Stop, Collaborate, and Listen:
Using Geographic Information Systems in Agricultural Education

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Introduction

Aeronautical Reconnaissance Coverage Geographic Information System (ArcGIS) is a "system designed to store, manipulate, analyze, and output map-based, or spatial, information" (Steinberg & Steinberg, 2006, p. 2). ArcGIS is typically used for planning urban or rural areas, transportation planning, tracking wildlife, environmental impact analysis, and agricultural applications such as soil testing (Grind GIS, 2015). Although ArcGIS is used in many disciplines, it is not typically used in agricultural education research.

ArcGIS can contribute to agricultural education by identifying concerns, motivations, and relationships between humans and the environment (Ballas, Clarke, Franklin, & Newing, 2017). Specifically, ArcGIS can visually display contextual situations by merging quantitative and qualitative data. ArcGIS is innovative to agricultural education because it can spatially identify geographic locations in collaboration with human dimensions, such as data collected through surveys, interviews, and other methods used in social sciences. By visually representing relationships between humans and environmental elements, we can have a holistic systems thinking (Weinberg, 1975) approach to solving problems.

A more holistic approach can result from collaboration and partnership between research disciplines (e.g., social science, engineering, communications, wildlife, mathematics, etc.). However, collaboration, partnership, and coalition themes were only identified 19 times in articles across Agricultural Education journals (Edgar, Briers, & Rutherford, 2008). In fact, research priority four of the National Association of Agricultural Educators identifies the use of collaboration and partnerships important to delivering effective agricultural education programs (Roberts, Harder, & Brashears, 2016). Therefore, there is need to explore, expand, and collaborate with other disciplines to further the development of agricultural education research. One suggestion is for agricultural education researchers and biological science researchers to work collaboratively to communicate and deliver agricultural education. The use of ArcGIS in agricultural education can be a useful tool for collaborating and producing visual dimensions of human and environmental elements to solve issues.

How it Works

ArcGIS is useful for visually representing collected data and exploring new perspectives from many angles. To fulfill an Introduction to ArcGIS course project, survey data from an agricultural education study was used (Dewald, Leggette, Murphrey, Berthold, & Wagner, 2018). This collaboration study identified communication preferences for and barriers to adopting management practices related to water quality (Dewald et al., 2018).

To complete the course project, I first needed to identify the initial goal; visually identify landowners who are within a 2-mile radius of water testing stations where higher levels of bacteria are present. By identifying the landowners closest to higher levels of bacteria, the communication coordinators can directly provide water and agricultural-related education to landowners, ultimately to reduce bacteria entering the waterway.

Using ArcGIS, I first plotted landowners' location who did and did not participate in the study (Dewald et al., 2018) on the map. Survey results (e.g., communication preference, most trustworthy source of information, etc.) were added to each landowners' location attribute table.

Additional environmental data (e.g., waterways containing high levels of bacteria, and county lines) was added to the map in the appropriate locations were data was obtained. Then, a 2-mile radius around the water testing stations was added, removing all landowners outside of the radius, from the map. Finally, landowners who did and did not participate in the study, and were within the 2-mile radius of the high bacteria water testing stations, were identified. The ending map provided justification to target communication and education outreach to landowners closest to high bacteria water testing stations. By identifying landowners within areas of high bacteria water testing stations, communication efforts could be better directed to those landowners. More directed communication can potentially increase the adoption and implementation of best management practice, ultimately, to reduce bacteria entering the waterways (Dewald et al., 2018).

Implications

In this setting (Dewald et al., 2018), the visual representation of data was beneficial to reach the project goal. Specifically, it brought together many elements, both human (e.g., communication preference, most trustworthy source of information, etc.) and environmental (i.e., locations of landowners, locations of waterways with high levels of bacteria, and a 2-mile radius). This holistic view took into consideration several factors, then narrowed down the scope to target specific landowners to provide water-related outreach and education. ArcGIS was used in this project to use an applied research approach to solving both environmental and sociological issues.

By gathering sociological and biological data, we can use ArcGIS to spatially analyze the relationship between humans and the environment. That relationship can provide outreach and education information to positively change the way humans interact with environmental systems. Additionally, using programs like ArcGIS, maps and interpretive designs can be disseminated to stakeholders, partners, or the public in a visually appealing way. It is important to not limit the expansive array of abilities that ArcGIS can supplement to projects. For example, ArcGIS can target audiences of a specific characteristic (e.g., live within food desert, own land near housing development, etc.), or educate homeowners about monarch butterfly migration near their home (Tapaneeyakul, 2017). These examples are the type of outreach agricultural educators and communicators are directly involved in.

Advice to Others

When using ArcGIS to visually represent human dimensions, it is imperative to know what the goal of the project is before beginning. By doing so, gathering the appropriate data resources to use and reaching the project goal is easier. Sometimes the goal of the project might not be what the study research objectives were asking; therefore, collaborating with others can be useful when taking into consider all perspectives.

Costs and Resources Needed

Potential implementers of this innovative idea should first focus on collecting various types of data, in fact, mixed-method data from various disciplines of science is most useful (e.g., wildlife, water resources, crop sciences, etc.). Although the ArcGIS program is effective, it is expensive to purchase and does require training to operate. Therefore, it is imperative to collaborate with a colleague or resource that knows how to use ArcGIS programs.

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