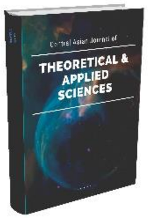

CENTRAL ASIAN JOURNAL OF THEORETICAL AND APPLIED SCIENCES

Volume: 03 Issue: 11 | Nov 2022 ISSN: 2660-5317
https://cajotas.centralasianstudies.org

Create a Layer of Maps Those are Part of the Livestock and Poultry Astral

Khakimova Kamola Rakhimonovna
PhD of Fergana Polytechnic Institute

Abdusalomov Abdusaid Abdulhay o'g'li
Magister of Fergana Polytechnic Institute

Received 9th Sep 2022, Accepted 8th Oct 2022, Online 15th Nov 2022

Annotation: *A review of livestock census and mapping methods and databases. Livestock contributes directly to the livelihoods and food security of almost a billion people and affects the diet and health of many more. With estimated standing populations of 1.43 billion cattle, 1.87 billion sheep and goats, 0.98 billion pigs, and 19.60 billion chickens, reliable and accessible information on the distribution and abundance of livestock is needed for a many reasons. These include analyses of the social and economic aspects of the livestock sector; the environmental impacts of livestock such as the production and management of waste, greenhouse gas emissions and livestock-related land-use change; and large-scale public health and epidemiological investigations.*

Keywords: *pixel, area files, WGS84, GIS, European Commission (EC).*

Introduction

"Livestock make an important contribution to most economies. Livestock produce food, provide security, enhance crop production, generate cash incomes for rural and urban populations, provide fuel and transport, and produce value added goods which can have multiplier effects and create a need for services. Furthermore, livestock diversify production and income, provide year-round employment, and spread risk. Livestock also form a major capital reserve of farming households. Because of livestock's contribution to societies, human and economic pressures can direct livestock production in ways detrimental to the environment." [1-5]

Though these roles alone justify considerable efforts to map the distribution of livestock in as much detail as possible, there are several other incentives to devote significant resources to what has been termed 'livestock geography'. These include (in no particular order):

the need to locate the environmental impact of livestock, through greenhouse gas emissions, vegetative cover and botanical composition, overgrazing and land degradation, nutrient balance and effluent pollution2;

the use of livestock data in (rural) poverty indicators or in identifying livelihood strategies, primarily in developing countries, and increasingly in remote areas –thereby contributing to development targeting;

the need to determine levels of financial subsidies or tax liabilities;

assessing livestock production and its requirements in relation to cropping: particularly important in this context is the need to identify and project the likely demand for livestock feed, the land resources required to produce it, and the potential for conflict with the requirement for producing crops for direct human consumption;

assessing livestock production and its requirements in relation to other possibly competing natural resource sectors (wildlife, forestry, amenities); and

prioritising agricultural and environmental research.

Ancillary to these is the necessity of estimating animal populations at risk from current and emerging diseases, and the possible consequences of disease induced restrictions (such as those imposed on the movement of people in the recent Foot and Mouth epidemic in the UK) on other sectors of the economy, such as tourism. Livestock disease mapping and the associated spatial/temporal epidemiological modelling (used to aid the management of disease outbreaks and compare the values of alternative disease controls) are burgeoning fields but have been specifically excluded from this overview [1-5].

Materials and Methods.

The GIS data layers used in the modelling process fall into 3 categories: 1) masks and pixel area files; 2) the predictor covariates; and 3) the stratification layers. All variables are un-projected, using latitude and longitude coordinates and the WGS84 datum. The images have a pixel resolution of 30 minutes of arc (0.00833 degrees) – a nominal pixel resolution of approximately 1 km×1 km at the equator. All imagery is maintained and used as scaled integer data in Idrisi format [6-10].

Suitability masking is an important step of the modelling process; firstly for adjusting the reported livestock numbers into the densities used as dependent variables in the regression models, and secondly for masking out unsuitable areas with densities of zero in the modelled results. If, for example, an administrative area of 100 km^2 is reported to contain 100 cattle, but half of its area is deemed unsuitable for raising cattle, the effective density of cattle on ‘usable’ land is not 1 but 2 head km^{-2}. Suitability masking in this version is more conservative that it was in the original GLW ; areas of forest and desert are no longer explicitly excluded – it is left for the model to determine the suitability of these – so a single mask is used for both ruminant and monogastric species. Land pixels with elevations higher than 4,750 m above sea level or at a slope of gradient higher than 40 percent are deemed unsuitable as well as urban areas and pixels permanently covered with snow or ice. The digital elevation model (DEM) GTOPO30 of the US Geological Survey (USGS) is the source for elevation data and for derived slope information (https://lta.cr.usgs.gov/GTOPO30). The GLC2000 land cover classification developed by the Joint Research Centre (JRC) of the European Commission (EC) is the source for the land cover categories of urban areas and snow and ice [11-16].

Areas unsuitable for reasons that are not biological or environmental, for example protected areas, are treated differently in the modelling procedure, and are therefore masked separately. A global mask of protected areas is derived from the 2010 version of the World Database on Protected Areas (WDPA)(www.wdpa.org). The International Union for the Conservation of Nature (IUCN) categories Ia and Ib, II, and III were masked as unsuitable as these are characterised by stringent conservation measures and tight regulation of human activity – the encroachment of roaming cattle and other grazing activities is therefore less likely in these than in other areas . Any sample point falling in an area masked for environmental or biological reasons is maintained as a sample point in the model, with a livestock density of zero. If, however a sample point falls in an area deemed unsuitable for legislative reasons, it is dropped from the analysis. The area may, in fact, be quite suitable for livestock, and a zero value for livestock density would mislead the statistical model. A simple land mask is also employed in the modelling process and a file containing the area of each pixel is required for converting livestock numbers into densities, and vice versa. The independent predictor variables offered to the regression analyses are drawn from a spatial data set that allows the modelling process to take advantage of any relationship between livestock densities and climatic, environmental, demographic or topographic factors. The mainstay of these is a Fourier-processed, decadal time series of geo-physical variables derived from Moderate Resolution Imaging Spectroradiometer (MODIS) satellite data (http://modis.gsfc.nasa.gov) from 2001 to 2008. The variables include two vegetation indices, the land surface temperature and the band 3 middle-infra-red, which is particularly suitable for vegetation mapping. Rogers and associates have described the Fourier processing of satellite data in several studies, while a description specific to the MODIS data series is provided by Scharlemann and colleagues. The use of Fourier-processed time-series data is central to the modelling process since the Fourier variables reveal the seasonal characteristics of the environment.[17-21] Each multi-temporal series is reduced to seven separate, and quite independent, data layers: the mean, and the phases and amplitudes of the annual, biannual and tri-annual cycles of change. Three additional variables combine the amplitude and phase of the three cycles of change and report the contribution of this combination to the total variance in the seasonal phenology. These are further supplemented by the maximum, the minimum and the variance of the satellite-derived geo-physical variables. Two other MODIS-derived products are included as predictor variables: 'green-up' and 'senescence', derived by Boston University from the NASA MOD12Q2 MODIS tiled phenology layers (http://www.bu.edu/lcsc/research/land-cover-dynamics). These represent the dates when new green vegetation is first detected at the beginning of a growth cycle, and the onset of senescence at the end of that cycle. Detailed information on the MODIS-derived predictor variables is available on file S2. Two climate-related variables are also used: the length of growing period (LGP), which has been modelled to 1 km spatial resolution and the annual precipitation data (synoptic period 1950 to 2000) from the WorldClim climate dataset. Since human activities are associated with livestock distributions, two demographic variables are also included. The first is the human population density in 2006, for which the source is the Global Rural-Urban Mapping Project (GRUMP) (http://sedac.ciesin.columbia.edu/data/collection/grump-v1), with country totals adjusted to match the United Nations population values in 2006. The second is the travel time to areas populated by 50,000 people or more. Finally, the GTOPO30 dataset is the source for elevation and slope information [22-26].

A given predictor variable may be associated quite differently with livestock densities in different ecological zones. For instance, daytime temperature may have a negative association with livestock densities in an ecological zone describing arid environments, whilst it may have a positive association in temperate regions. In GLW 2 the analyses are therefore spatially stratified using three stratification layers selected to represent different types of spatial zonation. The first of these comprises 25 discrete ecological zones (EZ25) and is the result of an unsupervised classification of some of the Fourier-processed MODIS data, achieved by first reducing the data using a principal component analysis (PCA), followed by clustering using the ADDAPIX programme. The zonation is based on the mean values of the temperature and vegetation variables, as well as elevation and a vegetation seasonality index derived from the Fourier processed time-series of the satellite imagery to distinguish zones in each hemisphere. This is very similar to the stratification scheme that was used to produce the 2007 livestock densities. A second stratification scheme, that has proved very useful, is the map of global livestock production systems (GLPS version 5). This distinguishes livestock-only, mixed irrigated and mixed rain-fed farming areas, based on land cover, human population densities and data on irrigation. Each of the three categories is then sub-divided, using data on temperature, elevation and LGP, into four sub-categories: hyper-arid; arid and semi-arid; humid and sub-humid; and temperate and tropical highland. A third stratification scheme is provided by a published dataset on the biomes of the world. Olson and associates subdivided the terrestrial world into 867 ecoregions, nested within 14 biomes. The ecoregions were evaluated as a stratification layer but proved too detailed, resulting in many strata failing to contain sufficient sample points to produce models. The biomes, however, have proved to be a useful means of stratification [27-31].

Results

Figure 1 shows the global distributions of cattle, pigs and chickens and the partial distribution of ducks respectively; created by merging the results from the continental tiles for each species. These global maps represent the predicted data, first corrected to match the polygon values of the observed data and then to match the FAOSTAT country values in 2006. The highest cattle densities (Figure 1a) are found in India, in the East African highlands (particularly in Ethiopia), in Northern Europe and in South America. Desert areas and the tropical rain forests of Amazonia and of the Congo Basin have practically no cattle. The highest concentrations of pigs are found in China and in other Eastern Pacific countries (Figure 1b). Pigs are also densely distributed in European countries while only a few countries in Africa (e.g. Uganda, Burkina Faso, Ghana, Nigeria and Togo) have significant densities. Relatively high concentrations are also found in Central America and in Brazil. The distribution of chickens (Figure 1c) closely follows that of the human population. The highest concentrations are found in eastern China, in Pakistan and India, and in western Europe. In Africa, the countries facing the Gulf of Guinea and Madagascar also have high chicken densities. The densely populated east coast of the United States also shows high numbers whilst chickens are only sparsely distributed in the central and western states. The heavily populated areas of southern Brazil also show high concentrations of chickens [32-36]. The distribution of ducks (Figure 1d), for those regions for which sub-national statistics were available, adds information to previous national and regional duck mapping efforts. Ducks are far less common than chickens worldwide although high densities are to be found in South-East Asia and China where duck production is often integrated with rice cropping and fish farming. Though to a lesser extent, duck densities are also quite high in a few European countries (e.g. France). file S4 provides a summary of the sub-national statistics used for the modelling and file S5 provides detailed metadata for the sub-national statistics used to develop the livestock distribution models. file S6 provides two graphic summaries of data availability for the modelled species (a) the average spatial resolution of the training data and (b) administrative level of the training data.

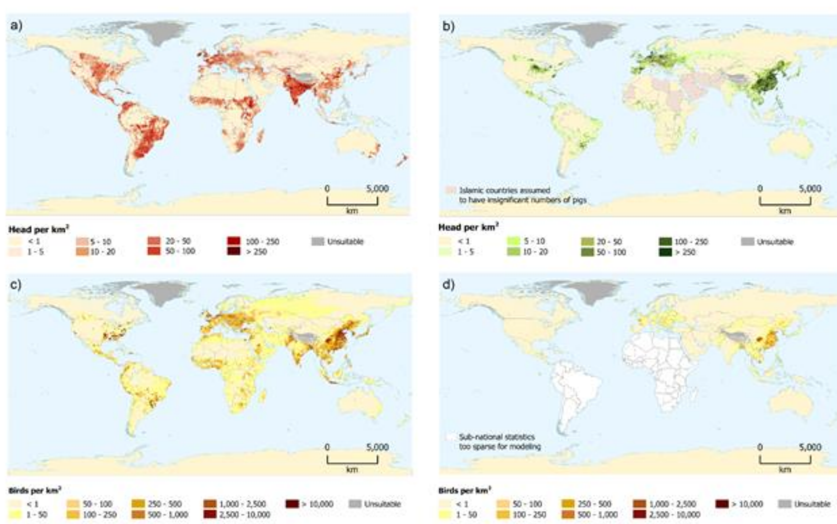

Figure 1

Discussion

The new GLW 2 livestock density maps described above provide a timely update of the GLW 2021 livestock distributions and the enhnaced methods and automated procedures mean that updates will, in future, be more frequent than they have been to date. The differences in the modelling procedures, the type and resolution of predictor variables and the different unsuitability masks prevent an explicit, quantitative assessment of change between the livestock densities as mapped by the old and new GLW version. However, we can discuss the improvements that have been made over the original GLW, the accuracy of the predictions and areas where further advances could be made [1-5].

References

1. Robinson TP, Wint GRW, Conchedda G, Van Boeckel TP, Ercoli V, Palamara E, et al. (2014) Mapping the Global Distribution of Livestock. PLoS ONE 9(5): e96084. https://doi.org/10.1371/journal.pone.0096084
2. FAO (2009) The State of Food and Agriculture. Livestock in the Balance. Rome, Italy: Food and Agriculture Organization of the United Nations (FAO).
3. FAO (2011) World Livestock 2011 - Livestock in food security. Rome, Italy: Food and Agriculture Organization of the United Nations (FAO).
4. Alexandratos N, Bruinsma J (2012) World Agriculture Towards 2030/2050. The 2012 Revision. Global Perspective Studies Team. ESA Working Paper No. 12-03. Rome, Italy FAO, Food and Agriculture Organization of the United Nations.
5. Mavlyankulova S. Z. THE ESSENCE AND FUNCTIONS OF CREATING A CARD, CHOOSING A METHOD FOR CREATING A CARD //INTERNATIONAL CONFERENCES ON LEARNING AND TEACHING. – 2022. – Т. 1. – №. 11. – С. 3-8.
6. Mamatqulov O., Qobilov S., Yokubov S. FARG ‘ONA VILOYATINING TUPROQ QOPLAMIDA DORIVOR ZAFARON O ‘SIMLIGINI YETISHTRISH //Science and innovation. – 2022. – Т. 1. – №. D7. – С. 240-244.
7. Khakimova K. R. et al. SOME TECHNOLOGICAL ISSUES OF USING GIS IN MAPPING OF IRRIGATED LANDS //Galaxy International Interdisciplinary Research Journal. – 2022. – Т. 10. – №. 4. – С. 226-233.
8. Khakimova K. R. et al. THEORETICAL AND METHODOLOGICAL QUESTIONS OF MAPPING THE ENVIRONMENTAL ATLAS //Galaxy International Interdisciplinary Research Journal. – 2022. – Т. 10. – №. 4. – С. 240-245.
9. Sherzodbek Y., Sitora M. THE ESSENCE OF CARTOGRAPHIC MAPS IS THAT THEY ARE USED FOR CARTOGRAPHIC DESCRIPTION OF THE TERRAIN //GENERALIZING WORKS IN THE PREPARATION OF MAPS.–2022.–2022. – 2022.
10. Khakimova K. R. et al. DEVELOPMENT OF CADASTRAL MAPS AND PLANS IN THE GEOINFORMATION SYSTEM //Galaxy International Interdisciplinary Research Journal. – 2022. – Т. 10. – №. 4. – С. 212-216.
11. Mavlyankulova S. Z. et al. THE ESSENCE OF CARTOGRAPHIC MAPS IS THAT THEY ARE USED FOR CARTOGRAPHIC DESCRIPTION OF THE TERRAIN. GENERALIZING WORKS IN THE PREPARATION OF MAPS //RESEARCH AND EDUCATION. – 2022. – Т. 1. – №. 4. – С. 27-33.

12. Abduraxmonov A. A. et al. DAVLAT YER KADASTRIDA GIS TEXNALOGIYALARIDAN FOYDALANISH //INTERNATIONAL CONFERENCES ON LEARNING AND TEACHING. – 2022. – Т. 1. – №. 8. – С. 228-233.
13. Abbosxonovich M. A., Abduvaxobovich A. A. Measures for the Protection of the Historical and Cultural Heritage of Fergana and the Mode of Monitoring of Cultures with the Help of Geoinformation Systems //Central Asian Journal of Theoretical and Applied Science. – 2022. – Т. 3. – №. 6. – С. 342-348.
14. Abduvaxobovich A. A. Methods of Improving Physical and Mechanical Properties of Light Concrete on the Basis of Chemical Additives //Texas Journal of Multidisciplinary Studies. – 2022. – Т. 8. – С. 165-167.
15. Arabboyevna A. M. Biological Activity of Typical Irrigated Gray Soils //Central Asian Journal of Theoretical and Applied Science. – 2022. – Т. 3. – №. 6. – С. 285-289.
16. Arabboevna A. M., Shavkat o‘g‘li Y. S. The Use of Geoinformation Systems in the Study of the Land Fund of Household and Dekhkan Farms //Texas Journal of Multidisciplinary Studies. – 2022. – Т. 8. – С. 163-164.
17. Axmedov B. M. et al. Knauf Insulation is Effective Isolation //Central Asian Journal of Theoretical and Applied Science. – 2022. – Т. 3. – №. 6. – С. 298-302.
18. Khakimova K. R., Ahmedov B. M., Qosimov M. Structure and content of the fergana valley ecological atlas //ACADEMICIA: An International Multidisciplinary Research Journal. – 2020. – Т. 10. – №. 5. – С. 456-459.
19. Mukhriddinkhonovich A. Z. Actual Issues of Design of Small Towns in Uzbekistan //Central Asian Journal of Theoretical and Applied Science. – 2022. – Т. 3. – №. 6. – С. 576-580.
20. Abdukadirova M. A., Mirzakarimova G. M. The importance of installation of base gps stations in permanent activity in Fergana region //Asian Journal of Multidimensional Research. – 2021. – Т. 10. – №. 9. – С. 483-488.
21. Zokir A., Sherzodbek Y., Durdona O. THE STATE CADASTRE FOR THE REGULATION OF INFORMATION RESOURCES FOR THE FORMATION AND IMPROVEMENT //Educational Research in Universal Sciences. – 2022. – Т. 1. – №. 1. – С. 47-53.
22. Мадумаров Б. Б., Манопов Х. В. НАЧАЛО РАБОТЫ С ARCGIS. ARCMAP //Central Asian Journal of Theoretical and Applied Science. – 2022. – Т. 3. – №. 6. – С. 325-333.
23. Makhmud K., Khasan M. Horizontal Survey of Crane Paths //Middle European Scientific Bulletin. – 2021. – Т. 18. – С. 410-417.
24. Khudoynazarovich T. H. et al. Complex of Anti-Erosion Measures to Increase the Efficiency of Irrigated Lands //Central Asian Journal of Theoretical and Applied Science. – 2022. – Т. 3. – №. 10. – С. 194-199.
25. Турдикулов Х. Х. Анализ Устойчивости Аякчинской Грунтовой Плотины При Сейсмических Нагрузках //CENTRAL ASIAN JOURNAL OF THEORETICAL & APPLIED SCIENCES. – 2022. – Т. 3. – №. 6. – С. 1-6.
26. Khakimova K. R., Ahmedov B. M., Qosimov M. Structure and content of the fergana valley ecological atlas //ACADEMICIA: An International Multidisciplinary Research Journal. – 2020. – Т. 10. – №. 5. – С. 456-459.

27. Kasimov M., Habibullaev E., Kosimov L. Determination of the chimney roll //An International Multidisciplinary Research Journal. – 2020. – Т. 10. – №. 6. – С. 1313-1318.
28. Abbosxonovich M. A. et al. Introduction of GIS Technology for Soil and Ecologycal Monitoring of the Foothill Areas of the South of the Fergana Region //Central Asian Journal of Theoretical and Applied Science. – 2022. – Т. 3. – №. 6. – С. 334-341.
29. Mamanazarovna E. M., Abbosxonovich M. A. Analysis of Agricultural Soils Designation of Different Linear Protected Zones using GIS Technology //CENTRAL ASIAN JOURNAL OF THEORETICAL & APPLIED SCIENCES. – 2021. – Т. 2. – №. 11. – С. 188-192.
30. Mamatkulov O. O., Numanov J. O. Recycling of the Curve Planning in Gat Technology (Auto Cad) Program //Middle European Scientific Bulletin. – 2021. – Т. 18. – С. 418-423.
31. Ugli M. O. O. RECYCLING OF THE CURVE PLANNING IN GAT TECHNOLOGY (Auto CAD) PROGRAM //Galaxy International Interdisciplinary Research Journal. – 2021. – Т. 9. – №. 11. – С. 480-483.
32. Yusufovich G. Y. et al. Formation of a Personal Database of Data in the Creation of Soil Science Cards in GIS Programs //Central Asian Journal of Theoretical and Applied Science. – 2022. – Т. 3. – №. 6. – С. 303-311.
33. Mirzaakbarovna M. S. Determining the Value of Coniferous Wood Drying //Miasto Przyszłości. – 2022. – С. 104-107.
34. Mirzababayeva S. M. et al. BINOLARNING YUK KO ‘TARUVCHI KONSTRUKTSIYALARINI EKSPLUATATSIYAVIY ISHONCHLILIGI //INTERNATIONAL CONFERENCES ON LEARNING AND TEACHING. – 2022. – Т. 1. – №. 6. – С. 110-115.
35. Ilmiddinovich K. S. Integrating 21st Century Skills into Teaching Medical Terminology //Journal of Pedagogical Inventions and Practices. – 2022. – Т. 9. – С. 114-117.
36. Ilmiddinovich K. S. Online evaluating the language learners on the platforms of the social networking services and delivery people //International Journal of Research in Economics and Social Sciences (IJRESS). – 2020. – Т. 10. – №. 11.

