FIGHTING FOREST FIRES WITH VORONOI DIAGRAM

Arflyno Chrisdion Pudayar Pahombar Ludjen
Supervisor: Nur Chasanah, M.Sc
Center for Young Scientists. SMA Bina Cita Utama, Palangkaraya, Indonesia. ludjen.dion@gmail.com

1. Introduction

Indonesia ranks second in forest loss in the last 25 years [1]. Central Kalimantan forests, the lungs of the earth, is the center of forest fires. Not only resulting in a wide area of forest loss, forest fires also cause more complicated issues, i.e. haze. In 2015, the haze that covered Central Kalimantan lasted for about 3 months causing numerous issues including deaths. Forest fire stations are then built to tackle the fire issue. However, until now there is no proper way of determining the location of these forest fire stations.

2. Research Method

This research aims at finding a method to determine the locations for new forest fire stations. In order to do this, a voronoi map constructed and a simulation is built with the program NetLogo. Beginning with the preparation phase, various theories were studied through references as well as current and past news on forest fire stations of Central Kalimantan.

In the data collection phase, interviews with the local governmental officer working around this issue were conducted. The locations of hotspots and forest fire stations were collected from trusted sources.

The above data were combined and put into a map. Then a Voronoi Diagram was constructed based on the map and analyzed afterwards. In order to test the map, the simulation is used to picture the incident of a forest fire.

3. Results and Analysis

The simulation pictures the event of forest fires along with the handling capabilities of the forest fire stations. Inside the simulation, an area is randomly filled with trees. The starting point(s) of the forest fire is also chosen randomly. Meanwhile, the location of the forest fire stations is determined by two ways: manually distributed by the user or are placed randomly around the map. The display is as Figure 1.

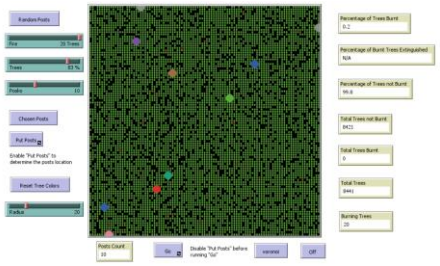

Fig 1. The display of simulation. The green area represents the trees with red trees as the starting point(s) of the forest fires. The forest fire stations are represented by the large dots.

In the simulation, the percentage number of trees to the area can be determined manually, as well as the number of starting point(s) of the forest fires and the number of forest fire stations. The handling capabilities of the forest fire stations are shown as radius and can be changed.

Once the simulation starts, the starting forest fire point(s) spreads the fire into the neighboring trees and will continue to do so unless a forest fire station is nearby. Meanwhile, the forest fire stations will extinguish the fires inside the radius. The simulation will stop when there are no more trees that are burnt.

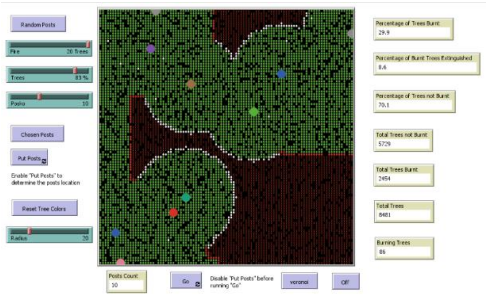

Fig 2. The simulation being run shows the trees burning

In addition, the Voronoi diagram is applied in order to compare the radius of the forest fire stations and the areas that should be handled by those stations. This may help in deciding the location of the new forest fire stations.

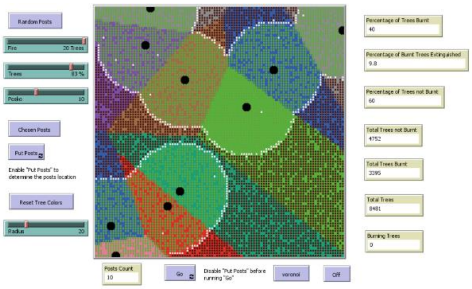

Fig 3. The simulation with the voronoi diagram

4. Conclusion

With this simulation, the comparison between the forest fire stations and the forest fires itself is seen clearly and testing the forest fire stations can be done. Combined with the Voronoi diagram, locations for new forest fire stations can be determined.

5. Literature

[1] https://interactive.aljazeera.com/aje/2016/lungs-of-the-earth/index.html