Annotated bibliography of precision agriculture

Whelan, B., & Taylor, J. (2013). Precision agriculture for grain production systems . Collingwood, VIC: CSIRO Publishing. doi: http://ezproxy. nwmissouri. edu: 2098/eds/ebookviewer/ebook/bmxlYmtfXzU2OTcwNF9fQU41? sid= 0f562d5f-e822-4752-baf2-de27033dddee@sdc-v-sessmgr06&vid= 0&format= EB&lpid= lp_13&rid= 0

-          Both authors are from the University of Sydney and with the funds granted by Grains Research & Development Corporation allowed for the research of precision agriculture in grain crop production with the use of technologies and techniques. These techniques and technologies allow for increased agronomic practices through the crop and soil relationship. They used 4 main objectives to focus on for their study: " optimizing production efficiency, optimizing quality, minimizing environmental impact and minimizing risk (pg. 2)."

Through these four objectives they determined the financial gain and cost of implementing said technologies. They analyzed all areas of crop productions such as seed, labor, and fertilizers to determine if precision agriculture was worth the investment. They determined that based on their discoveries that it was more cost efficient to implement these techniques and technologies on a site-by-site basis. By using precision agriculture's technologies and techniques was a way to reduce costs while maximizing returns from the investment in a high input system such as precision agriculture.

After reading this article and analyzing their data, I found their results quite interesting. In my field of research, which is in agriculture, we constantly

study the relationship between the soil and the crops we grow in it. We consistently analyze what is financially worth it to implement into the soil and/or crop to get the most increase in yield. This paper outlined how these technologies or techniques can improve the field of agriculture.

Mihail KANTOR, & Amnon LEVI. (2018). Utilizing Genetic Resources and Precision Agriculture to Enhance Resistance to Biotic and Abiotic Stress in Watermelon. Notulae Scientia Biologicae, Vol 10, Iss 1, Pp 1-7 (2018), (1), 1. https://ezproxy. nwmissouri. edu: 2105/10. 15835/nsb10110242

-        In this article, a team of scientist research a problem with biotic and abiotic resistance in watermelons. Due to the numerous health benefits of watermelon, it is important that this issue be resolved to maintain the vegetable and market it possesses. Many crop plants whether that be grain, fruit or vegetable crops have some sort of breeding strategy that is managed to create certain cultivars. Cultivars is simple a broad term for different " breeds" of the same species.

Due to abiotic and biotic resistance, the watermelon is more susceptible to disease and other pests such as insects due to the resistance to insecticides, pesticides, etc. Most vegetable breeders use a traditional breeding method to reproduce their plants, however with growing resistance it is crucial to implement new strategies. The researchers discovered with the use of genome selection and breeding methods they can create new cultivars of watermelon that are better adapted for abiotic and biotic issues. With the use of precision agriculture technologies, they can select specific genomes and modify them to be better adapted for issues.

This article and the research that was conducted was very interesting and worth reading. With the constant debate of GMO's within the food market, this brings background knowledge and insight into how they are able to continue to evade issues that decrease the food production and farmer profit. This is often a topic of discussion in my field as an animal scientist and an agriculturalist. With studies like this, it opens the worlds eyes into how food can be produced more efficiently and effectively without loss of profit or production.

Milioto, A., Lottes, P., & Stachniss, C. (2017). Real-time Semantic Segmentation of Crop and Weed for Precision Agriculture Robots Leveraging Background Knowledge in CNNs. Retrieved from http://ezproxy. nwmissouri. edu: 2048/login? url= http://search. ebscohost. com/login. aspx? direct= true&db= edsarx&AN= edsarx. 1709. 06764&site= eds-live&scope= site

-        In this article, researches explore remote sensing robots in the crop fields. These robots allow for the real time identification between crops and weeds in the field. Weeds influence on crops is quite detrimental when final yield is considered. When crop fields are infested with weeds, the crops must compete for nutrients, sunlight, and space. When the crops are fighting for nutrients their growth and seed production are compromised thus yield and final profit are diminished.

These robots capture images in real time and identify them as either crops or weeds. With this type of technology, the users of these machines can see the infestation their fields are under and implement strategies to reduce them. This also reduces labor during scouting for infestations. This will also

reduce the amount of exposure to herbicides the farmers use. Overuse of herbicides allow for greater resistance against them, which can cause further issues down the road. By implementing better strategies we can manage weeds on a population basis and reduce resistance rate. By this study, it was determined that these systems improve weed identification in fields and training of employees.

This information was quite new to me, but very interesting to see real-time image capturing systems implemented within agriculture. Technology like this will improve the genetics tremendously by reducing the amount of herbicides on populations within threshold. Resistance among weeds is a struggling issue within my field and it is inspiring to see technology helping real time issues.

Lewis, D. (1995). Importance of GIS to Community-Based Management of Wildlife: Lessons from Zambia. Ecological Applications, 5(4), 861-871. doi: 10. 2307/2269337

-        This research was conducted in rural African communities and their relationship of resources with wildlife. Due to the still very rural areas within Africa and the need for vast spaces of land for its natural wildlife, resources can be competition and management of land use lines can be blurred. Wildlife management can be done so that it benefits the animals it protects and the people that coexist with said animals, but rural communities lack the education of wildlife management to understand its importance. This study was contact to use software to produce maps to help educate rural community members on land use within their areas.

Community members were a huge part of this study and allowed map creators to better understand the land and its current uses. Due to the communities' first-hand experience with the lands natural inhabitants, it allowed map creators to have first-hand data collects to create more accurate mapping. Issues were even brought to the attention of officials and corrected such as excessive netting of issues in certain areas which diminish fish populations. Due to these maps, community leaders were allowed to resolve issues and build consensus within their communities. Since local individuals were used to collect GIS data, maps become more used at the rural individual level.

This study allowed me to see into a part of my career that I was not so educated about. As an animal scientist, management of livestock is always considered. While in my studies we discussed wildlife management, we generally only covered issues within our own country. This is vastly different than what wildlife management is to individuals in rural areas in Africa due to many of the areas still being underdeveloped. This was quite an eye-opener and made you think in a new perspective about what wildlife management is among different areas and cultures.

Durr, P. A. (2008). GIS and spatial analysis in veterinary science. Wallingford, Oxfordshire, UK: CABI Pub. doi: https://books. google. com/books? hl= en&lr=&id= pP3ykP7261YC&oi= fnd&pg= PR8&dq= GIS in veterinary science&ots= IrcvMK6oM2&sig= vG_lUh9-7TyW5ENxfNJcWN3x0Qk#v= onepage&q= GIS in veterinary science&f= false

-          In this publication, the author expands on the research conducted by another scientist and further investigates the use of GIS in Veterinary Science, specifically epidemiology. They thrived with the use of GIS, because codependence on someone else's maps was eliminated and the ability to create one's own map was possible. Through the use of real spatial data, veterinarians, researchers alongside GIS experts were able to create maps that displayed areas of disease and areas that are more common to certain animal illnesses.

By using spatial data collected by researchers and veterinarians, they were able to input the data into GIS software and create maps to display the data and the area it was collected in. This was used in issues specifically to epidemiology, such as chronic pulmonary disease in dogs. By using the data collected by instances of dogs with chronic pulmonary disease in the area of Philadelphia, they were able to input the data into GIS software and see the data on a digital map of the city and compare cases with area-based influence. They furthered this use by collecting data of other diseases and being able to see and record certain areas with higher instances and then provide advice on strategies to better control or manage said disease or outbreak.

This article was by far my favorite due to my interest and pursuit in the veterinary science/medicine career field. Working within a veterinary clinic and seeing disease and illness first hand gave me insight on how within a clinic setting a veterinarian must give advice on how to control said disease or illness with only the information given by the owner. Data and its uses in this GIS software manner will allow veterinarians more information on the

diseases and/or illnesses' in their area and implement better strategies on controlling them. This can be stricter vaccine regimens, recommendation on better exercise programs for pets or even increased biosecurity in areas where they are more prevalent.

Rinaldi, L., Musella, V., Biggeri, A., & Cringoli, G. (2006). New insights into the application of geographical information systems and remote sensing in veterinary parasitology. Geospatial Health, 1(1), 33. doi: 10. 4081/gh. 2006. 279

-        In this article, researchers discuss how GIS and remote sensing has been influential to human and animal parasitology. Due to these technologies disease mapping, spatial data and analysis, and territorial sampling have advanced in helping the veterinary and medical field in parasitology. Due to the software's ability to utilize and create maps, the researchers were able to create maps for their own benefit. By collecting data and creating a map to display the data, they were able to get a better understanding of the parasite in question and how vast it is among an area.

One of the most influential uses of this data is disease mapping. By displaying a map and then entering data collected for the area the data can be drawn based off a demographic or geographic base. By doing so, researchers or users are able to relate the data to a population and relate it to population size. By doing so, this allows veterinarians and doctors to see areas of epidemics and increasing cases of parasitism. This then allows them to implement strategies with the CDC or among their own practice to decrease the population size effected and prevent further cases.

This type of use of GIS and RM software is quite intriguing to me. It allows medical professionals to better understand not only humans, but the parasite and its behaviors. By receiving a better understanding of both, they are able to create strategies to ultimately create a healthier environment for the affected population whether that be humans or animals. Again, this goes along with my goal career as a veterinarian and allows me to have hope and a better understanding that GIS can be used in my everyday career.

Genchi, C., Rinaldi, L., Mortarino, M., Genchi, M., & Cringoli, G. (2009). Climate and Dirofilaria infection in Europe. Veterinary Parasitology, 163(4), 286-292. doi: 10. 1016/j. vetpar. 2009. 03. 026

-        This article uses the unique ability of GIS to study climate and the spreading of disease. This study was focused within Europe and is overpopulation of stray dogs and cats. These strays are common carrier of Dirofilaria, commonly known as roundworms which are a mosquito-borne nematode. Dirofolaria can infect not only animals, but also humans and cause illness. Dirofilaria larvae are climate dependent and without proper climate will not develop, thus not spread. By researching the growing degree days and animal population in Europe allowed researchers to see the spread of the infection throughout the country.

With the use of spatial data on climate throughout the country for a yearlong period and the areas in which infection was seen, researchers were able to create maps to display the data. By comparing the rates of infection and the areas climate, researchers were able to find a correlation between climate and the spread of the infection. This allowed for them to create

epidemiological patterns of dirofilariosis in humans and animals within Europe.

This research was interesting to read due to its comparison of climate and infection rates. Most do not consider climate to be a driving factor of disease, but research like this with the implementation of GIS allows others to see the relationship in real-time with maps for each month spanning for one calendar year. This again relates to my future career as a veterinarian, because roundworm infections are quite common in household pets. Due to household pets, such as cats and dogs, close contact with humans makes this infection makes it just as much veterinarians problems as it does human medical professionals.

Bergquist, R., & Rinaldi, L. (2010). Health research based on geospatial tools: A timely approach in a changing environment. Journal of Helminthology, 84(1), 1-11. doi: 10. 1017/S0022149X09990484

-        This article takes geospatial tools into a more vast and broad use incorporating it into health among humans, animals and improvement of environment. The focus of this article is on disease prediction by the study of environmental characteristics in comparison with geographical areas and their instances of infectious agents within them. By using many geospatial tools from GIS software, they determine their uses in health research. They used tools such as spatial statistics of epidemiological data, maps for visualization and exploratory analysis for certain parasites.

This article takes numerous GIS software tools and tests them in how they can predict disease and infections that influence human and animals' lives.

They even lightly touch on the limitations of remote sensing in data collection for disease predictions. By using climate-based forecast systems they are able to study growing degree days (GDD's) for certain parasitic larvae and predict their infestation growth. Systems such as the disease surveillance systems and early-warning systems generally categorized under remote sensing have influenced disease predictability vastly in the fact it accounts for not only geographical features, but man-made ones too that may influence the data.

This article was one of my favorites as well. They took the limitations and abilities of GIS tools and put them to the test in their own area of research that influences all. By being able to test all tools and take the positives from each one and implement them into predicting disease is amazing. This can be used in humans, animals and most likely even plant-based disease prevention. As someone who wants to be in the agriculture field this is simply inspiring.

Zenilman JM, Glass G, Shields T, et al Geographic epidemiology of gonorrhoea and chlamydia on a large military installation: application of a GIS system Sexually Transmitted Infections 2002; 78: 40-44.

-        This article sought out to implement a GIS for infectious diseases, specifically Gonorrhea and Chlamydia in a large military base. The hope by implementing this system would allow for recording, analyzation of outbreaks, outbreak patterns among populations based on demographics and finally control strategies to be implemented. This also can be used in public health factors with other diseases and public health issues.

They used a mapping function to display man-made features within the base such as streets, houses, etc. to display the full format of the base in its entirety. Each individual on base was given an STD test specific to these two STDs. By using the map function and cross analyzing it with data collected from the STD test, it allowed to see specific correlations between positive tests and the demographics of that individual. By doing so, this allows officials to see where the biggest need of treatment, education and prevention strategies need to be implemented within their base.

I chose this study due to its relation still to the medical field, which I find most interesting. However, this study brought social factors into the equation which I find interesting as well. It was thought-provoking to see what demographics such as race or subdivision influenced the individual's likely-hood of testing positive of either or both STDs. Implementation of software like this can be then extended out to other public health issues on a wider area and population.

Baldwin, R. (2014). Planning for land use and conservation : assessing GIS-based conservation software for land use planning / Rob Baldwin [and four others]. Retrieved from http://ezproxy. nwmissouri. edu: 2048/login? url= http://search. ebscohost. com/login. aspx? direct= true&db= edsgpr&AN= edsgpr. 000980272&site= eds-live&scope= site

-        This article reviews the application of GIS software in conversation and land use planning. " We grouped several conservation software tools into five themes: reserve selection, habitat connectivity, species distribution and viability modeling, threats, and climate forecasting (pg. 1)." By

implementing these tools, they were able to better determine what was needed in community planning and determine where resources were best needed.

Due to conservation not being legally required and land use planning being controlled mostly by local government, a push to link the two has been on an increase. By creating a conservation software, this allows local officials to better plan land use within their communities so that functioning ecosystems can be maintained. They were able to use this software " to predict species distributions and variability, model habitat connectivity, where and when threats will accumulate and forecast how systems may respond to large-scale environmental changes, including climate change (pg. 2)." This allowed them to create models based on each of the listed variables above and implement strategies to best suit both public development and maintaining ecosystems and their inhabitants.

This article covered numerous topics, but it explains conversation and GIS software's ability to maintain ecosystems while still developing in a societal since. I recommend this article for anyone interested in conservation and their ability to tie GIS knowledge to helping ecosystem conversation. I found it especially interesting that the species distribution model helped predict when species will be in said area depending on migration, breeding season, etc. Then the use of climate-predicting software and its influence on the species model as well was interesting, because many do not consider the relationship between the two.