Modeling the Leach Rate of Arsenic after Hurricanes

New Mexico Super Computing Challenge
Final Report
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Team Number 26
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Executive Summary

How long does it take for arsenic to leech from hurricane debris into the ground? How long does it take for it to become neutralized (if it does get neutralized)? How does this affect the area and resources around it? How does it affect us? Arsenic is poisonous and dangerous to the environment, but how dangerous? Why does the government enforce the arsenic levels in our water? Well, by finding out statistics on arsenic and how it is carried, we can model how quickly arsenic spreads and how much damage it causes. To do this, we will use the software NetLogo TNG to model and test these variables.

Introduction

Project Definition

How long does it take for arsenic to leech from hurricane debris into the ground?

Hurricane Background

Hurricanes devastate the U.S. coastline and other coastlines and other coastlines yearly. It drives people out of their homes yearly. It ruins property and lives and even caused death. Hurricane Katrina was a recent hurricane that had far reaching and long lasting effects. Over 700 trees an estimated 300,000 cubic yards of brush fell. The deserter debris from hurricane Katrina is one of the largest in terms of volume and economic loss in American history. Fences, decks, and homes a considerable amount of treated wood and consequently arsenic will be disposed as disaster debris. Construction and demolition wood resulting in an estimated 1740 metric tons of arsenic disposed.

Understanding Arsenic: What is Arsenic?

Arsenic is a poisonous metalloid discovered by Albertus Magnus in 1250. In small concentrations, arsenic can be found naturally in soil, water, air, and minerals. Though arsenic is essential for some animals, the recommended daily intake of arsenic for humans is as possibly as low as 0.01 mg. "CCA treatment leaves about one ounce of inorganic arsenic in each 12 foot 2 x 6. This is enough arsenic, if released, to kill about 250 adults." (**http://www.origen.net/arsenic.html**)

Program Design

In the screen shot above you can see red lines circling the high and low points in the terrain where rain is either running off or pooling this is our progress to date.

We hope to augment this program by inputting arsenic contamination piles and a more realistic terrain

Simplification
Our model does not represent reality fully yet. For example, when the rain-rate is low than the level of arsenic leeched slowly increases and levels out at a higher level than when the rain-rate is high. There are many things that we assume that makes our program simpler than reality. First we assume that all material in the program is arsenic contaminated. We assume that a rain rate is constant. We assume that rain falls evenly through the whole area. We assume that there are no tides. We assume that there is no wind or other weather besides rain. We assume that there is no human intervention.

Our Computer Model

Our model simulates a natural phenomenon that occurs on the gulf and Atlantic coast of the United States. Hurricanes cause many problems for us including causing arsenic, a deadly poison, to leech out of treated wood after a hurricane. This creates many environmental nightmares. It can poison our water supply, kill and poison fish in our bays, and when we eat the fish we accumulate arsenic which can cause negative health effects including death. Our model, models this cycle by simulating rain running down hill sides coming in contact with arsenic debris. When the rain droplets come in contact with the arsenic debris, the droplets become contaminated and carry the arsenic and carry the arsenic into the bays and estuary.

User Inputs
We have sliders that allow us to chance the rainfall rate from zero to one, absorption rate from 0.001 to 1.00, and debris. These user inputs are here so that the user can aply the program to many different scenarios therefore making it more applicable and therefore giving it a purpose.

User Outputs
The outputs we have are raindrops flow downhill, raindrops that accumulate in lower places, and rate of flow is dependant on slope. We also have a graph that shows the contaminated water versus the uncontaminated water.

Assumptions
We assume that all material in the program is arsenic contaminated. We assume that a rain rate is constant. We assume that rain falls evenly through the whole area. We assume that there are no tides. We assume that there is no wind or other weather besides rain. We assume that there is no human intervention.

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