# Too Many Or Not Enough

New Mexico Supercomputing challenge Final Report April 1, 2014

# Team 56 Jackson Middle School

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# **Executive Summary**

Ecosystems are very delicate. They always change, because of their many variables. Rain is one of the reasons, too little affects plant growth a natural resource and too much also affects plant growth. Due to the drought in New Mexico it's hard for bears to find natural resources. Since the resources for food aren't available to mother bears they don't have enough energy to bare the cubs, so the population of bears might decrease. The goal for our model is to show the relationship between the mother bear and the nutrients, which are the berries. We show that relationship by using sliders to control the plant growth rate and how many berries the plant can hold. We also have sliders that control the amount of energy that a bear has and how much energy it decreases when it move; how much energy a bear gains by eating berries. We have no results to give yet as we are still finishing our program and running the simulations.

### Statement of the problem

The question is because of the drought the amount of nutrients for bears gets lower, how does it affect mother bears and its cubs? Since the drought the main food supply, which is berries, is very scarce. Without the nutrients that berries supply, reproduction for the bears goes down. Since cubs need to have good health in order to be born, being without the nutrients needed or survive the cub will then not have those nutrients and may not be able to be born. The mother loses weight while the cub gets the same amount the mother bear had before it loss energy weight during the first couple months of nurturing the cub.

Berries are vital for a bear's nutrition. If berry crops fail bears could have a difficult time finding enough food. During our drought, with little water source from the runoff, there will be a loss of berry crop. Without enough food to eat young bears will not have enough to build their reserves for the winter. This would cut short their ability to survive the winter. If there are not enough berries the female bears will have less ability to produce babies in the winter.

#### Method

We came up with many ideas. Our mentors told us that we would have to choose which ONE thing we wanted to. We both talked about animals, so we decided to do something with bears and make it related to New Mexico. Here in New Mexico we have had a very bad drought problem that seemed to help narrow your question. In our research we found information about mother bears and their cubs. We researched their diets and their dens. We researched bears ecosystems. One other thing we researched is droughts and climate control through the past 11 years. Then we researched the type of berries that bears eat, and which ones give off energy to the mother bears and their cubs. We took the research and tried to make our model close to the information. We created an ecosystem of the bear's habitat.

## Verified and validated

Calling the state forest services allowed us to check our model for accuracy. We also called close by rangers and biologists in the surrounding areas of Albuquerque. We also had our mentor Nicholas Bennet who has experience with ecosystem, advise what we could change or add in order to make it more realistic. We also went back to Starlogo and looked at Fish and Plankton. We also went to NetLogo and looked at the sample biology models. Using that research we found the ideas of were to fix things in our model.

# Results of our study

Our project is still in progress. We are still running tests on our models. We have all of our components that we would like to show in our model that we would like run

#### Conclusions

We have no conclusions that we can make because we are still in progress with our program.

#### Software

This is our program.

```
breed [ bears bear ]
breed [ plants plant ]
breed [ helping-plants helping-plant ]
bears-own [ good-sniff bad-sniff appetite energy ]
plants-own [ berries ]
helping-plants-own [ berries ]
patches-own [ is-cave? ]
to setup
  clear-all
  import-pcolors "Cave_land.png"
  ask patches
  [
```

```
set is-cave? ( shade-of? pcolor magenta)
  1
  set-default-shape plants "brush"
  create-plants num-plants
  Γ
   set color red
   set size 5
    set berries random plant-capacity
    setxy random-xcor random-ycor
   while [ is-cave? ]
    Γ
      setxy random-xcor random-ycor
    1
  ]
  set-default-shape helping-plants "helping-bush"
  create-helping-plants num-help-plants
   set size 5
    set berries random plant-capacity
    setxy random-xcor random-ycor
   while [ is-cave? ]
      setxy random-xcor random-ycor
    1
  1
  create-bears num-bears
  Γ
    set color brown + 1
    set size 5
    set good-sniff ( max list 0 random-normal avg-sniff-
radius (min list 1 avg-sniff-radius / 5 ))
    set bad-sniff 2 * avg-sniff-radius - good-sniff
    setxy random-xcor random-ycor
   while [ is-cave? ]
      Γ
        setxy random-xcor random-ycor
      1
    set energy initial-energy-bears
  ]
 reset-ticks
end
to go
  ask bears
   [
```

```
walk
      eat-berries
      hatch-cubs
    1
  ask plants
    Γ
      set berries ( min list plant-capacity (berries +
berries-grow-rate ) )
    1
  ask helping-plants
    ſ
      set berries ( min list plant-capacity ( berries +
berries-grow-rate) )
    1
  tick
end
to walk
  lt random 35
  rt random 35
  ifelse can-move? 1
  Γ
    fd 1
    set energy ( energy - energy-decrease )
    set appetite ( appetite + appetite-increase )
    if energy <= 0
    Γ
      die
    ]
  ]
  Γ
    set heading random 360
  1
end
to eat-berries
  if appetite >= appetite-threshold
  Γ
    let possible-good (helping-plants in-radius good-sniff
with [ berries > 0 ] )
    let possible-bad (plants in-radius good-sniff with [
berries > 0] )
    let possible-berries ( turtle-set possible-good
possible-bad )
    if any? possible-berries
```

```
Γ
      let target-berry min-one-of possible-berries [
distance myself ]
      ifelse distance target-berry <= predation-reach
        [
          ifelse [ breed ] of target-berry = helping-plants
            [
              set energy ( energy + energy-good-plant )
            ]
            Γ
              set energy ( energy + energy-bad-plant )
            1
          set appetite ( appetite - decrease-appetite )
          ask target-berry
            Γ
              set berries ( berries - 1 )
            1
        ]
        Γ
          face target-berry
        ]
    ]
  1
end
to hatch-cubs
  if energy >= breeding-threshold
  [
    set energy ( ( energy * (1 - breeding-energy-loss ) ) /
2)
    hatch 1
    Γ
      setxy random-xcor random-ycor
      while [ not is-cave?]
        Γ
          setxy random-xcor random-ycor
        1
    ]
  ]
end
```

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### Significant Achievement.

One of our many achievements was learning teamwork and trust that we would have things done. Katrina learned a new programming language. Hannah learned how to write down ideas and thoughts that didn't make sense in her head. We both were able to bounce ideas off of one another; a big accomplishment.

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