drifts away from the field under different conditions.

We think that our model has helped us gain a better understanding of the actions and processes involved in crop-dusting, and we think it can be used as a learning tool by others.

Problem

We want to do our project on crop dusting. Crop dusting is where you use a plane to spray crops with chemicals to help them grow. Farmers use crop dusters when they need to quickly solve a problem or fix a situation like insects, diseases, or when the field is too wet for a tractor.

Method

Description – The model looks like a map with roads which are black, the homes that are all red, all of the fields in the color of dark green, an airplane that is a velvet color with a light blinking, and the weeds that indicate the direction of the wind.

Patches- The different spaces in the NetLogo landscape represent different items like the roads that are black in the model (the airplane will not spray the road). The homes are represented by red squares which the plane will also have to avoid spraying. All of the fields are dark green. These are the main targets for spraying. The grass is the light green over the whole model. If any spray goes here, it is wasted.

Some variables that we used in our model that can change and have different values include the wind and the type of chemical sprayed. Their effects are as follows:

A. The direction of the wind is mostly going to effect the chemicals drift and where it will land, and the speed of the wind will control how much it will drift in the wind's direction.
B. The altitude. The altitude of the plane will also have an effect on the crop dusting because of how high the plane is, which will give the chemicals more air time before they land on plants.
C. Chemical-types. These are a partner to the wind direction and wind speed. This is because different chemicals spray with different sizes of drops. Large drops fall quickly, while mists tend to drift with the wind more.

These variables will affect how the agents operate and help us determine the amount of safety that crop dusting is showing.

Agents: Our agents include:

Tumble weeds that are light brown. These are a visual indicator of the current wind speeds and directions.

The Airplane, which moves to actually do the spraying of the chemicals. And:

The Sprayed Chemicals, which are what the farmers want to apply to their crops.

Controls- The controls are the sliders that allow you to vary any of the variables to see how different conditions will affect how the crop dusting works.

Procedures- first you can click field, then homes, next road, and then plants, and lastly airplane. Then you can go to the sliders and get tumble weeds, up to 30, and change the way the tumble weeds go on the screen. Then hit move and they will move. Next you will chose which chemical you want and change the heaviness of the chemical. You can chose your field by clicking the mouse button when it is over the field to spray. Then you will click the button pattern and the plane will move in a pattern. Finally if you want to delete the model you made you will hit the button called ca, it will delete your model and you can create another one.

Verification

After we received impute from Mr. Tate about the most important things on the project to emphasize, we started to see some accomplishments, Mr. tate has looked over our project to see if it had the basics or the ideal things that might help us to improve our display or our work, but he said that it had a basic representation of the crop dusting process.

Results and Conclusion

We have just started to get an understanding of Supercomputing and computer programming. We wanted to have a project that could test our ability to use models in basic life situation. After we learned and practiced using basic coding, we were successfully able to make a model of a crop duster.

Software

Attached you will find a copy of the computer code and commands that we used to make our model.

Achievements

Our significant achievements on this activity are based on what we had to learn in order to accomplish a completed project. We first made an achievement by learning the basics of Supercomputing and learning how to use a computer programming language. Then we had to make a display for the crop duster. Another thing that we accomplished is that by doing this entire project we proved we can do a year-long activity as a team. This was a fun project for all of us just as it was very challenging as well. We now know much more about computer coding and other things based on computers as well as about the subject of crop dusting.

Acknowledgments

In this activity with crop dusting, we had much help from our parents and teachers. We would first like to thank Mr. Daugherty, a teacher in the high school who first introduced us to the idea of Supercomputing and taught us about it before starting us on this project. Then there was the ideas from the judges from the ENMU presentation. They had very good ideas to improve the project and we took some of the ideas and put them to use. They also tested our abilities to show our project to others and have helped us get ready for other competitions. We would also like to thank our parents and guardians who helped us with transportation to the places that we needed to be, and for helping get supplies that we needed to complete the project.

Attachment: Computer Code:

```
breed [planes plane]

breed [sprays spray]

breed [tumbleweeds tumbleweed]

breed [chemicals chemical]


chemicals-own [height]

patches-own [sprayed]


to land

  ask patches [set pcolor 67 set sprayed 0]

end


to plant

  ask patches [if pxcor > 4 And pxcor < 12 And pycor > -12 And pycor < -4 [set pcolor green]]

  ask patches [if pxcor < -2 And pxcor > -14  And pycor < 14 And pycor < -2 [set pcolor green]]

  ask patches [if pxcor > 1  And pxcor < 10 And pycor > 8  And pycor < 15 [set pcolor green]]

end



To homes
```

```
  ask patches [if pxcor > 2 And pxcor < 4 And pycor > 1 And pycor < 3 [set pcolor red]]

  ask patch 1 -13 [set pcolor red]   ask patch 6 0 [set pcolor red]

  ask  patches  [if pxcor < -4 And pxcor > -12 And pycor > 2 And pycor < 10 [set pcolor red]]

end



to road

   ask patches[ if pxcor > 11 and pxcor < 14 [set pcolor black]]

end



to see-wind

   crt 3[set breed  tumbleweeds set shape "plant" set color brown set size 2  ]

   ask tumbleweeds[setxy random-xcor random-ycor ]           ;; move each tumblweeds to a random point

   windy

end



to airplane

  crt 1 [set breed planes set shape "airplane" set color 122 set size 3 set heading 0]

end



to windy
```

```
  ask tumbleweeds [set heading wind-direction fd (.00001 * windspeed)]
  ask chemicals [set heading wind-direction fd (.00001 * windspeed) set height (height - (chemical-type / 50))]
  ask chemicals [if height < 1 [die]]
end

to crop-dust
  ask  planes [if patch-ahead 1 = green [spray-field]]
end

to spray-field
  ask planes [ fd 1
     hatch 1 [set breed chemicals set color red set shape "dot" set size 1 set height altitude set xcor xcor - 1]
     hatch 1 [set breed chemicals set color blue set shape "dot" set size 1 set height altitude set xcor xcor + 1]
     hatch 1 [set breed chemicals set color white set shape "dot" set size 1 set height altitude] ]
end

to turn
  ask  planes [lt 45 repeat 6 [rt 45 fd 1] lt 45]
end
to move
```

```
  ask planes [ ifelse pcolor = 64 [hatch 1 [ set breed sprays set shape "dot" set size 1] fd 1][rt 90 fd 1 rt 90 fd 1]]  if
pcolor = 67 [stop]

  ask planes [ ifelse pcolor = 64 [fd 1][lt 90 fd 1 lt 90 fd 1]] if pcolor = 67 [stop]

end
```