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REMOTE SENSING SPECIALIST SUMMER INTERNSHIP AT GEOADAPTIVE LLC.

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ACADEMIC HISTORY

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DEDICATION

This final paper is dedicated to my father, mother, friends and families, who have offered their unconditional understanding and support throughout the pursuit of my Master's degree. I would also like to extend my sincerest gratitude to my fellow GISDE peers, who have been an incredible source of inspiration.

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CHAPTER1. INTRODUCTION

In my youth, I imagined countless possibilities of future academic and professional path I might take on: metallurgy, physics, engineering, biochemistry, even philosophy. Geographic Information Science/System (GIS) and Remote Sensing (RS) was not one of them (GIS and RS will be referred as GIS later on, as a single field). The reason is not simply that I never heard of this field until late in undergrads. Even if I were to know one or two things about it, given other options, like the ones listed above, I would still not choose this discipline. I suppose, at the time, my vision was too narrow to see the complexity that could be explored by the implementation of GIS tools and skills. Long story short, I was partially-forced to walk on the path of GIS, and surprisingly, I have grown increasingly fond of it even since.

Through my experience till now, the more I study and practice, the clearer I realize that GIS, as a tool with its corresponding skillsets, cannot and should not stand alone as a profession (Of course, for scientists who dedicate themselves into the theoretical development of GIS, it is a whole other story). It is my understanding that the value of GIS is so precious because it empowers us to organize the past, understand the present and further take a peek into the possibilities of the future. These aspiring traits can only be revealed when GIS stop being a mere tool or a set of skills; and being used, appropriately, to address a certain challenge or solve a specific question. I believe this realization is the major contributor to my decision of choosing the internship route to fulfill my graduation requirement.

I was fortuned to receive an offer from GeoAdaptive, a geospatial consulting firm, during summer 2015, with the title of Remote Sensing Specialist. My duty includes providing data collection and visualization support of all the research teams per their request. Moreover,

I was solely responsible for one of the ongoing pioneer projects regarding drought detecting and monitoring. This internship was the only item on my priority list that summer, and the reason I value this particular internship so much is not simply because it allows me to utilize and polish concepts and skills I learnt in classroom. More importantly, the idea of being part of a consulting firm, who people come to with questions they cannot solve on themselves, excites me; not to mention, I have always been and still am in enormous awe in the notion that our final products, with my contribution, may cause an impact on a region's policy, hence influence hundreds, even thousands of human lives live there.

CHAPTER 2: DESCRIPTION OF ORGANIZATION

2.1 Company Introduction

GeoAdaptive is a Boston-based consulting and research group founded 4 years ago. The aspects of their work covers up urban and environmental planning, sustainability science and policy. The purpose of the firm is to make a difference by assisting clients in unveiling, visualizing and understanding the complex spatial dynamics of infrastructure, conservation and financial investments.

The firm is made up by people coming from various disciplines: Regional Planning, Landscape Architecture, Environmental Science, Landscape Ecology and Environmental Planning and Geographic Information System. The level of the complexity of people with different background has largely widen and strengthen the capability and flexibility of GeoAdaptive as a functioning team.

During daily operations, the group conducts detailed studies and provides advices and recommendations that improve the decision making process of the built and maintenance of urban and/or natural environment. Through past practices, utilization of geographic information technologies became a necessary and essential part of GeoAdaptive's work to construct appropriate analyses, and therefore understand the relationships underlying urban, economic and environmental spatial structures. As for clientele, GeoAdaptive works not only with regional governments and national agencies, but also with multilateral foundations, organizations and international agencies.

2.2 GeoAdaptive Practice Areas

Services provided by GeoAdaptive can be categorized in to one of the following four tracks.

Conservation and Environment

Conservation and Environment, combined, is a huge topic to look upon. However, there are many branches stretching out from the stem. For someone who works in the conservation field and/or being an environmental activists, he/she is trained to look at this broad concept in a rather specialized way. For example, urban planner may focus on land acquisition; environmental scientist may take a different route and look at the general green networks, and marine biologist would prefer to take on issues specifically related to coastal and marine spatial planning.

Being an adequate research team, with great diversity, GeoAdaptive actively engaged in projects concerns habitats, species, ecosystems and biodiversity in the past. During the course

of those projects, both natural and anthropogenic factors are taken into account, for the purpose of creating such a setting that decision making becoming informed. The final product possesses the potential to project influences on strategies and/or policies decision makers eventually create, and improve the sustainability and resilience of the urban and natural environment.

Urban Sustainability

This planet is, at all, governed by human being, and the cluster of human beings formed into what we call city and nation now. As we searching options for environmental preservation, it is equally important that we take a close look at the place we currently reside within. Sustainability of urban development had become a popular norm, especially for municipal and regional planners during the past few decades. Moreover, it was also brought up by different interest groups under different occasions, more importantly, with increasing formality.

Studies surrounding this topic contribute, as a guide, towards the creation and/or polishing processes of related policy and investment decision. In GeoAdaptive, the urban sustainability team looks forward to discover the pattern of current and potential future development, through data-driven analyses. Given that urban and natural environments are essentially inseparable, GeoAdaptive provides comprehensive tools, considering a range of conditions, to improve urban sustainability, by basing its research on the recognition of the interrelationships between nature and human activities.

Risk and Resilience

Projections and/recommendations for the future could never be completed without adequate awareness of existing and/or potential risk and respective resilience. Through researches, it is not hard to discover a sea of models and algorithms. Normally, the key factors include vulnerability, cope and adaptive capacity. Given its qualified research capability, the risk and resilience team is able to formulate its very own scientific modeling and conduct specialized spatial analyses and strategies for the purpose of strengthening the resilience of cites and natural environment through reducing risks caused by natural hazards, climate change and/or development.

Development Planning

Development seems to be one of the main themes throughout the entire human history. Nowadays, no matter where you go, the conversations you are most likely to have with people would be involved with development on some level, whether it is on personal, community, national or even global level. To GeoAdaptive, as an organization who values the dynamic of world, development simply cannot be overlooked from its radar. Although the urban sustainability would inevitably be touched on issues related to development, GeoAdaptive decided, nevertheless, to form another development planning group to focus specifically on this matter. Different than the sustainability group, who look at the 'hardware', as in the physical conditions, the development planning group also integrates variables like social just, resource distribution, economical factors and so on to address problems emerging from uncontrolled urbanization, infrastructure deficiency, social marginalization, and productivity and decline of resource-based development

2.3 Strength and Weakness

GeoAdaptive's specialization in strategic spatial planning and supporting technologies is certainly one of their strength. Their work uses spatial analysis and scenario methods to help clients visualize alternative futures and their consequences. GeoAdaptive's strength also lies in its proven experience and the unique interdisciplinary expertise of our team which has worked on some of the most innovative and complex spatial planning projects around the world.

However, from my point of view, especially after working with the team closely on most of the current project, and solely on one of the pioneer projects, the company lacks its own research and development division, in terms of carrying out preliminary research, organizing existing published methods or approaches, constructing valuable database and performing pre-processing before actual analysis. In academia, these process might be essential to be carried out on a project to project or task to task –base. But in terms of an operating consulting group, it is more than important to have a parallel streamline system for both theoretical and practical approaches.

In GeoAdaptive LLC, a R&D group made up by GIS personnel can take over the data collection, cleaning and pre-processing, and database construction, while the environmental architects searching or examining for theoretical approaches of the actual analysis later on. A qualified R&D division would save a huge amount of unnecessary time and effort which would be spent on preliminary research, and expended indefinitely given the hump and curve along the path. It can also greatly increase the effectiveness of allocating the company resource as

the project begins and the clock starts ticking, not to mention a drastically increase on the efficiency of time streaming, given quality and well-organized database.

CHAPTER 3. INTERNSHIP RESPONSIBILITIES

Unlike many of the others' internship paper, mine is without the presence of illustrations, and I feel obligated to include an explanation. At the moment I accepted the offer of this summer internship, I signed a contract with a strict confidentiality clause and non-competitive clause. Given this contract, I was bound by law not to disclose any information regarding GeoAdaptive's daily operation, management structure and especially the ongoing projects to any entities.

Moreover, all outcomes and final results of the internship were produced on local hard drive, and directly backed-up into the company's cloud storage. As the contract ended towards the end of August, my access toward the cloud storage was revoked. GeoAdaptive reached out to me at the end of November, indicating their willingness of offering a part-time position and the intention to further the study. I temporally rejected them due to the somewhat excessive course workload this semester, therefore, I lack the necessary means to access my work during the past summer. I reached out to the executive manager of GeoAdaptive, and have not gotten any response at the moment of composing this report. I hope the committee could consider my efforts and the extreme circumstances under which I was bound by the contract not to include many details of what I did.

3.1 Visualization

My summer internship experience was composed of essentially two period. During the first half, one of my main duties is to provide data visualizations for all research teams. The related content include visualizing all the raw input data layers, granting the research team with a direct perception of what they are dealing with.

Of course, the portrait of the information was kept as unbiased as possible. Not solely depending on the past publications, the research team may get a general idea of the context of their research area, and thereby develop a set of much more informed and relatively more realistic strategies for future analyses.

3.2 On-call support

Another responsibility I had for the first half of the intern is to shadow all the research teams' currently ongoing project, and provide on-call literature review, data collection and processing support. In this way, my contribution reduced a considerable amount of time which would have been delegated to research preparation and data processing. Moreover, I was also allowed to observe closely the manner and routine of how a private consulting and research group operates during its daily practices, and therefore, significantly reduced the time I need to align my thinking patterns with the team and become part of this dynamic team.

3.3 Drought Pioneer Project

Approaching to the end of July, as I entered the second half of the internship, the executive manager of the firm assigned me with a pioneer project, which intend to achieve large area drought detecting and monitoring provided only with remotely sensed data. He suspected that

there ought to be only a handful of related researched being published given the emergence of remote sensing technologies, improved satellite instruments and advanced analytical platforms are still quite recent. Without any support, I was the only person who is fully responsible for the initiation and following development of this research. The lack of assistance fueled not only my anxiety but also my excitement, as I was informed the level of importance of this project to the firm.

As I was trained at Clark University, my first step was to discover the validity of conducting such a project that could potentially cost the firm temporally and financially for the next several months. As the manager expected, while most of the studies insist on including in-site field data, only a handful of researches had been done with remotely sensed data only, and almost none of them was done on the same scale as we are aiming for. One exception being that NASA DEVELOP team released a study, on July 1, 2015, developing a tool with drought-monitoring capacity to help provide drought-related information to local stakeholders reside within the country of Uruguay. This discovery confirmed the manager's suspicion, and strengthen our determination to carry out this project.

According to the information I gathered from literature review, I was able to develop a model, which is used to produce a drought index with the capacity to measure the severity of drought damage. The variables I looked at are mainly related to evapotranspiration, precipitation, land surface temperature and several index-based vegetation indices. The testing data are required to be not only public accessible but also remotely acquired. Before processing any of the data, all raw inputs are aligned into the same spatial and/or temporal resolution with the same geographical reference, and then organized into a geodatabase. Through the

intensive calculations, the model was able to combine all potential factors into one single index. Then, different critical values for index value classification within different environmental settings (arid regional, semi-arid regional, dry regional, multi-country, etc.) were tested out given criterions indicated within all the pre-existing researches. As the final step of the project, historical records of various aspects including socio-economic status, natural landscape and regional anthropogenic influences were taken into account, cross-referencing with each other and the index, to validate the accuracy and effectiveness of the model.

3.4 Streamlining

Over the course of model developing, it is more than reasonable to expect circumstances under which repeated data collection, organizing and processing are required, and I did encounter such scenarios. Fortunately, a complete record of the entire process was kept from the beginning. Utilizing that, I was able to break the length procedure down into smaller pieces and formulate them step by step into separated tools using the model builder enabled by ArcGIS desktop. These separated tools became exceptional useful, as I was constantly required to repeat the previous several steps due to one single mistake. However, as these tool remained to be separated by the time my contract ends, I was instructed to compose a thorough documentation depicting the terminology, a technical report describing every single step of carrying out the procedure, and an internal manual for others to use given my absence in the future.

3.5 Continuance

As I mentioned earlier, as the continuance of the summer internship, GeoAdaptive intended to hire me again and let me continue the project with more programming workload. This is also one of the main reason GeoAdaptive hired back in summer. I learnt the basics of programming during my undergrads. Then, I aced my programming course at Clark, and later on, I was chosen to be the TA of those two programming course. As the person is familiar with programming and started this particular research project, the company believe that, with full knowledge of every piece of the project, I should be able to streamline the entire procedure by concatenating all those tools via the use of programming language. I'd alright replied the manager, explaining my current heavy course workload and indicating that I should be able to pick the project up towards the end of January next year, if the company is willing to wait. The response is still pending at the moment.

CHAPTER 4. INTERNSHIP ASSESSMENTS

4.1 Gain at GeoAdaptive

This summer internship with GeoAdaptive was a great professional and learning experience, and it was proven to be a quite an incredible journey. It serves, greatly, as a stepping stone for me to tie the real world problems with the conceptual knowledge and basic skill learnt in classroom. Over the course of this internship, not only did I utilize and polish the knowledge and skills I learnt at Clark University, I also got the chance to develop my own professional network and demeanor. Moreover, given the diverse demographic composition of the firm, GeoAdaptive is apparently well-equipped with the capability to take on a wide range of projects. These projects are closely related to urban development, regional planning,

landscape architecture, landscape ecology, environmental science, conservation and environmental planning. Benefit from that, I was mentored to form a more sophisticated way to discern or think when a question comes or a challenge approaches. Last but not the least, the entire team had really taken on the role to nurture and mentor me, both professionally and personally. Be courageous! Be resourceful! Be organized! These words are the parting gift that the executive manage sent to me.

4.2 Skills Learnt At Clark University

Being graduated with a Bachelor's degree in Geography, my weaponry is not particularly fully loaded with lots of GIS equipment. Suffice it to say, besides all the basic concepts of GIS, I learnt almost everything I used to get this internship at Clark. The skills that came in handy in my daily work include GIS and RS data collection, data management, data pre-processing, data processing, and to top off all the above, analytical skills. ArcGIS and IDRISI are used as the main platforms to carry out most of the daily workload. This was a huge advantage to me, whose work is immediately requested from the very first day at work, provided with minimal amount of guidance. My familiarity with the usage of ArcGIS series was nurtured gradually over the course of my undergraduate education, and the experience at Clark University had helped me greatly into mastering all the applications in ArcGIS and IDRISI. The knowledge and familiarity with remote sensing platforms and techniques is the most crucial factor that helped me securing this internship, as a bulk of workload, and the proportion which the executive manager values the most, is RS related. Not to mention, at the second half of the internship, I was solely responsible for a pioneer project focuses on drought detection and monitoring with the

premises of using satellite imagery only. Furthermore, given the exploratory nature of a pioneer project, the skill of composing a thorough research report became essential during the process of conducting literature review; the proficiency of working with model building, procedure streamlining, scripting language (e.g. Python) and its corresponding integration with mainstream GIS platforms (e.g. ArcGIS) saves a bulk of time that would be spent on the repeated cycle of data downloading, data unpacking, and data processing; the ability of creating a comprehensive technical manual is also critical, especially towards the end of the internship, for it needs to be detailed and informative enough, yet not excessively obscure so that people with no systematic knowledge of the models, scripts and procedures, as the creator does, can use or further improve them with little to no assistance.

Less technically speaking, there are also several traits which I developed at Clark that helped me a great deal to get through the internship. Given the private company setting, effectiveness and efficiency are valued tremendously. When several teams are all waiting on the visualization product to further their projects, good time management skill and strong multi-tasking capacities in combination has never become more important. Lastly, the ability to work both in group and individually is also a must-have. As I was responsible for a sole project in the second half of the internship, I was also capable of working with all the research teams and provide them with support in data management and data visualization during the first half of the internship.

4.3 Recommendation and Remark

I would most certainly encourage everyone who is looking for such an internship, which values both technicality and analytical skills, to pursue the chance of working with a private company like GeoAdaptive. In my biased opinion, not being bound by certain goal of research outcome, and not being limited by profit earning, a private consulting group is more likely to be involved into issues and challenges that concerns its member. Interests and opinions of each member may essentially decide which project the firm will work on for the next months or years, and this strong personal engagement will guarantee the purposefulness of daily working and ensure the satisfaction at the end of day. Working to become a solution to what concerns you is precious, not to mention it is also a great chance to develop one's network with the help of so many knowledgeable professionals.

Furthermore, GeoAdaptive's main office is located in Boston, MA. It is a great place to live and explore, for its diverse cultural interaction and historical heritage. Last but not the least, this internship is full-time and paid, which is a rather desirable first-step for a student to build resume and launch his/her future career.

CHAPTER 5. CONCLUSION

Having the honor to work with GeoAdaptive, as an intern, is evidentially one of the most valuable occurrences I had during my academic life. The intrinsic value of working with a group of well-trained professionals, with such diverse demographic diversity, racially and academically, is enormous. It had not only widen my vision, but also it strengthened my capability to communicate and further collaborate with people with little to none GIS knowledge, which is crucial to people like us, who spend most of their time sitting in front of

the computer and focus on the technologies. Besides the personal and professional network I was helped to developed, the life advises my boss gave me, occasionally, seems to be equally important. Be courageous! Be resourceful! Be organized! With everything stated above, it is safe to say that I am fully satisfied with this opportunity I was so fortuned to have. I fully expect this internship possesses the value to launch a whole new journey, and I am more than willing to carry it with me further down the road. Should anybody encounter such an opportunity, do not hesitate to pursue it.