LIVESTOCK GEO-DATABASE FOR PUNJAB PROVINCE

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ABSTRACT: *Livestock is the most important subsector of agrarian economy of Pakistan. With advent of technology in each and every sector of economy and development of e-government, Punjab government is aiming at making all public sector organizations' data accessible to public through Punjab government web portal and ultimately integration of entrie data to national Spatial Data Infrastructure. This research provides a framework for development of geodatabase to explore, visualize and manipulate livestock data at various administrative jurisdictions and at parcel level details. Spatial component of this project consists of provincial, division, district, tehsil and parcel shape files integrated with livestock census data 2006. Census data provides details of total animals and their segregation according to age and sex. Parcel level details of animals and their owners are collected through survey. Entire level of details are developed as a geodatabase in ArcMap 10 to visualize and analyze livestock data at district level. The research provides an estimation of livestock products in Puanjb province.*

Keywords: geodatabase, livestock, equine, lrage ruminants, small ruminants.

INTRODUCTION:

LIVESTOCK in a broader sense is a term used for all grown animals. Livestock rearing and domestication of animals is one of the earliest human activity. Livestock products are also an important way of securing a livelihood among the poor and of creating job opportunities for a large proportion (30%) of the world's population [16] . Livestock also provide benefits other than food, such as biodiversity [4]. Livestock contributes directly to the livelihoods and food security of almost a billion people [6][7]. In recent decades, the world food economy has seen a shift towards increased consumption of animal-source foods. In developing countries, the meat and dairy sectors have grown at average yearly rates of 5.1 percent and 3.6 percent respectively since 1970 [2]. As the largest land-use system on Earth, the livestock sector occupies 30% of the world's ice-free surface, contributes 40% of global agricultural gross domestic product, and provides income for more than 1.3 billion people and nourishment for at least 800 million food-insecure people [11].

Pakistan is rich in livestock wealth in terms of numbers of species and breeds as well as their population. Livestock found in Pakistan belong to seven species i.e. buffaloes, cattle, sheep, goats, camels, equine (horses, donkeys and mules) and poultry. Currently, livestock population of Pakistan consists of 26.3 million buffaloes, 24.2 million cattle, 56.7 million goats, 24.9 million sheep, 800 thousand camels, 300 thousand horses and 4.5 million mules/ donkeys [8].

With the advent of computer technology and development of e-Government concept, each and every public sector organization in Pakistan is now a days aiming at developing their data in electronic format and making it accessible to the public through their web portals. E-Government has been developed in various countries. E-government is defined as the use of Information Technology by the public sector organization [13]. One of the new paradigm in e-Government is e-Livestock [1].

Keeping in view the importance of livestock in agrarian economy of Pakistan, this research aims at developing GIS database exhibiting livestock distribution in administrative enumeration units of Punjab and a case study of distribution of livestock at parcel level in Basirpur Punjab. GIS as "an organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information" [5]. The use of GIS plays already a fundamental role in many areas (health and human services, utilities and communication, natural resources, etc.) with a continuous increase in the number of studies dealing with the analysis of geo-referenced data [3][12].

Study Area

The project has two different level of details. Firstly, the livestock cadastral database is prepared at district level based upon livestock census of 2006 with a provision of integration of next census. whereas next part is livestock database at parcel level. Parcel level details are provided by Livestock and husbandry department of Punjab Government. The study Area selected for parcel level mapping is Basirpur that is located in Tehsil Depalpur District Okara in Punjab.

Figure 1: Study Area

Methodology

The importance of the livestock sector as a user of natural resources, as a source of livelihoods, and as an engine of economic growth has been the focus of significant attention in the last decade [6,9,10,14,15]. The existing livestock enumeration system consists of livestock census at the national level every ten years conducted by the Agricultural Census Organization (ACO), which is an attached department of the statistics Division, Ministry of Finance, Economic Affairs and Statistics, Government of Pakistan. For the sake of simplicity, the population estimates of livestock species (2001-2002) have been grouped into three types i.e. Large

Ruminants (cattle and buffaloes), Small Ruminants (sheep and goats) and Work Animals (camels, and equine) [8]. Livestock data in ACO provides enumeration of animals at district level. For this research Livestock census of 2006 data was processed in Arc Map 10.3 . detailed methodology is being provided in figure 2.

Figure 2: Methodology

In this project two types of Spatial data was acquired and processed. First category of spatial data was administrative boundaries of Punjab province, including   provincial, division, district, tehsil boundaries. All boundaries' shape files were prepared by scanning and digitizing of administrative maps prepared by Survey of Pakistan. In administrative boundaries geo-database, each administrative unit was given a unique identifier with a provision of relating hierarchy at each level. This administrative identifier was used as a unique identifier to realte spatial component with non-spatial componenet.

Second category of spatial data was parcel mapping of Basirpur Mauza, tehsil Depalpur. For parcel mapping one Index Mussavie and twelve Shajra Parcha maps (Lathhas) were acquired from Patwari of said area. All these maps were scanned at 300 dpi. Index Mussavi helps in mosaicking all the Shajra parchas as each Shajra parcha has an alphanumeric key as unique identifier ranging from *Alif aik – daal teen* (ج۲۳د). In each shajra parcha there was marginal area and information so all scanned images were cropped in adobe photo shop to extract only mapped objects and then mosaicked by using alphanumeric keys. Table 1 provides the indexing of twelve Shajra Parchas according to the said alphanumeric keys
. Afterwards the mosaicked images were georeferenced in Arcmap. In georeferencing spatial reference system specified was a s UTM Zone 43, WGS84 and transverse mercators projection. Then the boundaries of parcels were digitized to have a shapefile with each parcel having a unique identifier.

For attribute data processing, livestock census 2006 was available as a pdf document. Each table in given pdf was converted into excel sheets. As the source data was provided by names of districts so in excel each district was given similar Unique identifier as it was in district shapefile.

For parcel level details ground survey was conducted in Basirpur Mouza and details of animal as provided in census along their owners details were collected and processed with parcel id in excel format.
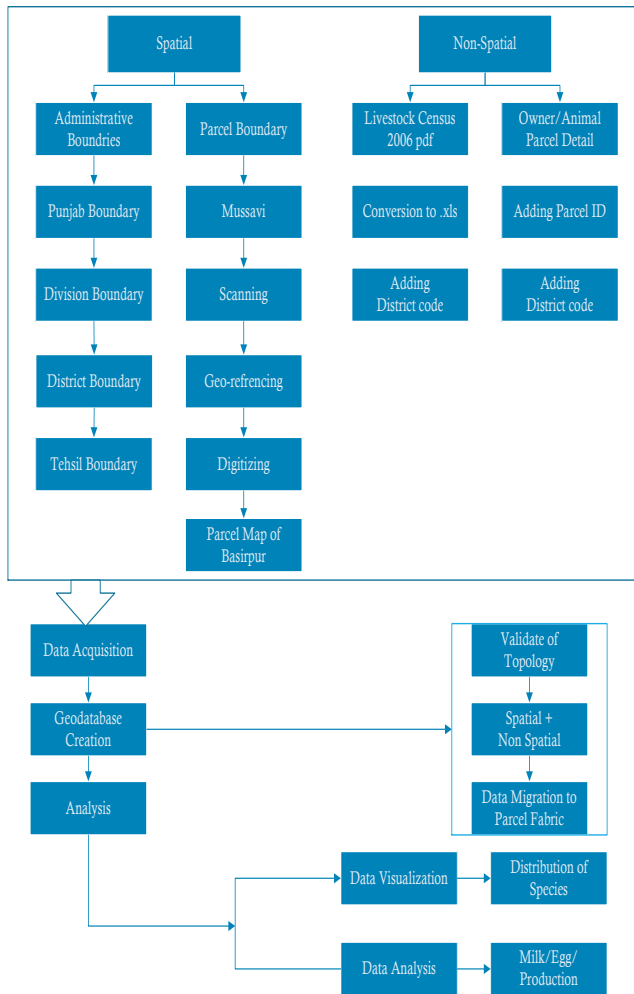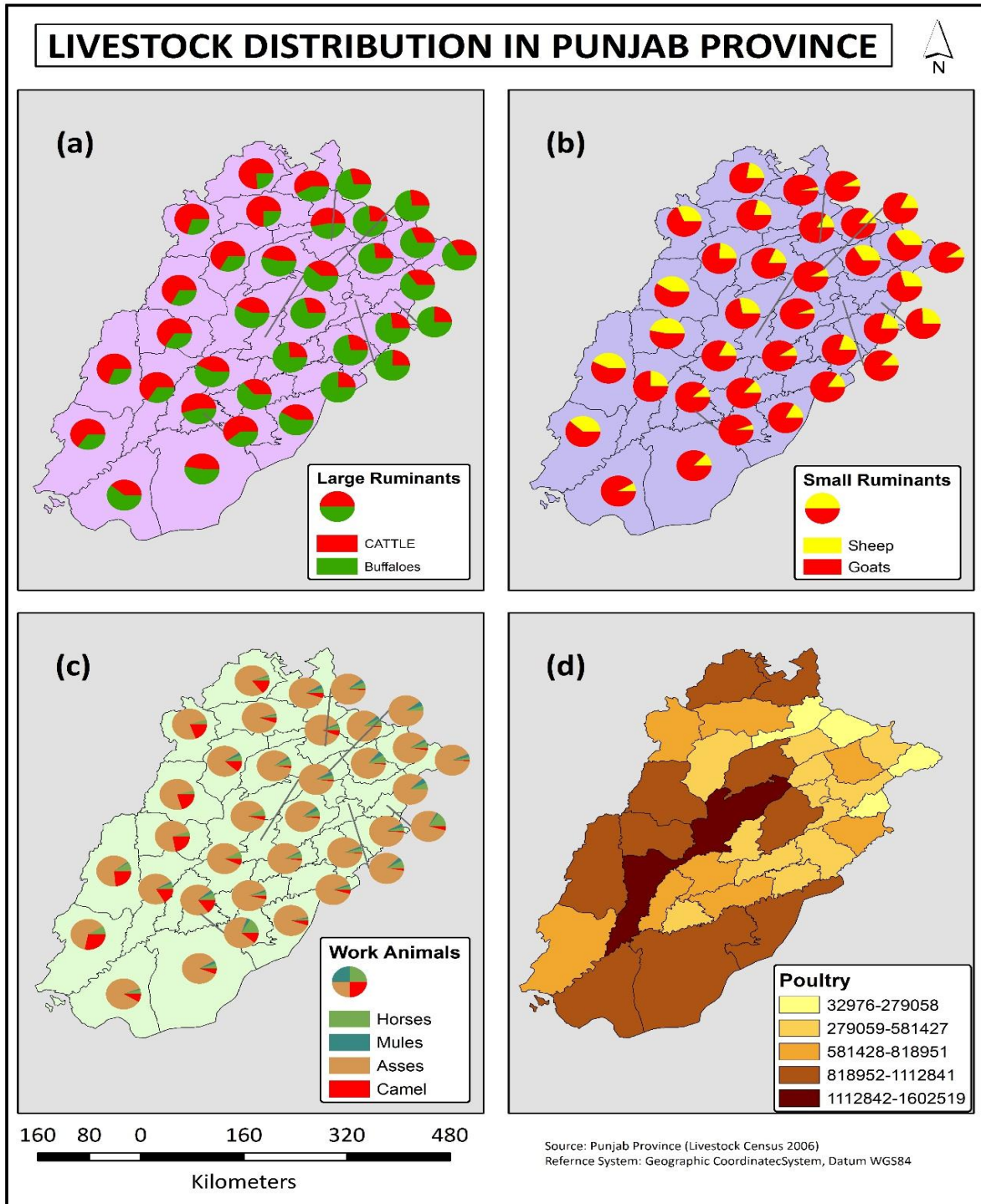
د	ج	ب	ا	
	ج۱	ب۱	الف۱	۱
	ج۲	ب۲	الف۲	۲
د۳	ج۳	ب۳	الف۳	۳
	ج٤	ب٤		٤

Table 1: Indexing of Mussavies

Figure 3: Livestock Distribution In Puanjb Districts

After preparation of entire spatial and non-spatial components, a personal geo-database was created in Arcmap to integrate spatial and non-spatial data based upon unique identifier. Geodatabases store both the spatial and attribute data together in a single database management system.

ANALYSIS AND INTERPRETATION OF RESULTS

With reference to Methodology Figure 1 the next step was data visualization and analysis. For visualization, maps were produced to demonstrate spatial distribution of three categories of animals.

As shown in figure 3 (a), map shows distribution of large ruminants (Cattles and buffaloes). Cattle population is mainly

concentrated in middle districts along rivers or canal fed agricultural areas and Buffaloes are mainly concentrated in north eastern urban districts of Punjab. It may be primarily due to milk consumption in urban areas.

Figure 3 (b) represents small ruminants (Sheep and Goat) spatial concentration. Population of sheep is mainly concentrated in western districts mainly attributed towards rugged terrain and dry climatic conditions. Goats are mainly found in west and south west districts of Punjab as they are mainly found in semi desert areas.

Figuree 3 (c) shows the third category of work animal including camels and equines (Horses, donkeys and mules). Equines are mainly found in surroundings of main urban districts of Punjab because in these areas they are mainly used for transportation.

Figure 3 (d) shows poultry distribution. Poultry is mainly a domesticated activity found in all non-urban districts of Punjab province.

ata provides previlige of querying individual parcel in ArcMap. As shown in Figure. 3, information about individual parcel of Basirpur can be retrieved including no of animals of different types owned by an individual along detailed information of an owner.
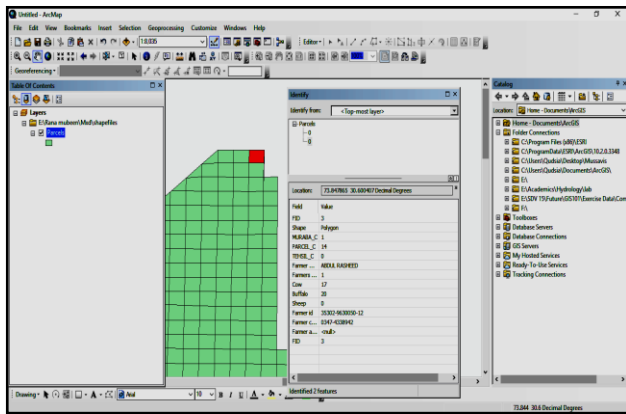
Figure:4 Parcel level details of Livestock

The next step of analysis was daily milk production in Punjab. For milk production estimation cattles were classified according to sex and age groups. As per cattle avrerage milk produced is 20 litres per day. So the average production was multiplied by total In millk female population of cattle. Estimated daily production of milk in Punjab is 80 million litre. Maximum milk production is in Muzaffargarh district. As per buffaloe estimated milk produced is 10 litres per day. So the estimated production was multiplied by total population of In milk female buffaloe. Daily estimated monthly production of milk in Punjab is 62 million litres. Maximum milk production is in Faisalabad district.

CONCLUSION:

In rural economy of Pakistan, livestock is contributing significantly to the agriculture and the national GDPs. Livestock raising in Pakistan is primarily a subsistence activity and is characterized by small flocks/herds with widespread ownership. With increasing population in Pakistan demand of livestock products has increased demanding management of livestock on scientific principles.

Development of GIS based platform for livestock data management can play a vital role for policy makers to visualize and analyze spatio-temporal livestock data. Which can enhance effectiveness of policies to be carried out for increase in livestock and their products.

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