

Non-Traditional Security and Role of GIS

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Summary

Non-traditional security is a popular but rather unclear concept among academic circles. The non-traditional security threats are always referred to in the context of human security to focus on the security of individuals, societies and groups, which includes criminality, environmental degradation – energy, natural disasters, infectious disease and illegal migration etc. The term Geographic Information Systems (GIS) refers to the computerized database management system for the capture, storage, retrieval, analysis, and display of spatial and non-spatial data. GIS is no longer restricted to the fields of computer science, geography, cartography or environmental science, but nowadays GIS tools and techniques are successfully used and implemented in several fields of life. This paper explores the role of Geographical Information Systems (GIS) as a tool to facilitate non-traditional security threats.

Key words:

GIS, Security, Non-Traditional Security, Threats, Challenges

1. Introduction

The term “non-traditional” securities have become the source of increasing concern by many intellectuals after 9/11. What are they and how do they differ from ‘old’ or ‘traditional’ security threats and challenges? How should they be addressed—using traditional approaches and instruments or using non-traditional approaches and technologies? At the one end, the “new” or “non-traditional” threats can simply mean a different set of enemies or otherwise, novel means of inflicting harm to the state and at the other end, there is a re-conceptualization of security that puts primary emphasis on protecting the wellbeing of people and the planet in general rather than the survival of the state. There is range of possible security concerns broaden significantly to include a host of economic, epidemiological, environmental, social and political problems. Whether they come from outside or inside of the boundaries of the state or whether they are the product of deliberate or unintentional acts; is irrelevant the damaging impact on the individual or the surrounding environment is what matters. It is no denying a fact that after September 11, 2001, security has dominated the international policy and agenda in foreign affairs. Today there are many problems, including problems in developed and developing countries. Developed countries’ problems are terrorism, nuclear control, star war, cyberspace, ozone layers, green house

effect, and many more. Developing countries and third world countries have problems such as basic needs, food to eat, clean water to drink, clothes to wear, house to live, and other important challenges e.g. corruption, economic problems, health concerned, illiteracy, population and the most importantly terrorism [1]. Academicians, intellectual, planners, researchers, scholars, statesmen, thinkers, are trying to solve these problems and handle these challenges in their respective fields. This paper explores the role of GIS technology to combat non-traditional security (NTS) threats and challenges. The paper is organized as follow: Section 2 focus on NTS threats and challenges; Section 3 highlights the role of GIS in this regards; Section 4 reviews the GIS applications to defeat these threats and challenges; Section 4 discusses concluding remarks and future direction.

2. Non-Traditional Security Threats & Challenges

The term security means freedom from risk or danger; safety; freedom from doubt, anxiety, or fear. Another meaning of the term security is measures adopted by a government to prevent spying, sabotage or attack, or measures adopted by a business or homeowners, to prevent a crime such as robbery or physical attack etc. Traditional (or conventional) threats refer to hostile actions by terrorist groups or governments of nation-states against governments and populations of other nation-states. The instruments used are typically armed forces, intelligence services or surrogate actors (e.g., political parties, guerrilla forces, etc.) to carry out subversion, and the targets are typically another nation’s armed forces, intelligence services, key government agencies, and public institutions. The term non-traditional security refers to new security issues that are different from traditional politics and military security. Some concepts that close or similar to “non-traditional security” are being used, such as comprehensive security, human security, new security, sustainable security, etc. Also note that non-traditional security is not the substitute for traditional security [1]. Recently the dialogue on security has been shifted from a State security to individual security to broaden the analysis beyond military dimension in order to reach non-military threats to the individual [2]. If we have to focus on the

non-traditional security threats, we can identify the following broader categories of threats: Climate Change, Energy and Environmental Security, Gender Security, Health Security, Human Security, Irregular & Illegal Migration, Political Transition, Poverty & Economic Insecurity, Pollution, Transactional Crime, Corruption and Terrorism [3]. As a researcher of computer science and its applications, it is identified that all the above mentioned non-traditional threats have one thing in common; that is; the "spatial" aspect of information. Climate change is related to spatial phenomenon; Energy is the spatial occurrence; Environment is the spatial truth; Gender issues are spatial-oriented topics; Health security is the spatially related security matter; Human security is a spatial concern; Illegal migration is a spatial reality; Political transition is a spatial realism; Poverty can be controlled by spatial measures; Pollution is spatial experience; Transactional crime is spatial related realism, Corruption is reduced by spatial monitoring; Terrorism is no doubt can be deal with spatial characteristic and Geographical Information System (GIS) is no doubt identified as an spatial tool to deal with these spatial challenges [1][4][5].

3. Role of Geographical Information System

The term Geographical Information System (GIS) is a complex technology, starting with the digital representation of landscapes captured by cameras, digitizers or scanners, in some cases transmitted by satellite, and then with the help of computer systems, stored, checked, manipulated, enhanced analyzed, and displayed as data referenced to the earth. GIS today consists of a well-established scientific and technological field with many applications, a special technology, its experts and its market. The power of GIS lies not only in the ability to visualize spatial relationship, but also beyond the space to a holistic view of the world with its many interconnected subsystems and complex relationships [6]. GIS allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts. GIS helps us answer questions and solve problems by looking at our data in a way that is quickly understood and easily shared. GIS technology can be integrated into any enterprise information system framework. GIS can integrate and relate any data with a spatial component, regardless of the source of the data. GIS not only handles the spatial data, it also handles non spatial data. GIS is fully capable of handling spatial and non spatial state of affairs and plays a robust role in many fields of life including all fields of non-traditional security concerned [1][7].

4. GIS Applications

There have been, some research done in the field to combat non-traditional security threats and challenges in the traditional way. The authors believe that there are non-traditional ways to handle these non-traditional security threats and challenges and that is by using Computer Tools, specially, Geographical Information System (GIS) tool to facilitate, cope with non-traditional security threats and challenges [1]. Environmental System Research Institute (ESRI) is playing a leading role to combat the NTS using several GIS tools. The following are few examples from several researchers.

Climate Change: The term "climate change" or "global warming" often refers to changes in modern climate [8]. It is a global problem and yet to be resolved in aspect. GIS plays robust role in combating security issues related to climate change [5][9]. The National Centre for Atmospheric Research (NCAR) is also playing a leading role in this regards [10]. Several applications from various researchers can be found at [11]. EUNIS – Web-based GIS biodiversity database to find species, habitats and sites across Europe, along with another Web-based tool "Natura 2000 map viewer" [12], "Ouranos" – Web-based GIS Tool to diffuse climate and water data for regional climate change studies [13], HHIT – the Historical Hurricane Impact Tool (HHIT) is GIS Tool for climate analysis [14] and SCCT – a GIS-based Snow-Cover Comparison Tool (SCCT) to compare simulated and remotely sensed snow-cover observation [15] are the best examples of GIS applications related to climate change.

Energy: Energy security stresses the need to take measures to reduce vulnerability to energy supply disruption (e.g. coal, oil, nuclear etc). It includes measures such as diversifying energy fuels, developing fuel and technologies which enhance environmental health and build regional confidence. GIS plays a vital role in struggling security issues related to energy [5][16]. SSGC – the Sui Southern Gas Company (SSGC) is using GIS-based tool to outlines how Pakistan is developing its full potential of natural gas resources with GIS [17], NHESS – the GIS-based National Household Energy Surveillance System (NHESS) to contribute to health promotion, household energy safety and security [1], WTE – the Waste-To-Energy (WTE) GIS planning tool used to reduce environmental impact and control the pollution [1] and GIS models to investigate spatial hydrogen infrastructure development in a low-carbon UK energy system [18] are the prominent examples of GIS applications related to energy.

Environment: It is yet to be recognized that the protection of the environment and the sustainable use of natural resources are crucial to the success and to the sustainability of our economies, quality of life and health for current and future generations. GIS plays important role in skirmishing security issues related to environment [5]. WTE – the Waste-To-Energy (WTE) GIS planning tool used to reduce environmental impact and control pollution [1], Vision Map Viewer – from Institute for Environmental Security – it is an internet-interface using openGIS consortium (OGC) technology for viewing remotely sensed and GIS data online [19], Web-GIS Tool for environment and security [20], FHWA – Federal Highway Administration (FHWA) has several GIS tool that is responsible for planning, developing, natural resource protection, safety, and security [21] and MapGIS for evaluation of mine geological environment [22] are the main examples of GIS applications related to environment.

Gender: Gender security perspectives have a great deal in common with human security. Gender security research is only now starting to saturate the mainstream security discussions. GIS plays an extremely crucial role in managing security issues related to gender [23][24]. CAP REDEO – GIS tool for rural electrification planning – a project supported by the European Commission [25], Web-based GIS Tool, [26], DGUC – Department of Geography University of Copenhagen (DGUC) a project on GIS and Cartography [27] and using GIS to explore gender disparity in accessing mental health services in urban communities [28] are few examples of GIS applications related to gender.

Health: The Global Health and Security Initiatives are working around the world to prevent, detect, and respond to biological threats. GIS plays particularly very strong role in handling health related security issues [29]. For several GIS applications refer to [30]. NHESS – the GIS-based National Household Energy Surveillance System (NHESS) to contribute to health promotion, household energy safety and security [17], TOXMAP – a GIS tool for exploring environmental health data [31], ENVI – the Environment for Visualizing Images (ENVI) provides a powerful, innovative, and user-friendly environment to display and analyze images of any size and data type on a wide range of computing platforms [32], CATS – Consequence Assessment Tool Set (CATS), MIDAS-AT, and several Biostatistics and Health GIS applications [33] are few prominent examples of GIS applications related to health.

Human: Human security is people centered. The concept of human security focuses on an individual in all of his/her human dimensions, beyond their political boundaries. GIS

plays a significant role in observing human security issues [1][24][34][35][36]. Vision Map Viewer – from Institute for Environmental Security – it is an internet-interface using openGIS consortium (OGC) technology for viewing remotely sensed and GIS data online [19] and PGIS – Participatory Mapping and Participatory GIS (PGIS) for DRR, Community Risk and Hazard Assessment [37] are few examples of GIS applications related to human security.

Migration: Migrants have increasingly become a feature of the global economy as globalization has opened up opportunities for an unprecedented movement of people. GIS plays a key role in fighting against migration related security issues [29][38][39]. Great Migration – a Web-based GIS tools [40], Macsimum Migration Kit – GIS software for Mac user [41], a distributed architecture of Grid GIS [42] and Migratool – a Web-based spatial database migration tool [43] are few important examples of GIS applications related to migration.

Political Transition: Political transition is a political issue varies from one geographic region to another. GIS plays a main role in monitoring political transition issues [44][45]. IMF WEO and World GIS Tool – using Common GIS software supplied to intute by ESDS International [46], ITPD project – it combines location-based information linked to city units called Traffic Analysis Zones (TAZ) with several responses to a survey of shoppers at four malls [47] and American urban Transition GIS project [48] are few examples of GIS applications related to political transition.

Poverty & Economic Insecurity: Poverty is the common denominator of economic insecurity. Economic insecurity means economical instability. GIS plays a major role in examining poverty and economic insecurity issues [49][50][51][52]. FGGD – part of Poverty Mapping Project for global analysis of food insecurity and poverty in relation to environment [53], GIEWS – the Global Information and Early Warning Systems (GIEWS) an internet GIS mapping tool for food security and early warning data management system [54] and Poverty Mapping – a tool to improve effectiveness of agricultural development activities [1] are few main examples of GIS applications related to poverty and economic insecurity.

Pollution: Pollution is the introduction of contaminants into an environment that causes instability, disorder, harm or discomfort to the physical systems or living organisms they are in. GIS plays main role in controlling all type of pollutions issues [1][55][56][57]. Several applications from various researchers can be found at [55]. NIPR – is the primary source for material produced by the World

Bank's Economics of Industrial Pollution Control Research Project [58], PLOAD – an ArcView GIS tools to calculate nonpoint sources of pollution in watershed and storm-water projects [59], MANAGE Method – pollution risk assessment methods [60] and LI GIS – Long Island Geographic Information System (LI GIS). The LI GIS is a powerful computer system that permits layers of information, such as cancer rates and environmental exposures, to be viewed and studied simultaneously [61] are few major examples of GIS applications related to pollution.

Transactional Crime: Transactional crime is against the law and humanities. It is not the issue of a particular geographic region rather it is a global issue. GIS also plays an important role in combating transactional crime [4][62][63][64]. CAPERS – Crime Analysis Program and Event Reporting (CAPERS) is a tool with a spatial component to many aspects of crime analysis [65], CrimeMAPS – Crime Mapping and Analysis for Public Safety (CrimeMAPS) a software being piloted by the San Francisco Police Department will let officers graphically track and analyze crime trends [66] and COMSAT – one of the most invaluable tools available for effective crime fighting, CAT – Crime Analysis Tools (CAT) an ArcGIS extension designed to enable law enforcement professional to analyze crime and call for service [67] are few outstanding examples of GIS applications related to transactional crime.

Corruption: Corruption is seriously affecting democratic political institutions and the public and private sectors, and weakening the economic growth of countries. GIS can play significant role not to control the corruption exactly, but rather reduce the corruption as it need political will to control it completely. To fight against corruption we not only need political solutions, but also in need to apply latest technological tools and techniques. Transparency International is in process to use geospatial technology, by using GIS to reveal opportunities and evaluate patterns in corruption [68]. Project "Mapping the Media in the Americas" is an innovative application of GIS and hoping to decrease the corruption [69]. The eGIS anti-corruption information systems proposed in [70] and the Use of GIS to monitor corruption in Water Sector [71] are few example researchers are focusing and helping Government and Organizations to reduce or find pattern in all types of corruption.

Terrorism: Terrorism has changed the world and became a serious challenge for many governments during recent years. GIS no doubt plays an essential role to over come terrorism. To combat terrorism we not only need political solutions, but also in need to apply latest technological

tools and techniques. A real-time 3D GIS for quick emergency response in micro-spatial environments [72] and other researchers work for example, a good paper [73] on geography, GIS and Terrorism, detailed review [74] understanding terrorism through the use of GIS, and detection and prevention of terrorism activities using GIS and Remote Sensing [75] are the prominent example of research on role of GIS in terrorism.

5. Conclusion & Future Work

Important feature of GIS is the ability to fulfill the needs of both, analysts and decision makers, by presenting information in formats that could be easily visualized at different levels of complexity and consequently be interpreted from different perspectives. On one hand, the user friendliness of GIS is a feature that made it a popular platform that planners and decision-makers rely on. On the other hand, the ability of GIS to answer technical questions made it an excellent tool for analysts who need to answer scientific questions, identify existing patterns and predict trends. This paper presents a review of several GIS applications designed to handle non-traditional security threats and challenges, including corruption and terrorism. However, there are still many areas where researchers need to focus on, and where GIS can be utilized more efficiently and effectively. A GIS-based database is the main solution for fighting against these threats. The author is of the view that the use of GIS applications is crucial to combat non-traditional security threats and challenges.

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