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2014 International Conference on Smart Green Technology in Electrical and Information Systems (ICSGTEIS)

WELCOME MESSAGE

Welcome to the 2014 International Conference on Smart Green Technology in Electrical and Information Systems (ICSGTEIS), held on 5 – 7 November 2014, in Kuta, Bali, Indonesia. The conference is organized by the Department of Electrical and Computer Engineering and Postgraduate Study in Electrical and Computer Engineering, Udayana University.

The ICSGTEIS 2014 provides forum for international researchers, experts, and students to share, exchange ideas, innovation, experience and the latest research in the field of Smart-Green Technologies. The conference provides opportunity to strengthen collaboration and networking among participants while enjoying the religious atmosphere and the unique traditional culture of Bali.

This conference covers a number of topics, including Energy and Power Engineering, Electronic Devices and Systems, Multimedia Telecommunications, and Software Engineering and Information Systems. All accepted papers have been selected through peer reviewing process. The conference secretariat received nearly 50 submissions and 22 papers have been selected for presentation. In addition to the paper presentations, the conference program also covers plenary lecture, workshop and social events.

I would like to take this opportunity to thank keynote and workshop lecturers for sharing the latest research and development in the area of power cables. I also would like to thank the IEEE Indonesia Section for their continuous support. Many thanks also go to the technical program and the organizing committees, as well as to all the participants. Without your support, this conference would not be possible.

I wish you all have a successful conference.

Professor Ida Ayu Dwi Giriantari
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A Review : Identification of Avian Influenza Environmental Risk Factor using Remote Sensing Image and GIS

M.A. Padmasari, Linawati, N.M.A.E.D. Wirastuti
Department of Electrical Engineering, Udayana University
Bali, Indonesia
adisty.padmasari@gmail.com, linawati@unud.ac.id, dewi.wirastuti @ee.unud.ac.id

***Abstract* — Nowadays, outbreaks of bird flu (Avian Influenza: AI) has become a global issue. It needs to serious handling to be taken so that an outbreak of AI does not mutate into a flu that spreads from human to human and become a pandemic. it will be needed zoning of HPAI for for effective prevention and control and also to reduce the socio-economic impact of the outbreak.**

The spreading of infectious diseases is influenced by some factors. There are : environmental, meteorological, social, economic, also political and warlike conditions have all been shown to contribute to the occurrence and outbreaks of a large number of diseases. Among of them, the environmental and meteorological conditions are the factors that can be more easily quantified and measured. With the help of remote sensing, they can easily be measured repeatedly in either friendly or hostile territory. While other factors, on the other hand, will often require a major effort to measure and can only be expressed qualitatively.

It will be require a better understanding on the ecology and risk factors of HPAI as a form of surveillance, risk assessment and public health policy. This can be achieved with the use of remote sensing as a tool to monitor the climate and landscape dynamics associated with the migration of wild birds and agriculture in the context of the transmission of Avian Influenza. The use of epidemiological tools such as GIS can also be used as a form of surveillance of AIV in accordance with that already formulated by the WHO.

Keywords— Avian Influenza, remote sensing, environmental factor, GIS

I. INTRODUCTION

Bird flu (Avian Influenza) is an infectious disease caused by a virus "Orthomyxoviridae" that usually infects birds and mamalia. Avian influenza A (H5N1), or highly pathogenic avian influenza (HPAI), has become the world's attention because of possibility of a global pandemic. This disease is zoonotic and can cause a very high mortality up to 100%. Avian influenza (AI) is an acute viral disease in birds caused by type A influenza viruses of H5N1 subtype which was first found in Italy in 1878. Experts are concerned that the H5N1 virus could mutate into a form that can be transmitted easily from human to human, although until now there has been no accident which is shown as support of that. Migratory birds, human and farm equipment is a risk factor which is can make this disease spread out from one area to another [1].

Several Southeast Asian countries are currently infected with the H5N1 strain. While a common virus and host ecology are similar in Mekong countries, the pattern of their disease and epidemiology differ greatly. The disease is widely spread across Indonesia, especially in the smallholder sector and human cases and fatalities have been reported. It is now generally accepted that HPAI has become endemic in many parts of Indonesia, Viet Nam, Cambodia, Laos, and Thailand. Preventing recurrence of HPAI in endemic areas is very important, some areas in southern Asia and Central Asia contains highy concentrated, poultry predominatey small holder sector, including a large population of ducks [2]. Bali Indonesia as a tourism city, the H5N1 bird flu outbreak was first reported in the district of Karangasem in Bali in October 2003. After that, the disease spread to all nine counties. Twenty of the 38 sample villages have the H5N1 outbreak. Despite exposure to H5N1 outbreaks, none of the participants from the villages or the market who were seropositive for H5N1. The level of virus isolation in ducks and chickens in the market is higher than in the household. Poultry transport in or out of the village is a risk factor for outbreaks in chickens and ducks households [3].

Mapping environment variables by using remote sensing technology has previously been used in epidemiological studies over the past 25 years but still rare in the context of Avian Influenza.

Remote sensing technology in the field of epidemiology is used to study a wide range of disease vectors. Associations between satellite-derived environmental variables reviews such as temperature, humidity, and land cover type and vector density are used to identify and characterize vector habitats. The convergence from both factors are in the form of multi-temporal satellite of data and georeferenced epidemiological data, the collaboration between biologists and remote sensing scientists, and the availability of sophisticated, statistical geographic information system and image processing algorithms to creates a better research environment [4].

Few studies are available that include the extraction of agricultural indicators or environmental indicators [5]. In the study [6] showed that the remote sensing data can be used to assist the identification and tracking of environmental characteristics to study the disease. Satellite data can be used for monitoring land use patterns, types of vegetation, surface water quality, roads, built-up areas and climate change. For a better results these data can also be integrated with GIS data for subsequent needs and allows user to extrapolate local-level measurements to a regional scale and therefore to discern spatial and temporal patterns that could not otherwise be seen.

The objective of this paper is to review the previous research studies on the use of remote sensing and GIS to identify risk factors for avian influenza from their environment and inundated areas and Reviews their classifications According to various key variables, to define Ai-related health risk indicators. So later it was concluded that environmental risk factors for the spread of AI that can be detected by remote sensing.

II. Remote Sensing and GIS For Disease Surveillance

Association of geographic and environmental factors with occurrence of disease has been studied since olden days. The growth of information technology and geographical mapping techniques has created new opportunities for the health sector actors in order to improve planning, monitoring, analysis and management of health systems.

Geographic Information System (GIS) consists of an organized collection of computer hardware, software, geographic data and personnel, designed to efficiently capture, update, retrieve, analyse and display all form of geographically referenced information. In the field of epidemiology, GIS plays a crucial role in strengthening the overall information management process in terms of monitoring and analysis. This is because GIS is used to collect, update and manage health data serves as a common platform for the convergence of multi-disease surveillance activities. GIS can represent well the visualization and analysis of epidemiological data, revealing trends, dependencies and inter-relationships that would be more difficult, to discover in tabular formats. GIS enables for monitoring data association with background information such as demographic data, boundarie administration, hydrology and kind of vegetation types of the data.

Disease surveillance requires professional analysis and sophisticated judgement of data leading to recommendations for control activities. The ultimate objective of surveillance is prevention of disease. Disease surveillance involves mapping disease in terms of (a) disease, (b) host, (c) vector, and (d) parasite. It includes monitoring the disease in human populations, patterns of drug resistance in the vectors and the parasites, and intensity of transmission by the vector populations [6].

GIS will be able to strengthens data collecting were obtained locally whenpublic health personnel go into the field to investigate when an outbreak is detected, for further management and analysis phase. This is possible because GIS provides the foundation for monitoring and evaluating the outbreak investigation. Portable GIS will allow users of GPS devices by field personnel as the location of the navigation process efficiency and data collection. Where the use of time is the most crucial thing to be able to maintain monitoring the location, so the geographic progression of the disease at that location is continually monitored. When field staff have maps, imagery, and descriptive metadata at their fingertips, it will be easier for them to identified environmental conditions ideal for disease vectors at high-transmission areas (e.g., gathering places). GIS also facilitates targeting of control measures and prevention based on priority locations.At previous research has shown the effectiveness of implementing integrated vector control within a defined distance buffer of known dengue case locations.

In [1], a model for avian influenza infection based on the spatial integration of the relevant risk variable. The authors are formulating to coupling a GIS for additional models related variables To identify areas of risk of infection of bird flu in the province of Khon Kaen. Susceptible birds become infected when they come in contact with contaminated surfaces within a certain distance of the outbreak [1].

In a study [5], remote sensing images can be used to map the surface of open water and flooded areas and water to get a number of variables: temperature, turbidity and water depth (the latter in relative value). In situ measurements and / or additional modeling approaches needed to judge others for the survival of key variables such as pH virus or salinity. However, as the initial approach, as is currently available, could provide the first classification of the potential zone of AI virus survive in water of a certain area. To help identify and map areas of AI risk, this information can be combined with other layers of geographic information about the trade in poultry, such as the density and structure of the poultry, wild bird migration zone, etc., using a Geographic Information System-based approach [5].

GIS is often used without the help of remote sensing if only needed just as a mapping and not for determining the value of the environmental risk factors of a disease. In the study of spatial analysis [7] is used to map the GIS based spatial distribution of human infection with the H7N9 virus. Thematic maps showing the distribution of human cases indicates that although the majority of human cases are concentrated in the Yangtze River delta in the east coast of China, sporadic cases were distributed in large areas of adjacent provinces, even spread north to Beijing and exported to Taiwan.

GIS is also used by the complement of materials research. As in the study [8], because there is not a Geographic Information System (GIS) map layers are available for village administration level, possibly related to the variable density of virus transmission (transportation networks, water) or viral persistence (presence of non-paddy fields and water) is calculated for a buffer zone of 500-m-radius from the center of each village using GIS software

(ESRI Arc-GISTM, density transport features (national road and all the way) and production-related animal water features (canals, ponds and streams) calculated in each buffer zone by dividing the number of pixels occupied by a particular feature to the total number of pixels in the buffer. is defined as the pixel size of 20 x 20 m. a land cover map derived from a composite sPOT (Satellite Pour l'Observation de la Terre) supervised image classification is produced, validated by field visits and used to characterize the landscape of the area of their study to help determine the risk factors for Highly Pathogenic Avian influenza H5N1 incidence rate in the villages and farms in the Red River Delta region in Vietnam.

Overall, Geographic Information Systems (GIS) have the ability to handle and combine such a variety of data sources and is, therefore, being used increasingly to study the spatial and temporal patterns of infectious diseases. The application of GIS and geostatistics help to gain additional insight into the introduction, spread and persistence of the transboundary animal diseases like HPAI-H5N1 by utilizing the information from the mandatory reporting systems. This could potentially help advocating an enhanced control program and the design of an empirical surveillance system [9].

III. REMOTE SENSING, GIS AND AVIAN INFLUENZA

GIS in general, serves as a platform which is used for surveillance and monitoring needs of different regions of standard indicators (eg, epidemiological data georeferencing). With the use of this platform, the health organization will be able to produce a map showing the distribution of cases with various scales (eg levels, world, state, regional, provincial, and district) and also predict the number of the most vulnerable populations based on their proximity to risks. With the use of GIS, the pattern of the spread of diseases, especially infectious diseases will be more visible through the temporal animated maps and network analysis.

In GIS, maps provide graphic presentations of health related issue. Digital maps are the quickest means visualizing the entir health scenario, and can be used to convey more than one type of information at a time. Spatial patterns can be perceived and correlations visualized through the use of maps. It also aid in the visualization of differences, clusterinf heterogeneity or homogeneity within data. Symbols and colours can represent these details or relative importance of certain features. Maps can be used to communicate ideas and explanations about the determinants of disease and strategies control [6]. In [1], the maps is build by the conversion of Avian Influenza informations (epidemic and environmental factors) into GIS. This informations contains by the spread of epidemic and its impacts covered extensively for numerous places in Thailand during the outbreak period.

Combination of mapping and GIS can be good tools and methods that are important to help understand how to controlling the infectious diseases, identifying and rectifying environmental factors that caused them.

A. *Environmental Factors Affecting The Spread of AI*

Addressing environmental links to the spread of Avian Influenza may provide essential information to delay, minimize, or even prevent a costly pandemic. Possible environmental links that should be addressed include [6]:

- Deforestation and other methods of habitat destruction affects bird migration route.
- Agriculture environments that facilitate the spread of bird flu in humans or other animals.
- Utilization of water resources contact humans infected birds or animals.
- Market environment that facilitates the spread of avian influenza in animals and other

In [10], environmental factors of AI built using elevation, human population, chicken, ducks and geese, and the average rice cropping in a modeling framework for relating multiple logistic regression for predictors of the presence of HPAI H5N1 by collecting data with the epidemic wave and state, changing the number of outbreaks. Satellite-based mapping algorithm using data from the MODIS of the Terra satellite enables the identification and tracking of image pixels that experienced flooding and rice transplanting over time, based on the analysis of the temporal profile Normalized Different Vegetation Index, Enhanced Vegetation Index and Land Surface Water Index. This method allows estimates of cropping intensity (the amount of rice cropping in a year) within the individual 500-m pixels.

TABLE I. THEMATIC LAYERS

Layer or variable	Diagnostic factor	Unit
The 1st outbreak region	Distance to the 1st outbreak (C)	Km
Poultry density	Poultry density (D)	Number/km2
Poultry farm	Distance to the poultry farm (F)	Km
Land cover	Land cover type (L)	-
Distance to commercial poultry production	Distance to market, to slaughterhouse, to cockpit (P)	Km

Establishment of a model to predict areas at risk of bird flu using an integrated theme is concern by [1]. This methodology includes an analysis of the theme of the affected layer, overlay processing and assessment. The theme layers are the environmental factor that affecting AI, there are : density of poultry population, distance from the former outbreak communities, distance from the poultry farms, distance from the market or the slaughterhouse or the cockpit and land use type. Then, GIS will digitally performs it's database to eventually create five thematic layers from each of the theme layers which mentioned above.Overlay simultaneous operation at this layer with specified model (Risk Areas) produces a resultant polygonal layer, each of which is a unit of the class mapping risk areas. Each layer includes diagnostic factors and associated attributes which are assigned a risk rating factor. (Table 1). Factor rating assigned based on the outbreak area in relation to risk variables.

In [11], will discuss the potential of satellite remote sensing to measure the variables of the ecological factors that influence the migration of birds at a spatial resolution of 1 km or finer and temporal resolution daily to weekly. It is important to note that many of reviews Reviews those ecological variables (eg, temperature, snow) Also are important to agriculture, another important component for understanding epidemiology of Avian Influenza. The resultant geospatial data is is can be used to assess where the year-round availability of harvested crop fields may sustain free-range duck husbandry and wild waterbirds. Satellite imagery can be used to track the seasonal dynamics of wetlands where wild migratory waterbirds live.

In figure 2 illustrated the role of remote sensing for studying bird migration, agriculture, natural wetlands, and epidemiology of avian influenza virus (AIV).

In [12] the authors applied the combination of Serological Data on Avian Influenza infection with landscape classification in order to evaluate the effects of wetland rice cultivation and the spatial pattern of avian influenza prevalence in the highlands of Madagascar around Lake Alaotra. Seventeen of the landcover classes identified by the supervised classification of remote sensing imagery. Environmental pattern of AIV circulating highlighting more intense in areas where wetlands and rice are the dominant landscape in the highlands of Madagascar shares similarities with Southeast Asian agro-ecosystems, the which had previously been found associated with an increased risk of outbreaks of HPAI.

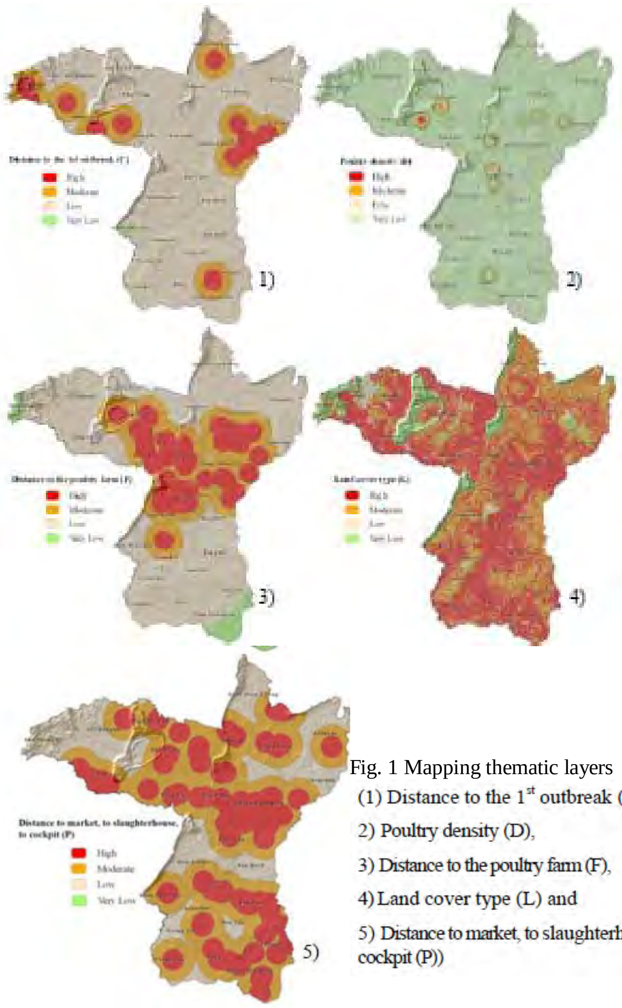

Fig. 1 Mapping thematic layers (1) Distance to the 1st outbreak (C), 2) Poultry density (D), 3) Distance to the poultry farm (F), 4) Land cover type (L) and 5) Distance to market, to slaughterhouse, to cockpit (P))

TABLE II. SPECTRAL INDICES USED FOR WATER DETECTION

Name	Calculation	Context	Reference
NIR	–	Water detection	Work and Gilmer (1976), White (1978), Rundquist et al. (1987)
NDVI (normalized difference vegetation index)	$NDVI = \frac{NIR-R}{NIR+R}$	The index NDVI was originally used to assess the biomass and vegetation primary production. Nevertheless, it can be of interest to detect water as NDVI shows positive values for vegetation, values close to zero for bare soil and negative values for water.	Rouse et al. (1973), Huete et al. (1997)
EVI (enhanced vegetation index)	$EVI = 2.5\frac{NIR-R}{NIR+6R-7.5B+1}$	EVI is derived from NDVI. EVI tends to limit the aerosols effects and minimize soil effects.	Huete et al. (2002)
NDWI (normalized difference water index)	$NDWI = \frac{G-NIR}{G+NIR}$	NDWI is derived from NDVI, adapted to the delimitation of water bodies with the use of reflectance in the green wavelength.	McFeeters (1996)
NDII (normalized difference infrared index); NDWI (normalized difference water index); NDMI (normalized difference moisture index); LSWI (land surface water index)	$NDII = NDWI = NDMI = LSWI = \frac{NIR-MIR}{NIR+MIR}$	Initially, Hardisky et al. (1983) showed a correlation between NDII and canopy water content. The NDWI (Gao, 1996) and the NDMI (Wilson and Sader, 2002) were used to detect leaves water content and to assess soil moisture. The LSWI (Xiao et al., 2005) is used to detect soil moisture from MODIS data.	Hardisky et al. (1983), Gao (1996), Wilson and Sader (2002), Xiao et al. (2005)
MNDWI (modified normalised difference water index); INH (normalized humidity index); NDPI (normalized difference pond index)	$MNDWI = -INH = -NDPI = \frac{G-MIR}{G+MIR}$	The MNDWI is derived from the NDWI defined by McFeeters (1996) by the use of middle infrared instead of near infrared (Xu, 2006). Water bodies are better delineated by a more efficient discrimination between open surface water and dry surfaces. The threshold of discrimination is located around 0. The INH was used by Clandillon et al. (1995) in order to detect humidity in wetland environment. The NDPI was used for detection of small ponds and streams semi-arid areas (Lacaux et al., 2007).	Xu (2006), Clandillon et al. (1995), Lacaux et al. (2007)

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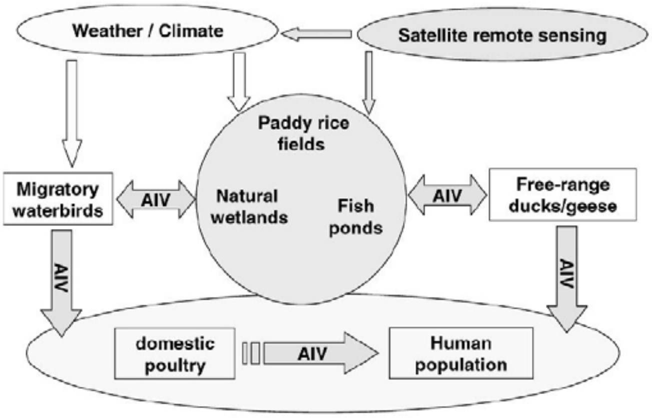

Fig. 2 Illustration of satellite remote sensing's role for studying AI environmental factor

A comparison of remotely sensed data product already have resesearch by [13], they illustrates a variety of points regarding the use of remote sensing data as data inputs to ecological niche models (or the related species distribution models, for that matter).

It this research, they assessed ecological niche model predictions of H5N1 avian flu presence quantitatively within and among four geographic regions, based on models incorporating two means of summarizing three vegetation indices derived from the MODIS satellite by evaluated models for predictive ability using partial ROC analysis and GLM ANOVA to compare performance among indices and regions.

The summary remote sensing and GIS usage for Avian Influenza research complement can be drawn as table III.

IV. CONCLUSION

In order to determine the control, buffer zone or area surveillance, risk assessment studies are needed to prevent the spread of this disease. The ability of GIS to integrate various spatial risk parameters can be a valuable tool for the assessment of the risks and help determine the sound control strategies.

In the future, the capacity of remote sensing to map the other relevant variables of AI (soil moisture, texture, vegetation cover, etc.) should be increased, given that the knowledge of the ecology of AI viruses in natural environments show the relationship between AI and risk factors such as soil characteristics, vegetation, etc., which can be monitored using remote sensing data. It will produce the maximum value in the detection, monitoring and preventive retrieval handling for this disease.

TABLE III. SUMMARY REMOTE SENSING AND GIS USAGE FOR AI RESEARCH COMPLEMENT

Satellite	GIS Software	Methods	Factor indicates	Area
Landsat TM	ArcView 3.2a	Kernel Density Function distance	a. the former outbreak communities (C), b. density of poultry population (D), c. distance from the poultry farms (F), d. land use type (L) and e. distance from the market or the slaughterhouse or the cockpit (P)	Khon Kaen, Northeast Thailand
Landsat Thematic Mapper (TM) and ETM+ or MODIS Terra		thermal infrared (TIR) images	Turbidity, Water surface temperature, salinity, pH,	Some areas
MODIS		multiple logistic regression framework	cropping intensity, cropping calendar (planting and harvesting dates), and irrigation practices at moderate spatial resolution (250–500 m) and in near-real-time fashion	Thailand & Vietnam
MODIS	ArcGIS (version 9.2),	ROC analysis and GLM ANOVA	different vegetation indices (NDVI, EVI, LSWI)	Middle East and northeastern Africa

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