

# NORTH DAKOTA ATLAS

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## ABSTRACT

The North Dakota Atlas is a collaborative project between the Departments of American Indian Studies, Anthropology, Biology, Communications, Computer Science, History, Integrated Studies, and Religious Studies seeking to create an online atlas. The purpose of the atlas is to engage an interdisciplinary group of students in experiential and collaborative learning to map demographic, economic, and social changes across the state. It will be an important resource for policy makers, community members, and K-12 colleagues and students. It will also expand students' education experiences with significant community engagement and impact. Finally, it will provide a tangible product for public consumption to increase participation of the public as informed citizens.

**Index Terms**— Web Design, Atlas, Maps, History

## 1. INTRODUCTION

The North Dakota Atlas website was originally started as a senior project. The previous group of students set up a server and designed an interactive website, but it was never officially finished. Dr. Michael Niedielski of the Geography Department wanted to see the project through but had some difficulties in the past with different groups of students coming in and out on the project. The goal this semester was to entirely overhaul the website with new graphics and to give it a clean, finished look.

## 2. APPROACH

### 2.1 Simplicity

Simple websites enable users to find the content they need without complications. “A cluttered website tries to convey too much info and too many messages at one time...Too many messages communicated on a website means that none of the messages are communicated properly” [4]. One of the main goals of the atlas is to convey the work students have done in a clear, concise manner. Less content that is balanced will contribute to this goal.

Further, a study was published named *The Impact of Visual Layout Factors on Performance in Web Pages: Cross-Language Study*. This study included tracking a user's eye movements. The authors write “We investigated interactions among four visual layout factors in Web page design...Performance was particularly poor in pages with many links” [3]. In order for this project to be effective, the visuals used on the site must establish a clear pattern for the user to follow. The fewer links and distractions, the easier it is for the user to navigate the site.

The original North Dakota Atlas site was a scroll style. All the information was on one page and the user had to continuously scroll for more content. To keep the website simple, the new design requires minimal scrolling and multiple pages with themes. The landing page provides two options to direct the users. There are more menus included to simplify the website design, including a page dedicated to a map table of contents.

### 1.1 Landing page on [ndatlas.und.edu](http://ndatlas.und.edu)



The clean and simple layout of the future North Dakota atlas webpages implements Bootstrap, “the most popular HTML, CSS, and JS framework for developing responsive, mobile first projects on the web” [5]. Most modern pages are based off of templates, but Bootstrap allows the designer to build from scratch with simple elements. “Bootstrap easily and efficiently scales your websites and applications with a single code base, from phones to tablets to desktops with

CSS media queries” [5]. The Bootstrap manual provides small portions of code that are easily copied or modified for the web designers use. The use of Bootstrap enables an organized, simple, and modern design.

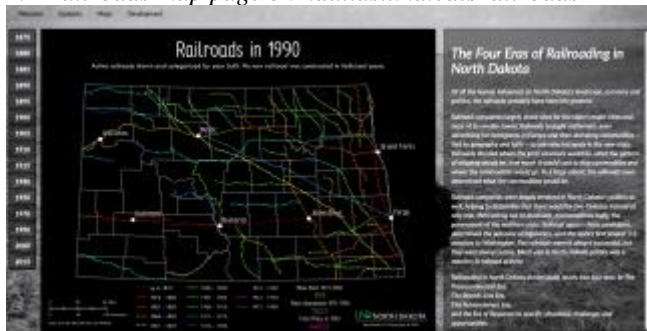
## 2.2 Usability and Efficiency

The usability and efficiency of a website are closely related. If the site runs slowly, users may get frustrated and move onto another source. In the book *Web Cartography*, it is noted that “the web map should not be too too large in both image and file size. Otherwise it is likely the user will be unwilling to wait for the map to download” [2].

According to Ilya Grigorik, the author of *Image Optimization*, “optimizing images can often yield some of the largest byte savings and performance improvements for your website.” He continues by advising “CSS effects and CSS animations can be used to produce resolution-independent assets that always look sharp... Vector graphics use lines, points, and polygons to represent an image... Vector formats are ideally suited for images that consist of simple geometric shapes” [6].

The atlas project uses vector graphic maps to display the data for each year in relation to the topic presented. These maps render well on various electronic devices. Unfortunately, the images in the backgrounds of the webpages take some time to load. This causes the webpages to lag. Optimization could be done to improve the performance of the webpage.

### 1.2 Railroads map page on ndatlas.und.edu/railroads



## 2.4 Maps, The Students Work

The main goal of this project is to display the work students from various departments have done. The format of an online atlas was favored because it includes maps, graphs, and text interacting together based on a specific theme.

According to Daniel Richard of the Institute of Cartography, “An atlas should be a combination of maps and additional information combined with a well structured work.” Further, “An atlas is a bound collection of maps. It often includes illustrations, informative tables, or textual matter...” For an online atlas to be successful, “Maps

produced with vector graphics applications...presented in an attractive way... and exported to a raster file format give best results.”

The maps that were used in the past were interactive maps implemented with an extension called Leaflet. These maps presented interesting information, however they were very slow to load. They had to request the information from a completely different server then load it to the ndatlas server. Also, they had zooming capabilities that slowed the site and were unnecessary. These delays led to the reimaging of the ndatlas page with static images.

The future map development on the North Dakota Atlas project will include interactive components. “Maps can be defined as graphic representations of our environment... The browser and the fact that most of these maps have to travel over networks put some constraints on the design and physical nature of web maps” [1]. To avoid these delays, it will be strictly front-end development with JavaScript that does not rely on information on other servers. Daniel Richard mentions that maps graphics are very suitable for interaction. “It is possible to put all kinds of additional information behind the map image. This extra information could be made accessible via techniques such as mouse-over” [1]. The expansion of the Atlas page may use this technique to create more advanced visuals based on the vector maps currently being used.

## 3. WORK ACCOMPLISHED

### 3.1 Redesign

The redesign of the entire website was successful. Initially, there were only a few zoomable maps displayed. These maps were problematic because they took a long time to load. The data required for the points on the maps to show was pulled from an entirely different server, causing a lot of delays when the user zoomed in or out.

After the redesign, the webpage is composed of more individual pages, but the organization is easy to follow. The user enters the site at ndatlas.und.edu and views the landing page. They can choose from two buttons, one that takes them to the map glossary and another that takes them to an explanation of the project. These webpages have menus along the top, reading: Welcome, Students, Maps, and Development.

The Welcome page is the description of the project. The Students page includes pictures and descriptions of the students that participated in the research required to create the maps. The Maps page is the table of contents for all the maps available. Instead of a traditional table of contents, it is a display of little map images so the user views a preview of the graphic. The Development page details the projects done by all the students involved with the North Dakota Atlas each semester.

## 3.2 Development

The development process of this project would not have been possible without Marshall Mattingly. He was one of the students that originally set up the server for the NDAAtlas project and was still at UND as a graduate student. He works with Travis Desell on a lot of Wildlife@Home projects and helped me out of many coding fails. When I was setting up the project, he verified the github repository could be used as the new code for the ndatlas server.

### 3.2.1. Accessing the server and working locally

The ndatlas server can be accessed by installing the AnyConnect Secure Mobility Client. It is the same VPN used to access the shell at school. Once connected with the VPN, Travis needed to set up an account for me on the server. I used the command line to ssh into the server (ssh [lwingate@ndatlas.und.edu](mailto:lwingate@ndatlas.und.edu)). The actual code referenced by the website is in the directory /var/www/ndatlas.

### 1.3 The Cisco Campus VPN



Once I was connected, Marshall and I were able to set up a local coding environment through the command line. We forked the original github repository (UND-CSCI491/nd125) and created a new repository where I had all the permissions and rights (lindseywingate/ndatlas). Once that was complete, we followed the instructions in the README file to create a local folder with all the code on my machine. This enabled me to work from my laptop through the command line. Whenever I made changes to the code, I needed to add any new pages (git add), commit them to the repository (git commit), and then push the changes to the master branch on my github account (git push origin master). Once that was done, I needed to log into the server (using the VPN and the command line) and pull the changes I had just made to the code. This process was necessary to bypass the origin code repository, to which we no longer had access or permissions. We attempted a few times to contact the other students that had permissions to this github account with no luck.

### 3.2.2 Translating Code and Jade

By the time the server and local working environment on my computer had been set up, I had already coded and designed the templates for the website. I had done all the coding with HTML, CSS, and Javascript. The server that was initially setup required the use of Jade for the webpages, which is a template engine used with NodeJS. Translating from HTML to Jade was time consuming and annoying, but it forced the code to be a lot more organized.

Jade works with the website layout because it allows you to create templates. This became very useful when Dr. Niedzielski began sending me maps to make live. I had designed each individual map page with a column of buttons down the left side, the map, then the narrative on the right.

One of the goals of the website was to be organized and standardized, so the same template was used for all the maps (map.jade). Each map had certain blocks of code that referenced the template; this made the individual map code easier to read and adjust as more features were added.

Later on, Dr. Niedzielski forwarded me some map graphics that did not have a corresponding narrative. Instead of using the same map template, I altered the original slightly so the map and buttons were more centered. This narrative is called map\_nonarrative.jade.

Jade, in some ways, made the project more complicated than necessary. In my original drafts, I had individual HTML pages for each map page. Once we translated the HTML into Jade, everything became compartmentalized.

For example, an HTML file can directly include any and all JS and CSS files it needs. When the HTML file was broken up into a jade file, all the individual elements were split and so were their JS and CSS files, creating a confusing map of code. The wheat.jade file is the map page that shows the wheat maps over a period of time. This jade file references a js file and extends another jade template. The jade template also references another JS file and two other CSS files. If I were to do this project over, I would consider the templating methods and how to make it easier to change the webpages for future development.

### 3.2.3 Code Review

Once I felt confident in my design and the performance of the website, Dr. Niedzielski sent the ndatlas.und.edu link out to his colleagues to review the site. We received a lot of insight over the period of one week. After the review period was done, I made the necessary design and functional changes.

## 3.3 Final Elements

### 3.3.1 Play Buttons

After the webpage went live, Dr. Niedzielski requested I create play buttons on each map page that would cycle through the images, showing changes over time. I ran into a timing issue with the images. The Javascript was referencing images on the server, but the image load time was still lagging. I went through and optimized most of the images so they would load faster. I also optimized a few of the backgrounds on the website for the same reason.

Once that was done, I lowered the speed the JavaScript switched the images from one second to two seconds and the performance was greatly improved. I did receive a suggestion to load all the images with the webpage, but I was behind on my project timeline to implement this change.

### 3.3.2 Interactive Map

The final goal of the North Dakota Atlas project was to create an interactive map that didn't require loading maps from a different server. After researching a few different methods, I learned this could be accomplished with simple HTML. In HTML, you can load an image as an image map, which allows the designer to indicate points on the image that can become clickable.

I have begun work on the first map, but I will still need a week or two to complete it. By the time the final draft of this paper is due, I will have more specifications I can add to finish the paper.

### 3.4 Future Projects

Things I want to change about the project now that it is "done," future work that could be done by other students, etc.

## 4. CONCLUSION

The North Dakota Atlas redesign project was a success. The project managed to stay on a strict timeline, completing all the functional and design formats desired by Dr. Niedzielski and the Geography Department. It fulfilled the goal of displaying research done by the students at UND and is a valuable resource for those studying the history and culture of North Dakota.

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