**Forest Fire Simulation - 4.2.3 Simulation Project**

**People Working on Project:**

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**Ideas:**

We chose the **Fire** simulation to use as our basic template.

* Add a slider to change the temperature
* Option for precipitation and its strength
* Wind strength option
* Choose season
* Edit the humidity and relative humidity
* Possibly allow to choose day or night
* Cloud formation

**Research & Rules:**

**Research Link:** https://docs.google.com/document/d/1ZuCDloNG13hxt3KbMoT08J8jirLVz946-gNc70SRciQ/edit?usp=sharing

**The article that we used for our background research in the fire simulation was Weather “Elements that Affect Fire Behavior.” This article states and dives into how weather is one of the most important component from the other factors (fuel and topography) of how a fire starts in its environment. Additionally, there are many components of weather that makes a fire behave the way it does.**

**Rules:**

* Fires also burn more intensely in the afternoon. The temperature is the highest at that time resulting in higher fuel temperatures. Consequently, less heat is needed to raise the fuel to its ignition temperature. The lower the relative humidity, the more readily a fire will start and burn; the more vigorously a fire will burn.
* Moisture in the fuel absorbs heat and reduces the fire’s intensity before it is converted to steam and driven off. When the relative humidity is low, the moisture in the fuel is readily evaporated as it rises to the surface of the fuel. When the humidity is high, it’s harder for the moisture to evaporate into the air.
* Relative Humidity will generally be the highest in the early morning hours before daylight and the lowest during the early afternoon.
* This is because relative humidity is changed by temperature. When air is warmed, it expands and as a result, will hold more moisture.
* As temperature changes, relative humidity changes but in the opposite direction. As temperature goes up, relative humidity goes down and vice versa.
* If the humidity is 100 percent or close to it, the fuel will not dry. On the other hand, the lower the relative humidity, the quicker the moisture will evaporate.
* Precipitation (rain or snow) has a direct and immediate effect on fuel moisture and relative humidity. Temperature usually drops as well and the winds became calm. When the atmosphere becomes saturated, precipitation usually occurs if more moisture is added.
* Precipitation will quickly dampen the surface of fuels to the point that fires cannot ignite and no wildfires will occur.
* In the South the fire season starts in the fall and generally slacks off during December and possibly January as the climate turns cold, with numerous rains, calm winds and overcast skies. Knowing typical weather patterns in an area is essential for the accomplished prescribed burn planner. Typically the last two weeks of February and the first two weeks of March are suitable for late dormant season burns in the deep South. As the rains lessen in the early spring and the winds increase, the fire season is again high until middle or late April. The last two weeks of March and first two weeks of April is generally a good period to plan early growing season burns depending on bud swelling and break of target species.
* If, however, a winter drought occurs and continues into the spring, fires will readily burn on into the summer because of the larger amount of dead, dry fuel and low fuel moisture.
* During long periods of dry weather, drought, moisture that is toward the center of larger fuels and deeper in surface litter is able to work its way to the surface and evaporate into the dry atmosphere. As a result, a larger percent of the total fuel becomes available fuel; available to burn.

**Create Prompt:**

Fire provides heat, warmth, and light in our daily lives. We use fire for many things as we know how to manipulate it under our control, or so we think. Though we have solutions to wildfires, the process is still insufficient as we are still left with areas damaged and unable to rehabilitate. This simulation represents fires and how they spread in a forest. Originally, the simulation uses an algorithm where, based on the set density of the user’s choice, will randomly generate red areas in which represent the area burnt from the left edge and spread from each direction. If the density is set less than 55%, the fire will spread slowly and die based on the set percentage the user chooses. If the density is set on 59%, the fire will guarantee a 50/50 chance of going from the left edge of the forest to the right. A 70% set density will ensure it will go to the right edge. Our modified code includes the functions day, precipitation, and temperature, which, in real life, affects firm and its behavior. These functions either increase or decrease the spread of the fire in the simulation. Using the same/near the same percentage as the density for the original algorithm, the simulation is now vulnerable by the settings the user sets for the simulation as there is now three additional options for users to play with. Based on our research, the new simulation represents the causes of fire and weather.

**Notes/Work for new Algorithm:**

**Temperature**

68 F = ~50% relative humidity

+1 spread at average

\68F

--1 at 80% or more

\28F or less

--2 at 100%

\8F or less

++1 at 20% or less

\108F or more

-Rule of Thumb: Relative Humidity doubles with each 20F drop in temperature and halves with each 20F increase in temperature.

-If the humidity is 100 percent or close to it, the fuel will not dry.

**Precipitation**

+0 at 0 inches of rain

--1 at 0.7 inches of rain or more

--2 at 1.5 inch of rain or more

--3 at 2 inches of rain or more

above is based on

http://www.usatoday.com/story/weather/2016/11/29/rain-helping-gatlinburg-wildfires/94599568/

-Precipitation will quickly dampen the surface of fuels to the point that fires cannot ignite and no wildfires will occur.

-Approx 1/2-3/4 inches of rain can significantly reduce a fire

**Day or Night**

day +0 spread

-most forest fires begin during the day so day would not have much effect

night -1 spread

-when night rolls around less sunlight is present resulting in a slower/weaker fire