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Original Article

A Health GIS Based Approach to Portray the Influence of Ambient Temperature on Goat Health in Two Different Agro-Climatic Zones in West Bengal, India

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Abstract

The spatial and temporal distribution patterns of the livestock health status in the developing countries like India are complex. In this regards, the application of Geographical Information System (GIS) is valuable as it has many features that make it an ideal tool for use in animal health surveillance, monitoring, prediction and its management strategy. The goal of the present study is to find out the effect of ambient temperature on goat health in two different agro-climatic zones in West Bengal, India with the additional help of GIS technology. The highest mean value of temperature (42.6 ± 1.5 ºC) has been reported during the month of April or May in the season of pre-monsoon in Purulia. Survey of India (SOI) topographical sheets (73 I/3 and 79 B/5) are used to map the study areas. Top sheets are scanned, geo-referenced and then digitized with the help of GIS software. The biochemical and meteorological data are entered to the newly prepared digitized map as the non-spatial data or attributes. Moreover, the present work aims to confer an indication of the potential applications and usages of a GIS in the field of animal health for advancing the knowledge about this innovative approach of goat heath surveillance and monitoring.

Keywords: Goats; GIS; Pre-Monsoon; Post-Monsoon; Purulia; Nadia.

Introduction

Our earth is now undergoing through a rapid demographic and ecologic changes, including tremendous pressure of population growth with successive increasing problems of food insufficiency[1], Inadequate development in public health sector, climate changes and simultaneous loosing of biodiversity, and the impacts on ecosystems which in common affects human and animal health [2]. The most important reason for using a GIS in an animal health information system is to facilitate the spatial component of animal health to be included in the reporting and analysis of animal health data. The applications of GIS can be divided into three main areas, which can be explained differently as inventory, analysis and management applications [3] or data visualisation, data exploration, and data modelling in an alternate way [4]. The problem is to consider whether a GIS for sustainably developing countries like India is able to provide the full range of functions required by such a system. An animal health information system has the necessary purposes of gathering, storing, analysing as well as reporting information on animal health [5]. Insertion of GIS into an animal health information system allows the spatial component of animal health to be incorporated into this process. The efficiency of data collection system has no impact here, or how equipped the data storage method, excluding data analysis, and ultimately reporting of the animal health information, the system provides no useful function [6]. Now in the developing country like India, GIS is becoming very popular in the observation as well as to track and to monitor the vector-borne and water-borne diseases [7].

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Methodology

Survey of India (SOI) topographical sheets of 1: 50,000 scales (No. 73 I/3 and 79 B/5) are used to map the study areas. Topographical sheets are scanned, geo-referenced and then digitized with the

Fig. 1: Non-spatial attributes including biochemical parameters of the pre-monsoon in the study area of Purulia

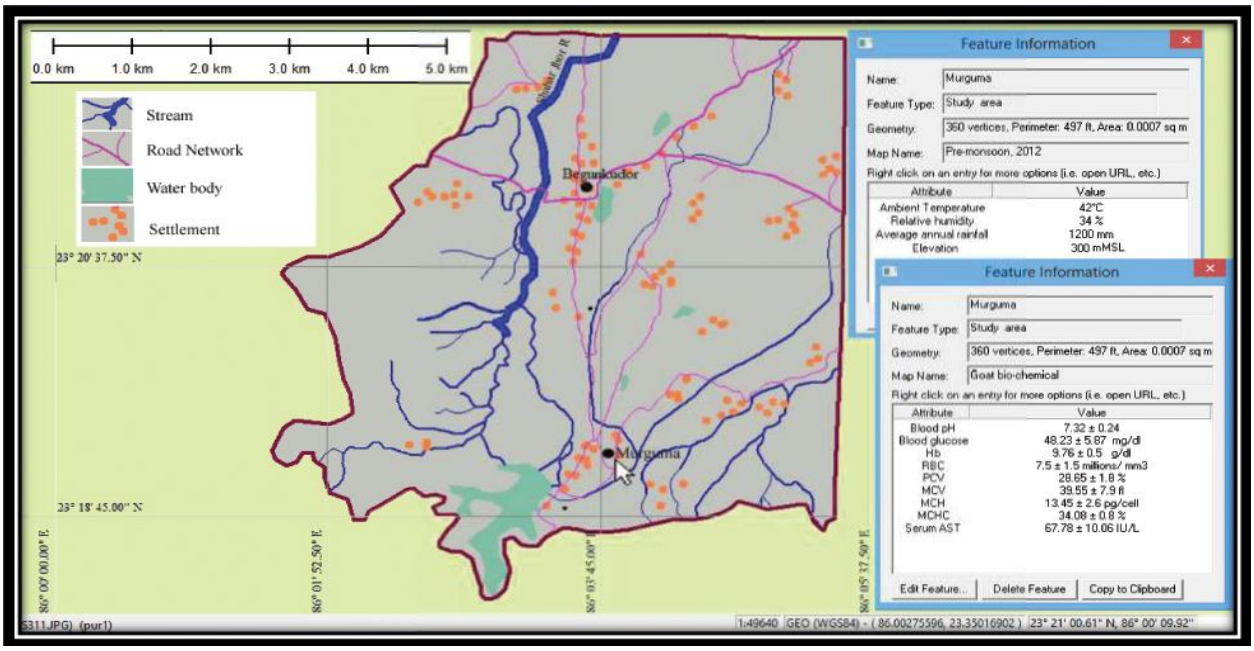
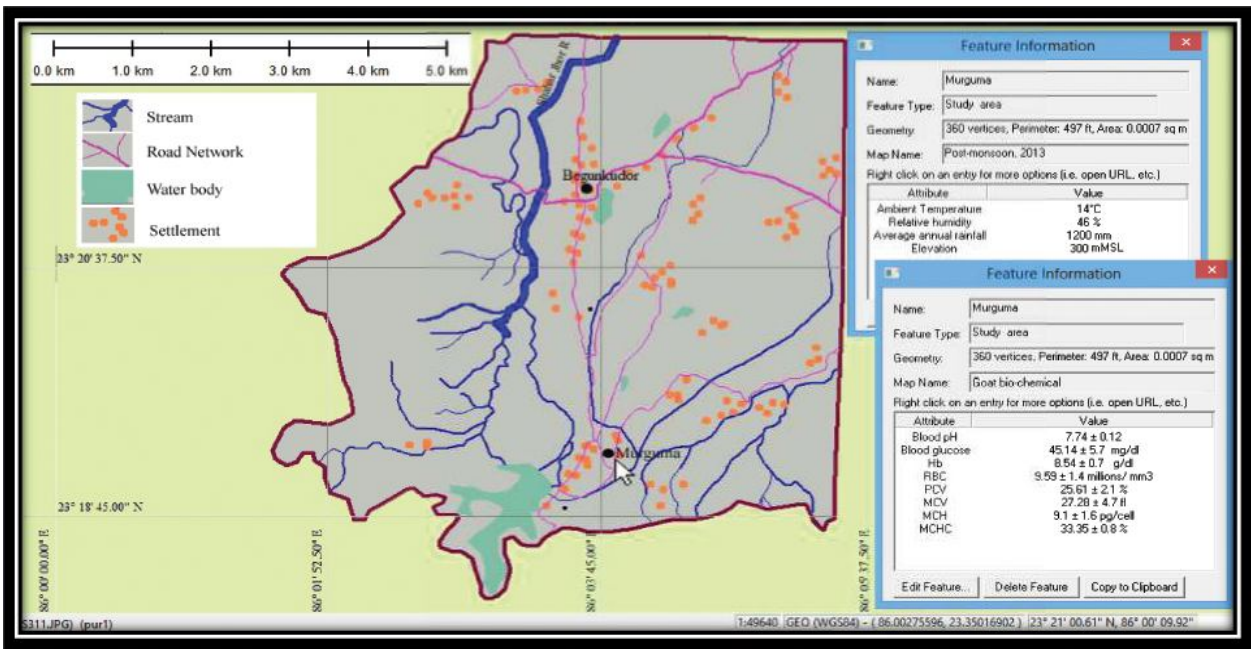


Fig. 2: Non-spatial attributes including goat's biochemical parameters of the post-monsoon in the study area of Purulia



help of GIS software [8] such as TNTmips® 7.2packages (©2015 Micro Images Inc.), Global Mapper® etc. The biochemical parameters such as blood glucose (mg / dl), total RBC (millions / mm3), total haemoglobin or Hb (g / dl), packed cell volume or PCV (%), mean corpuscular volume or MCV (femtoliter per cell or fl), mean corpuscular haemoglobin or MCH (in picogram per cell or pg) and mean corpuscular haemoglobin concentration or MCHC (%) and meteorological data such as ambient temperature (ÚC), relative humidity (%), average annual rain fall (mm) and elevation (mMSL) from previously published article[9] and from some recent work of the same authors, has been entered to the newly prepared digitized map as the non-spatial data or attributes. The data have been entered in such a manner so that, when the mouse (computing) has been ported and clicked on any selected point subsequently opening one or more windows containing the information about different non-spatial attributes (Figure 1, 2, 3 and 4). Latitude and longitude of the different study sites have been measured using GPS (eTrex, Garmin International, Inc.).

Fig. 3: Non-spatial attributes including goat's biochemical parameters of the pre-monsoon in the study area of Nadia

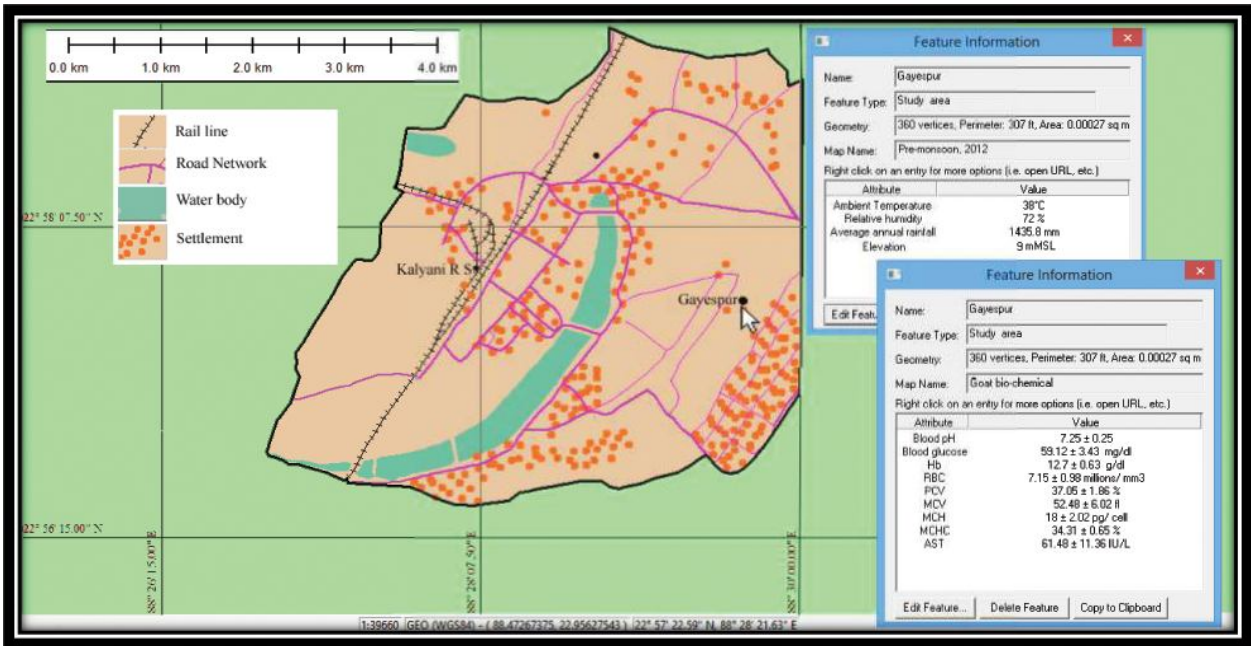
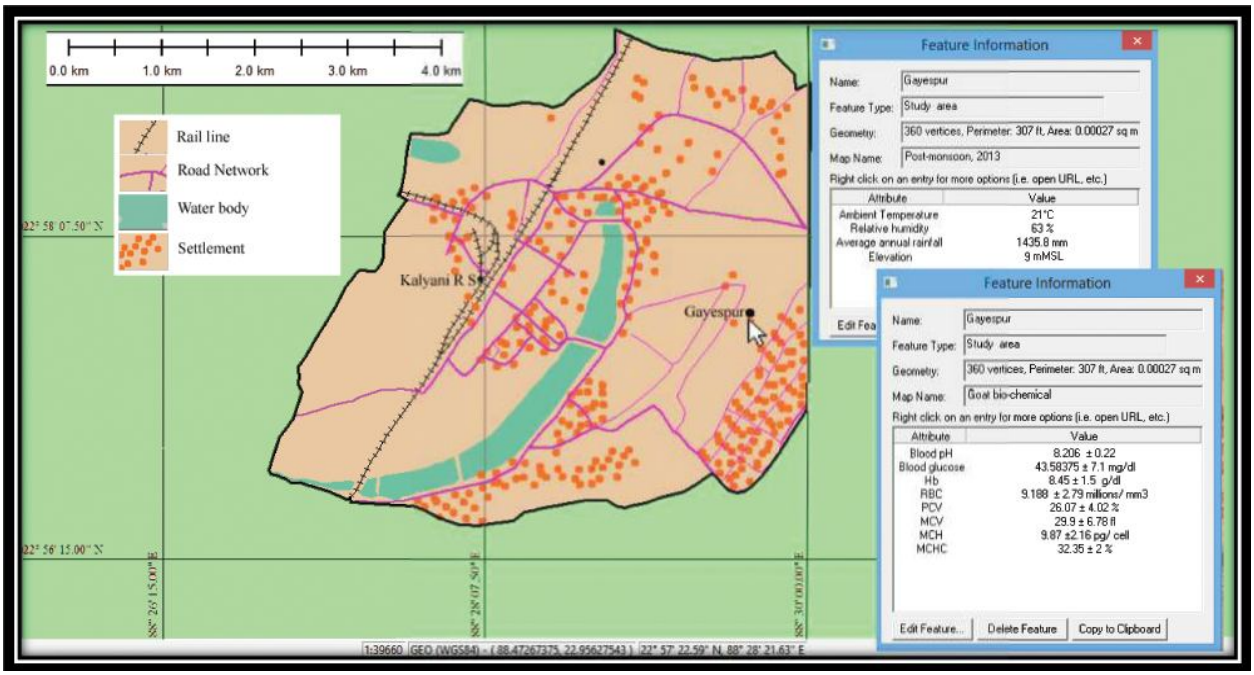


Fig. 4: Non-spatial attributes including goat's biochemical parameters of the post-monsoon in the study area of Nadia



Results and Discussion

The physiological, biochemical and meteorological data, from previously published article by the same authors [9] has been entered to the newly prepared digitized map as the non-spatial data or attributes. An effective linking of geographical and attribute information is an essential part of the function of a GIS. As a result, most of the GIS have very potent, and simple to use data linking capacities. This makes them well suited to the task of integrating the many different data sources that are necessary in an animal health information system. Keeping this view in mind the present work has been done. The maps are prepared from the topographical sheet 73 I/3, showing Murguma, Purulia and the maps are prepared from the topographical sheet 79 B/5, showing Gayespur, Nadia. The non-spatial attributes i.e. biochemical parameters of the goat blood during

the pre-monsoon season in the study area Murguma, Purulia have been entered in the map (Figure 1). Figure 2 showing the non-spatial attributes i.e. biochemical parameters of the goat blood during the post-monsoon season in the same study area of Purulia. Figure 3 and 4 showing non-spatial attributes i.e. biochemical parameters of the goat blood in the study area of Gayespur, Nadia, for the season of pre-monsoon and post-monsoon respectively.

The one of the present study area Murguma, situated in Purulia district, which fall under Eastern Plateau and Hills (agro-climatic) region of India [10]. It receives about 1200 mm of rainfall annually. During pre-monsoon season the average ambient temperature has been found 42^{0}C and relative humidity has been found 34 % (Figure 1). Whereas during post-monsoon season the average ambient temperature and relative humidity has been found 14^{0}C and 46 % respectively (Figure 2). The other study area of the present work is Gayespur from Nadiadistrict, which fall under Lower Gangetic Plains (agro-climatic) region of India [11]. Here annual rainfall ranging between1200 mm to 1700 mm. During pre-monsoon season the average ambient temperature has been found 38^{0}C and relative humidity has been found 72 % (Figure 3). Whereas during post-monsoon season the average ambient temperature and relative humidity has been found 21^{0}C and 63 % respectively (Figure 4).

The maps of Figure1 and Figure 2 are clearly showing marked differences in biophysical and biochemical parameters between two seasons in Murguma, Purulia [12]. Similarly Figure 3 and Figure 4 show some differences biochemical parameters between two seasons in Gayespur, Nadia. Here we can compare the Figure 1 with Figure 3, i.e. comparing bio-chemical parameters of goats under study of pre-monsoon season between the two present study areas of Purulia and Nadia. Which show significant difference in many aspects [9]. However, there are less significant difference in between the two study areas Purulia and Nadia during the post-monsoon seasons (comparing Figure 2 and Figure 4). Some other important findings from the prepared map are: blood pH values in pre-monsoon are lower than post-monsoon in both the region i.e. Purulia and Nadia. The blood glucose level always has been higher in post-monsoon. MCHC values remain unchanged throughout the year as well as in two different agro-climatic regions. As many workers [13] reported the steady level of MCHC during different seasons.

We know that the purpose of an animal health information system is to give information that provides a better understanding of the epidemiology of disease and the continuous study of goat's bio-physical parameters such as rectal temperature, heart rate, pulse rate and bio-chemical parameters such as blood pH, blood glucose, RBC, PCV, MCV, MCH, MCHC values can give an idea of the goat heath in real time [14 &15]. Examination of the spatial component of animal health data yields another important advantage of GIS – the capability to quickly identify the data errors. Lost and out-of-range data can be simply identified when the data going to incorporated into the map. Previously GIS have been effectively applied to a number of definite problems in veterinary epidemiology, such as calculating the risk of East Coast fever to the livestock in Africa [16]. An effective linking of geographical and attribute information is an essential part of the function of a GIS. As a result, most of the GIS have very potent, and simple to use data linking capacities. This makes them well suited to the task of integrating the many different data sources that are required in an animal health information system [14].

Conclusion

GIS has been efficient in collection and presentation of spatial and non-spatial data as well as disease occurrences, which assist to prepare immediate remedial and preventive approaches for disease prevention and management [17]. It is obvious that the systems in most developing countries fall far short of the optimal, due to a range of constraints strange to the developing parts of the world [18]. In the present context, the ability of GIS to link graphic and non-graphic data facilitates prevailing analysis of different non-spatial distribution and related issues. It will be feasible and quite easy to draw the maps and visualize possible temporal and spatial risk factors [19]. Particular problems exist in the collection of unbiased, reliable, timely information on the health status of livestock populations, and in the management of animal health data [20]. GIS provides strong spatial analytical potentialities [21], but the limited availability of consistent animal health data, such as that collected by dynamic surveillance, the analysis is of limited value. These systems are being increasingly applied to animal disease control as an integral component of supporting system concerning decisions in the field of veterinary science. Thus, GIS can be sighted as a possible tool for a novel move towards of science [22], to endorse the animal health in terms of monitoring, observation as well as disease management policies.

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