Macintosh HD:Users:Sara:Downloads:bluejayslogo.ai.pdf

**Daniela Castro, David Mills, Dylan Ham and Sara Breit**

**September 21, 2015**

**Mapping Christmas Bird Count Populations for Westcave Circle**

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1. **INTRODUCTION**

The Christmas Bird Count (CBC) has been a tradition for birders with the Audubon Society for almost 110 years. It is a chance for the scientific community to team with volunteers to acquire information on the prevalence of bird species and populations in various regions. Birds are an important indicator species to a whole slew of human-environmental factors such as habitat fragmentation, food or water shortage, and pollution levels. The GeoJays have the opportunity to add a spatial dimension to this data using Geographic Information Systems (GIS) to record where these birds are being seen, specifically within Westcave Circle CBC.

1. **PURPOSE**

Our goal is to develop a Geographic Information System (GIS) for the CBC Volunteers and Audubon Society to use for public and educational purposes. This GIS will be interactive, flexible, and accessible to the client for frequent updates.

There are several objectives that we have received from the Westcave CBC team. The GeoJays objectives and summarized goals are as follows: Westcave needs a new reference map with delineated boundaries between the ten count areas. This will enable the CBC volunteers to know which area is under their patrol jurisdiction, and help to ensure the integrity of each region. Also, it is our priority that we provide detailed maps of each area individually, so that the volunteers will have a detailed reference map for their patrol. We will aggregate information on the number of bird counts per species in each area from the past ten years. The aggregated information should allow predictions to be made on migratory patterns and changes in food, water, and bird habitat. Additionally, we will add a feature to the GIS called “hot spots”, which represent specific locations where the most birds have been found in past years. Time permitting, we will also create a layer of paths to use to get to these hotpots, as well as a parking lot layer.

1. **SCOPE**

The whole of the project will be accomplished between September and November. The final deliverables will be submitted on November 30. The project will be relevant to the Westcave circle 15-mile diameter area, coordinates 30.35525 x -98.02959.

1. **LITERATURE REVIEW**

INTEGRATING GIS TO IMPOWER EDUCATION AND CONSERVATION EFFORTS

Forest fragmentation and human habitat destruction are largely responsible for the disappearance of many avian species (W. Alice Boyle 2015). Both forest fragmentation and human habitat destruction are problems that stems from poor social attitudes towards conservation, as well as negligent political legislation. The Westcave Outdoor Discovery Center strives to integrate the young and elderly community into the annual Christmas bird counts in an effort to educate and inspire its volunteers to learn about the importance of conservation efforts. Our project’s primary objective is to implement GIS techniques to create user-friendly maps that enable the Westcave Outdoor Discovery Center to expand educational and conservation efforts.

The understanding of birds as biological indicators is fundamental to the field of environmental administration and conservation. A biological indicator is an organism that is strongly associated with unique environmental conditions. The presence of a biological indicator is evidence of a healthy eco-system, while its absence demonstrates the opposite (Koskimies 1989). A primary method that exists to explore the variables that affect changes in the decline or increase of birds, is bird population monitoring (Koskimies 1989). The purpose of bird population monitoring is two-fold: 1) It allows for tracking the increase or decline of a particular avian species. 2) Bird counting provides key insights about the variables that influence a species increase or decline. At the core of Westcave’s mission is the power information holds to educate all age groups about the importance of conservation efforts. Environmental Conservation organizations, the field of wildlife biology, and many other organizations benefit from tracking the fluctuations of avian species and the problems associated with these fluctuations.

The Christmas bird count in La Selva Biological Station, reported the decline of 44 avian species from a previously recorded number of 202 species. Over twenty-three years of bird counting La Selva Biological Station has reported more declines in bird populations than increases. This is a re-occurring pattern that has been reported by many chapters of the National Audubon Society. GeoJays hypothesizes that this may be the case for the Westcave Circle.

Westcave CDC’s on-the-ground conservation effort is primarily accomplished through bird population monitoring. Presently, Westcave’s volunteers monitor the bird population by dividing Westcave into regions where birds of interest are often spotted. At an individual level, each volunteer has gained insights into the patterns observed as they census the various birds. However, the broader picture is all encompassing and insightful. GIS techniques and mapping methods are pivotal for capturing the patterns exhibited in the bird monitoring process. The moving force behind GIS is its ability to yield clean and efficient maps which demonstrate extensive geographic data.

The Breeding Bird Atlas is a magnificent example that illustrates how GIS has captured a holistic picture on the mating patterns and regions of avian species around the world (William I. Butler 1995). The success yielded by GIS analysis and mapping stand unrivaled, and serve as a testament of the progress that can be achieved in wildlife conservation. GeoJays can further the Westcave education and conservations mission by developing digital records of the extensive data gathered over the years, and maps that highlight the hot spots of the regions being explored by Westcave volunteers. Though the desire and effort is evident in Westcave volunteers, the Christmas Bird Count is “weakly standardized” (Erica H. Dunn 2005). The future of the data collected rests in the methods for collection. Bird counts are useful to the study of Ornithology, but the data is highly contingent upon standardization of data collection methods and records.

The on-going research in GIS and environmental conservation is ample across multiple disciplines. Moreover, this field strives to advance in light of development of GIS applications and techniques. The successful implementation of GIS and mapping techniques have begun to influence societal attitudes about conservation efforts by visually illustrating to the public the negative effects of human impact on sensitive eco-systems.

1. **DATA**

To complete the project the following data will be required: Bird sighting data by species for the region as far as ten years back, approximate locations for prescribed routes and hotspots, land use patterns and local urban features of the area, relative borders dividing the area into sub-regions. All data will be projected using Lambert Conformal Conic.

1. **SOURCES**

Bird sighting data, locations for routes, hotspots, and relative borders of the sub-regions will be provided by the CBC coordinator, Jane Jones, through coordinating with team managers of the sub-regions.   
General CBC data: <http://netapp.audubon.org/cbcobservation>   
2011 National Landuse/landcover data from: <http://www.mrlc.gov/nlcd11_leg.php>.   
We will be using ESRI ArcGIS Software, coupled with Microsoft Excel for data input.

1. **METHODOLOGY**

Once the necessary data have been collected, the land use/land cover will be oriented to the area of interest. Next, the bird sighting, prescribed route, hotspots, and boundaries will be converted to a format that can be applied to the map, most of the data was collected by word of mouth and will need transferred to a unified digital format. Historical bird sighting data will also need to be sorted into the sub-regions, and each respective region will be made into its own map for use by CBC volunteers. The sighting data will be analyzed to determine if any significant changes to migration patterns have occurred as a result of urban development or climate change. Changes to threatened or endangered species migration patterns will receive priority to determine if there are any possible negative influences. After receiving information from the CBC coordinators we will be able to determine what analysis will be applicable in drawing migratory influences and/or predictions. We will also provide a GIS containing the data presented to us in a format that will allow future analysts to update the map with later CBC results recorded in the area. Currently, our hypothesis is that we expect the migratory patterns of some birds to have changed in the last ten years due to the area’s recent urban expansion.

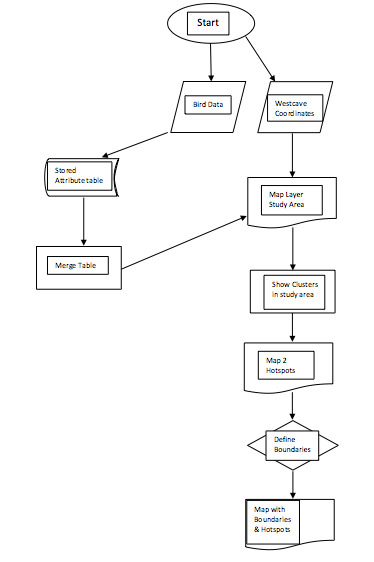
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Table 1. Flow Chart for Westcave GIS

1. **IMPLICATIONS**

The final product will be a GIS of the Westcave Circle area that shows each sub-area, along with the total bird counts, hot spots, and various routes that make the areas more accessible to volunteers. This map will be more accurate than the previous, and will give all of the CBC volunteers a point of reference for the patterns and numbers of species they should expect. Also, by creating separate maps detailing each area individually, volunteers will be aware of their spatial location and can start marking down each sighting area for rare birds or interesting landmarks that can be used in the creation of more detailed maps for future reference. Westcave Audubon enthusiasts will be able to see patterns and trends in bird migration and population, which could be useful to solving environmental problems in the area, such as habitat loss, food or water shortage, and human encroachment.

1. **BUDGET**

LABOR

*Geospatial Anthro-Analyst*

Work Hours: 150

Hourly Rate: $ 30

Subtotal: $4,500

*Wildlife Biologist Consultant*

Work Hours: 150

Hourly Rate: $ 30

Subtotal: $4,500

*GIS Analyst/Assistant Manager*

Work Hours: 150

Hourly Rate: $ 31

Subtotal: $4,650

*GIS Analyst/Manager*

Work Hours: 150

Hourly rate: $ 32

Subtotal: $4,800

SUPPLIES AND SOFTWARE

*Lab Space and Computers*

Work Hours: 150

Hourly Rate: $ 50

Subtotal: $7,500

*ArcGIS Subscription*

#: 4

3 months: $ 400

Subtotal: $1,600

*Microsoft Excel License*

#: 4

License: $ 80

Subtotal: $ 320

**Total: $27,870**

1. **TIMELINE**

PHASE 1 (SEPT, 2-23): DATA COLLECTION AND ENTRY

We will gather as much of the bird count, hot spot, and route data from the Audubon Society and Christmas Bird Count Managers as we can. Then, we will start digitize and consolidate it into Excel and ArcMap. This will also be the phase of proposal development.

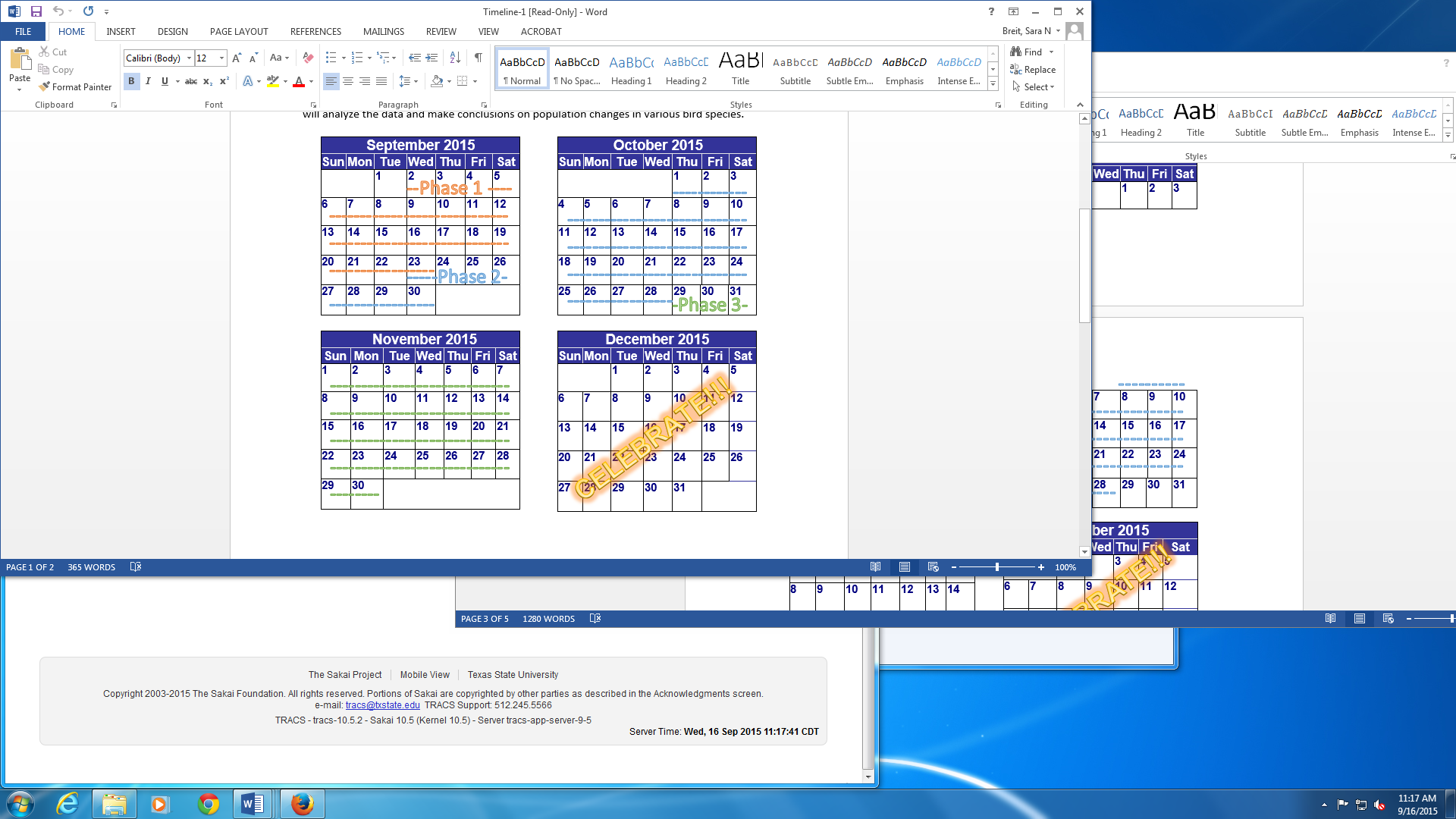
PHASE II (SEPT. 23-OCT. 28): MAP LAYER DEVELOPMENT & DATA ENTRY

Data entry will take up a significant portion of our resources for this project and will most likely span all three of the phases of this project. Another priority will be to gather and spatially display information such as parking lots, hot spots, routes, land cover, and the like. The development of separate maps will begin at this stage.

PHASE III (OCT. 29-NOV. 30): PROCESSING, DESIGN & QUALITY CONTROL

Final deliverables will be placed on a website and poster; functionality testing and aesthetics will be our focus during this time. During this phase we will analyze the data and make conclusions on population changes in various bird species.

Table 2. Timeline for Westcave Project



1. **DELIVERABLES**

The final products will be made available to the client via USB at the conclusion of the project:

* + Final Report on Project and findings
  + Poster of project that may be displayed in the Geography Department and the Discovery Center
  + Comprehensive Westcave Area GIS including separate close-up individual maps of the ten regions and respective hotspots, species reports, land use patterns, and routes
  + .mxd and shapefiles for the Westcave map data, and a CSV file of species reports and metadata
  + PowerPoint Presentation over the project
  + Readme file detailing what is contained on the USB and how to access it

1. **CONCLUSION**

The GeoJays seek to develop a GIS for Westcave to use in order to more efficiently count bird populations for the Westcave CBC. We will be creating a dataset on bird populations for the past 10 years, and will attempt to draw conclusions on migratory/population change, and possible factors involved. The CBC is important in determining the direction of human progress and health, as birds are sensitive to environmental degradation and pollution. The project will take approximately three months to complete, and will cost $27,870. We will provide a USB and a website containing a final copy of our GIS including reports, findings, files, and maps that Westcave has requested. We are hopeful that the GIS will be educational and effective in the conservation efforts of Audubon enthusiasts and bird-sighting hobbyists alike.

# **REFERENCES**

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1. **PARTICIPATION**

Sara Breit: Introduction, Timeline, Budget, Deliverables, Conclusion

David Mills: Timetable, Group Logo, Flow Chart, Proofreading and Revision of Drafts

Daniela Castro: Literature Review, References

Dylan Ham: Data, Methodology