James River Water Area Change From 1953 to 2003

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Location: Lake Springfield Dam; Springfield, MO

Introduction:

The building of the Lake Springfield Dam has impacted South Greene County in many ways. The project chosen was to look at the impact of change in the area surrounding Lake Springfield from before the dam was built to now. My interest was in seeing how the vegetation covers and human land use has changed around the lake, and also the actual area of water taken up by the lake. Then the impact of a 100 year will be looked at to see if the building of the dam and the expansion of human development will impact the flood damage. So, a quick summary of this report would be:

- Study of the James River at the Lake Springfield Dam
- Impact of the Dam on the amount of water and change in surrounding area
- See how the one hundred year flood will now affect the area around the lake.

The main goals of this project were to see how the landscape changed by the building of the Lake Springfield Dam, determine how much more area the water covers, how much impact the water could have on surrounding development, and what a 100 year flood could possibly impact. The results I'm looking to complete are to have classified all three dates and see the difference in water area and impact change on the surrounding land and to have the DEM image to help display the one hundred year flood, showing its impact on the area now. The possible problems I look to encounter along the way are getting images to overlay. (Different Scales), completing classifications accurate on each image, and finding base water level and one hundred year flood data

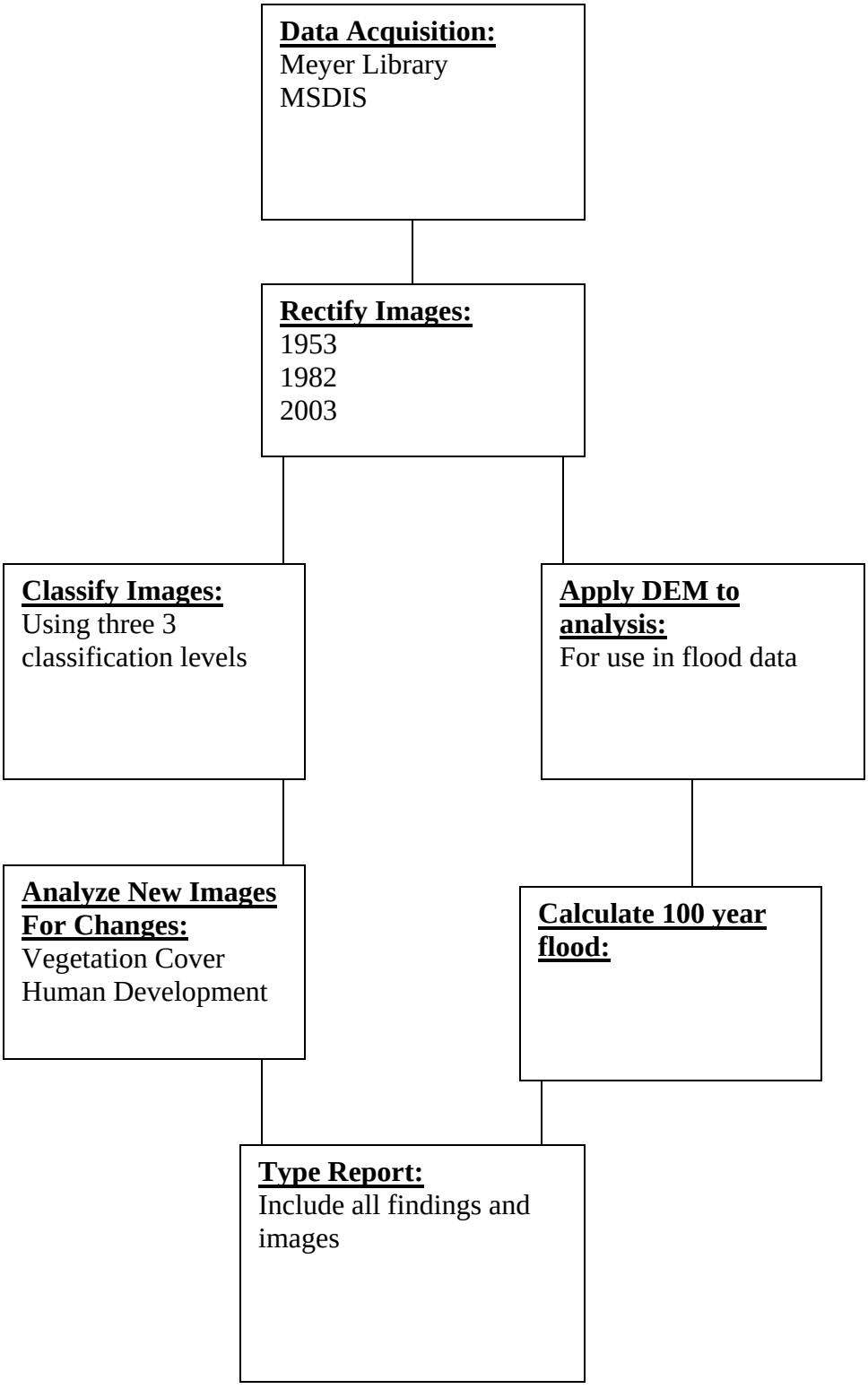
In looking for previous work on this subject, I could find none. The only work I know of being done on the area is water quality testing and recreation use studies.

For this study three air photos were acquired, one from 1953, 1982, and 2003. Also a DEM file for Greene County was used to help in the flood predictions. The challenge was to rectify all three photos and classify the land use in each to begin the analysis process. Once the classifications were complete, the findings could be determined. There of course many problems to overcome along the way and this report will lay them out.

The study area is along the James River in Missouri just to the South of the city of Springfield. There was a dam built along the James River Creating Lake Springfield. The Dam is used for generating power and the City Utilities of Springfield built there James River Power plant near the Dam Site. The Lake has now brought in many new forms of recreation from fishing to a trail network around the lake. There are how ever many water quality issues associated with the lake and its effects on the James River down stream.

Methodology:

Flow Chart:



The data used for this project came from three air photos. The first two were scanned copies of air photos of Southern Greene County over the Lake Springfield area. The earliest image was from 1953, before the lake was built. The second was from 1983 well after the dam on the James River was built. The third image was an ortho photo downloaded from the MSDIS web site. It was taken in 2003 and covers all of Greene County. My first challenge was going to be rectifying the images to overlay before any classification could happen. This is where the first of the problems for the project began.

The first step in acquiring the data was going to the Meyer Library on the Missouri State Campus and looking through the photos in there map library. After finding the two needed, they were scanned by a feed scanner then copied onto a flash drive. The ortho photo came from the MSDIS site where I downloaded the 2003 ortho county mosaic photo. The download took about three and half hours to complete. Also from the MSDIS site I downloaded the DEM file which took about forty five minutes to complete. Each file was in a zipped format, so the next step was to un-zip the photos using win-zip trial software.

The ortho photo from MSDIS came as a zipped file, so after unzipping it, it was loaded into Arc-Map, and the image was said to have to coordinate system. According to the data on the image though it was projected in UTM zone 15, NAD 1983. Only the photo was not actually coming in with the projection. After many attempts at re-unzipping the file, I decided to just except this and move on. The images would just have to be rectified without a projection.

From here I started a new map document in Arc-Map and added the images I had gotten. The first step was going to be rectifying the images together so I could begin my classification. The first rectification between the 2003 image and the 1982 image went very well. I zoomed in to the Lake Springfield area on the 2003 image then fit the 1983 image to display. Then I began a point to point digitizing of the images. There were many features similar between the two dates to rectify the two together. After establishing six control points I then rectified the new image. The hard part came when trying to rectify the 1953 image to the other two. With no lake and not much in the way of human development, finding control points was very difficult. I again used the 2003 images has the image to set control points to. I tried to use river features at first, but could find no similarities between the two, which was to a big surprise. I then tried to find tree that might have been the same, and with the resolution there was no way to pick out individual trees. Then there was one road running down to the river in 1953 which appeared to be about the current Evans road, and also what I assumed was the original Highway 65 going South. Using those roads I set some control points on the image.

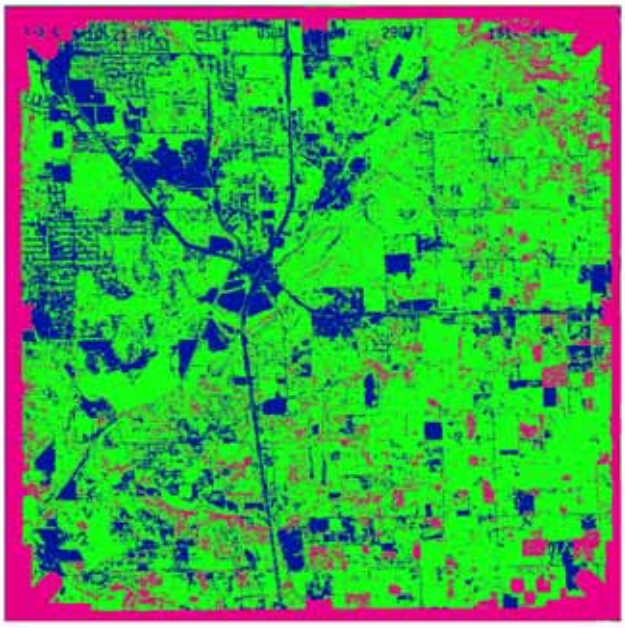
Now I had the images all somewhat overlaying and began then to classify each image. Using feature analyst I did an unsupervised classification of each image with three classification levels. The only three features I was looking to pull out were water, and either vegetation land cover, or other land cover. Each of the scanned photo images classified in about five minutes, however the ortho photo took about an hour and a half to complete its classification. The results though were somewhat expected. Water area increased a lot with the addition of the dam. Vegetation cover also increased around the lake in the 1983 and 2003 images. The other increase was also the human development around the area. Around the lake itself the 1983 and 2003 image did not have much change, but just beyond the lake, many new buildings were present in the photo and the classification showed more non-

vegetation coverage. The thought is that even though human development has increased, there also has been an effort to improve the quality of nature in the area.

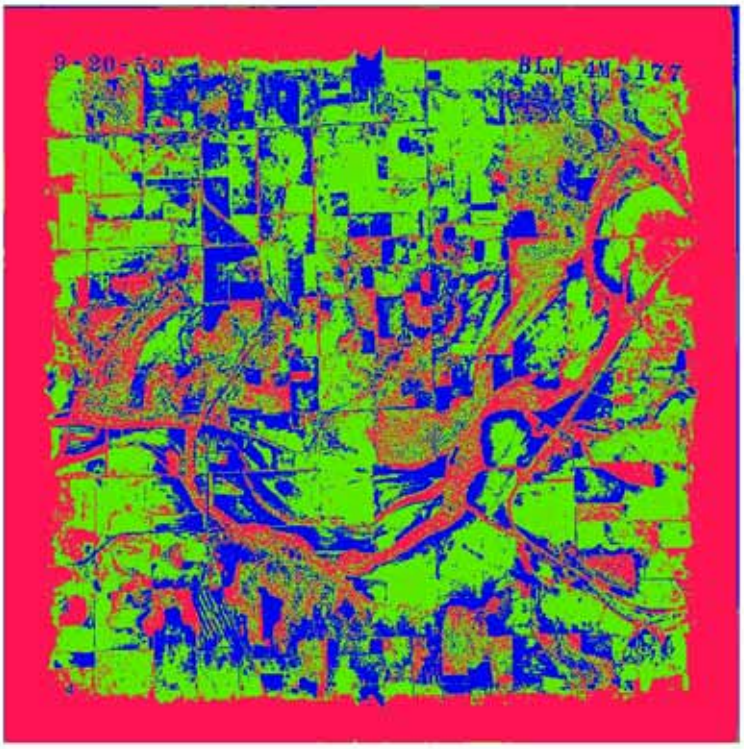
The next step in this project was to use the DEM data to gain a 3-D image of the area to try and estimate a one hundred year flood and see if there would be any increase damage due to increased human development. The first process was to get the EOO file converted into a coverage file. To do this I used Arc-Catalog and opened the tool box. With-in the tool box was the tool to create coverage from an interchange file. I imported the EOO file which is what I got from the unzipped information. Then I outputted the new raster image to my disk. I again started a new map document and added the DEM and the 2003 ortho photo. Since I had problems with the photo not bringing in its projection, I now had to rectify the image to the DEM. To do this I overlaid a highway layer onto the DEM in the same projection. Then I set control points to major road intersections and created a new rectified image to use with the DEM. I brought the DEM into Arc-Scene and changed its properties to give it height, then did the same with rectified image. The image did not look good after the changes though. So, I went back into Arc-Catalog and the set a raster projection to the 2003 image. I set the projection as an imported projection from the DEM. That way it would be the same projection. I then reapplied both of those into Arc-Scene. The problem now was finding flood data for the lake and the area. With no base flow information and also no information on where 100 year flood stage would be, I had to make assumptions. I assumed that the Highway 65 Bridge was built to be well high enough to avoid being covered in the 100 year flood, so I looked at what might happen if the river were to rise say 25 feet from the low elevation on the DEM. Not much would really be affected in that range, at least not much human development anyway.

Results:

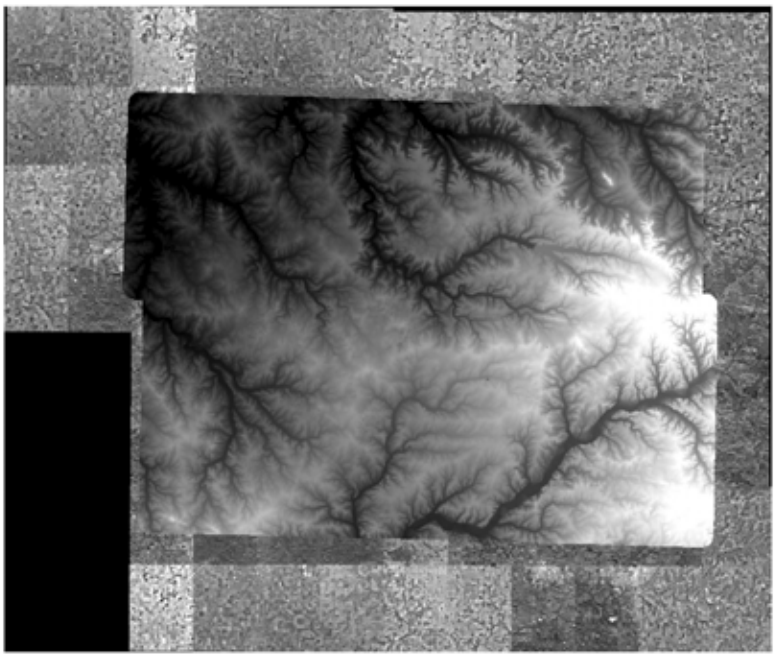
The results were actually what I expected from the beginning. No real surprises came from the work except for not much new impact on flooding. The only problem I could see from flooding were if the water topped the dam and cased it to fail, but that would be a very worse case scenario. The classifications were not real precise, but provided enough to draw some conclusions about the over change in the area.



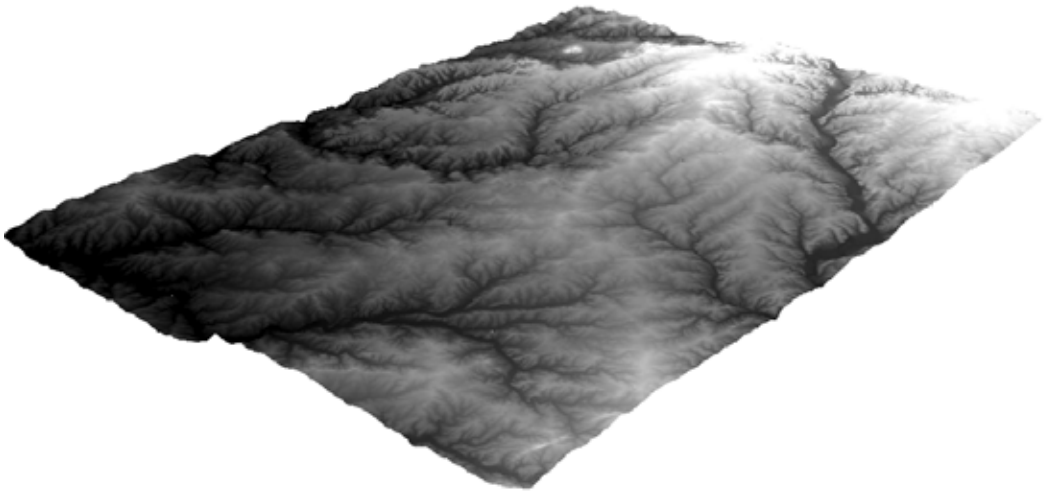
1953 classified image 1



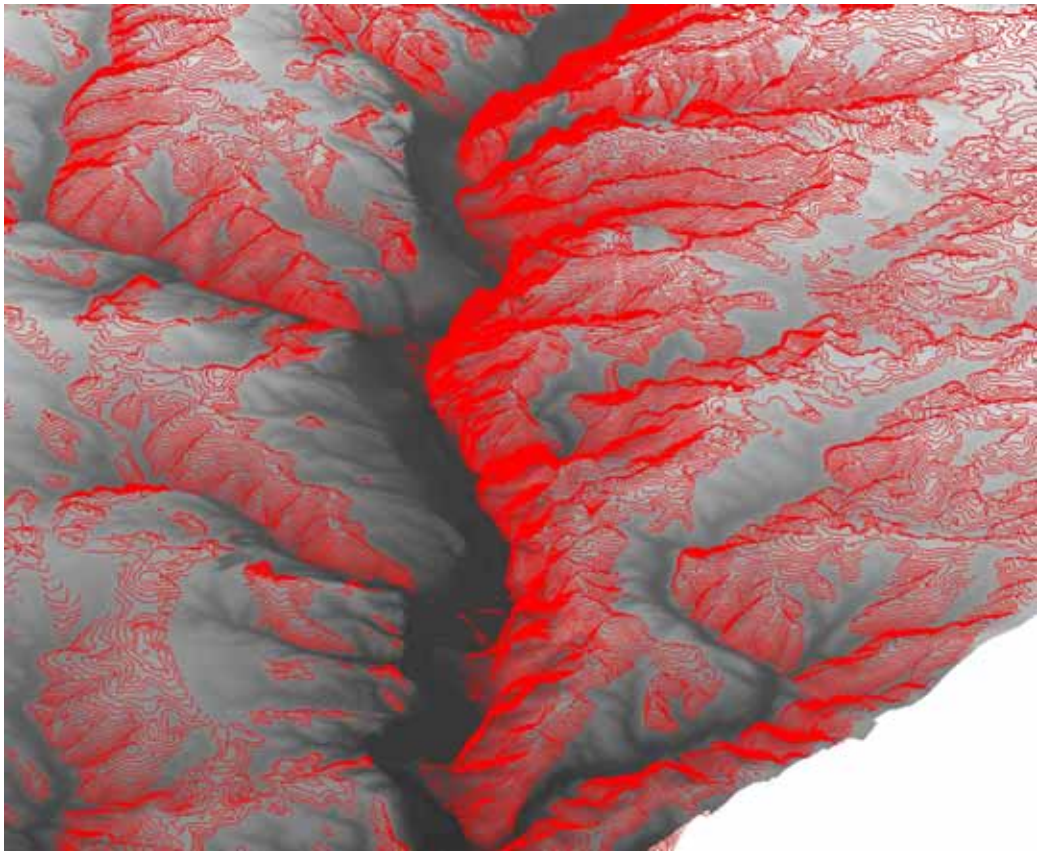
1982 classified image 1



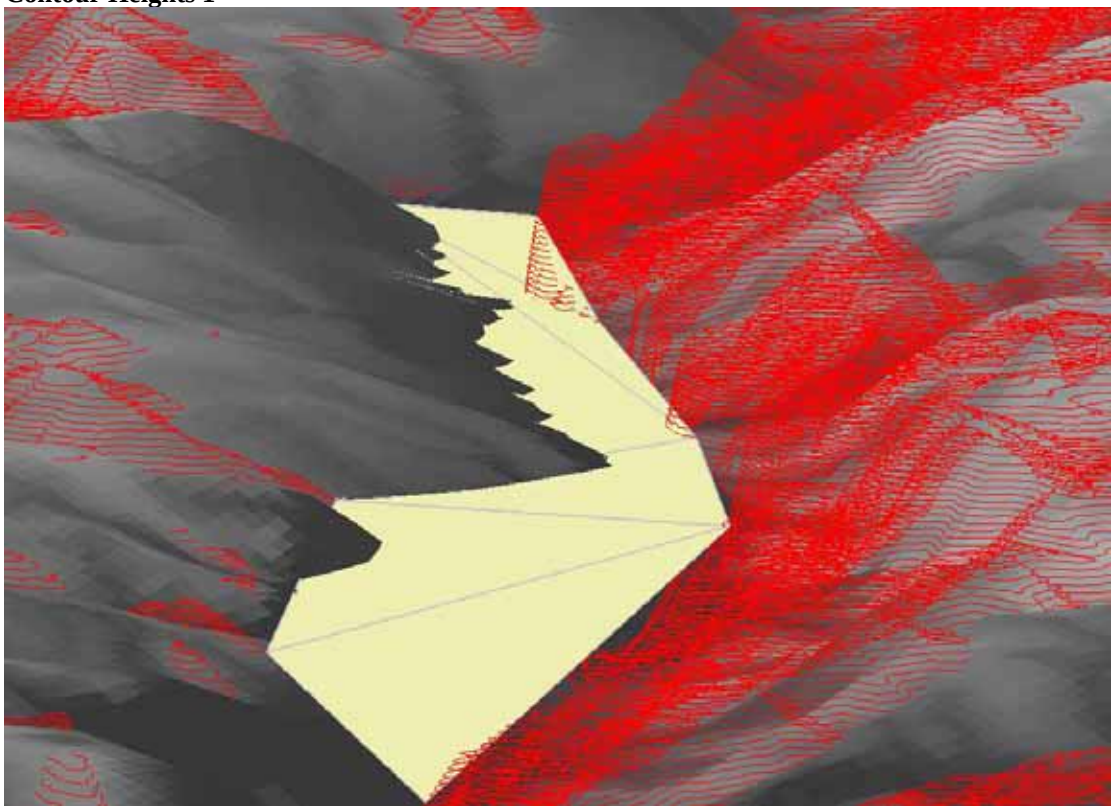
Rectified Image to DEM 1



3D view of valley 1



Contour Heights 1



Flood Area 1

Conclusions:

The most important findings in my project would have to be the showing of increased vegetation cover despite increase in human development around the lake. It shows that even as we spread out we are looking to maintaining some of the surrounding environment. It also shows that we are being wise enough to avoid building in the high flood prone area. Hopefully we will continue follow that same trend into the future.

This project could show a lot more given more time. With better classification you could actually calculate the percentage of human growth over the years. You would also be able to classify what plant types are increasing in coverage over the area, and how much area the increase is covering. Also given more time you could field survey the lake area to get actual lake levels and elevations to provide a better flood picture. The DEM model is lacking a great representation of flooding in the lake valley.

The project could be incorporated with many other projects as well. Water quality studies could help show what pollution problems would rise if a 100 year flood occurred. Also the data could be used to show how much the human development is impacting surface run off providing sources for poor water quality. The other impact could be to see how this dam compares to others built like it. To see if the water quality and development around it would be the same, or if other lakes are better or worse.

References:

- Meyer Library, Map Library
- **msdis**web.missouri.edu
- http://www.cityutilities.net/
- http://www.mdc.mo.gov/
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