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MASSACHUSETTS CLEAN TECHNOLOGY AWARDS

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Region II, Central MA
Climate Science Award:

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*"The Effect of River Meanders on
Flooding"*

ABOUT ME:

Since I can remember, I have always been interested in science. I moved to Massachusetts from Pittsburgh when I was two years old. My dad is a physicist and my mom is a reading teacher. I am an only child. I have two cats named Neptune and Fog. In addition to science I also enjoy music, singing as a tenor in my school's honors choir and playing classical and jazz piano. I am ethnically Greek and Italian and I am learning how to speak and write Greek. I am an avid skier and mountain biker and my other outdoor pastimes include hiking and rock climbing.

The Massachusetts Audubon Society has always been an influential part of my life. I always have enjoyed being outside and a project concerning the environment was a good fit for my interests. Even when I was little I was intrigued by trees, plants and animals, and I have kept a vegetable garden since I was three. I believe that one of the most important problems today is the destruction of the environment. Sometimes there is a mentality that people are separate from the environment and I believe this is the reason why we have harmed the environment so severely. I am unsure what I will study when I am older but I will either be a musician or a scientist. If I do pursue a science career, I would want to be doing studies and surveys outdoors that concern the environment.

MY PROJECT:

I became interested in doing a project on flood control after hearing many times of how floods around the world are destroying lives and property. In my background research, I learned about invasive methods of flood control, including channelization, i.e. building walls to confine the river to one fixed width, in order to "control" the river and prevent flooding. However, this restriction means that when more water flows into the river, instead of being able to spread over a larger flood-plain area, the water instead flows faster. As I began testing to see if channelization is an effective method of flood control, I also learned that it often has a negative effect on the environment, and studying this topic became even

more interesting for me. For instance, there was record flooding along the Rhine River in the 1990's that killed hundreds. Here in America, nearly two hundred people die every year due to flooding. In many cases, channelization has been a suspected cause.

The environment is also destroyed: riparian (riverside) vegetation is lost and fish populations usually drop in excess of 80%. Almost every type of wildlife in and around the river is hurt when a river is channelized. Today channelization is less popular than it was previously, and in some areas, rivers are being returned to their natural states. The Army Corps of Engineers has been the long-time proponent of channelized rivers in the U.S. but a shift in thinking is taking place; they are under especially severe criticism in Louisiana, where projects such as the Industrial Canal are being questioned for their role in the flooding damage from Katrina.

The purpose of this study was to determine if channelization was an effective and safe way to reduce flooding along a given stretch of river. This study focused on whether the benefits of channelization outweighed the unwanted effects that it produces. Does channelization reduce flooding along the floodplains of a river? What happens if a river was channelized upstream but not downstream?

Procedure: A river tank had to be built to carry out this experiment. To build a tank, plywood, sheet metal screws, Plexiglas and waterproofing materials were used, and the end-product was a tank 2' by 4' long and 8" deep. Soil was compacted into the tank and a river was carved out of the soil. The meandering river and floodplain were both waterproofed to eliminate uncontrolled variables. The river was flooded at 1.0, 1.5, 2.0, and 2.5 gallons per minute. Photos of the flooding were taken with each trial. After data was collected for multiple trials, the river was recarved, first to be channelized, and then to be channelized upstream and meandering downstream.

Results: The photos were analyzed using ImageJ to find the area of flooding. A computer program developed by the National Institutes of health, ImageJ allowed a scale to be set for the images and the flooded areas could be "painted." After this and several other steps, a particle analysis was used and the area of the flooding was found in inches squared. The banks along channelized rivers were safer from floods than those along meandering rivers. There was as much as a 4.5 standard deviation less flooding along rivers that were channelized than those that were meandering. However, channelization had severe unintended effects downstream. Although the river channelized upstream had roughly the same amount of flooding in total, about 98% of flooding was concentrated in the downstream meandering area, instead of spreading evenly over the floodplain of the entire river. Channelization may help save lives, but those living downstream may be in jeopardy. Whether channelization is a positive thing may depend on the exact situation.