

Using GIS to Overcome Non-Traditional Security (NTS) Threats and Challenges

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Abstract

Non-traditional security, often abbreviated as NTS, is a popular but rather ambiguous concept within and outside academic circles. The NTS threats and challenges 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. These threats and challenges are not within the scope of more traditional military concerns; these can be facilitated by non-traditional security measures; such as applying technological tools to overcome them. This paper explores the role of Geographical Information Systems (GIS) as a tool to facilitate non-traditional security threats and challenges.

Keywords: GIS, NTS, NTS Threats, NTS Challenges

1. Introduction

The term “new” or “non-traditional” security threats and challenges have become the source of increasing concern around the world after the end of cold war. Many intellectuals even believe that these concerns became dominant 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? [1]

At one end, there are typical beliefs about the primary objective of security, namely that it is to ensure the survival of the nation state from external attack and subjugation or internal subversion and overthrow. In both cases, the threat and use of countervailing force to deter and defend against the enemies of the state are the primary means by which security is sought and maintained. Thus, the “new” or “non-traditional” threats can simply mean a different set of enemies or otherwise, novel means of inflicting harm to the state. At the other end of the spectrum, 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. By doing so, the range of possible security concerns broadens significantly to include a host of economic, epidemiological, environmental, social and political problems. Whether they come from outside or inside

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. According to Paul Stares what makes these problems “new” or “non-traditional” threats, therefore, is not that they are truly novel phenomena or products but rather, that they are now treated as security concerns [1].

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 concerns, illiteracy, population and the most importantly terrorism. Planners, researchers, intellectuals, statesmen are trying to solve these problems and overcome 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 follows: 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 overcome these threats and challenges; Section 4 discusses concluding remarks and future direction.

2. Non-Traditional Security 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. 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 [2].

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. Scholars also pointed out that there is a qualitative difference between traditional security and non-traditional security, and the difference can be regarded as a re-invention and transformation of ideas [3]. Nontraditional threats can originate from a variety of non-state and natural causes, and they can affect both government institutions and civilian populations. Some threats are quite obvious, as when skyjacked commercial airliners are flown into buildings. But many others are in the eye of the beholder; that is, they are socially and politically defined as potential threats [2]. 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 [4].

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, etc. [5].

As a researcher of computer science and its applications, we identified one common point in all the above mentioned non-traditional threats 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; and Transactional crime is spatial related realism and Geographical Information System (GIS) is no doubt identified as an spatial tool to deal with these spatial challenges [6] [7].

3. Role of GIS

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 [8].

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 [9].

GIS not only handles the spatial data, it also handles non spatial data. Non-spatial can be stored besides the spatial data represented by the coordinates of vector geometry or the position of a raster cell. In vector data, the additional data are attributes of the object. In raster data the cell value can store attribute information, but it can also be used as an identifier that can relate to records in another table. There are also decision support software (DSS) systems being developed to support spatial and non-spatial decision-making. In these software systems the solutions to spatial problems are integrated with solutions to non-spatial problems. 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.

4. Review of GIS Applications

There have been, some research done in the field to overcome 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. Environmental System Research Institute (ESRI) is playing a leading role to combat the NTS using several GIS tools. The following are few examples in this regards:

Climate Change: The term "climate change" often refers to changes in modern climate (note that the term global warming is being used instead of climate change). It is a global problem and yet to be resolved in aspect. GIS plays robust role in combating security issues related to climate change [7]. 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 [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 [7]. 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 [16], NHESS – the GIS-based National Household Energy Surveillance System (NHESS) to contribute to health promotion, household energy safety and security [17] and WTE – the Waste-To-Energy (WTE) GIS planning tool used to reduce environmental impact and control the pollution [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 prosperity 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 [7]. WTE – the Waste-To-Energy (WTE) GIS planning tool used to reduce environmental impact and control pollution [18], 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] and FHWA – Federal Highway Administration (FHWA) is a GIS tool that is responsible for planning, developing, natural resource protection, safety, and security [21] 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 [22] [23]. CAP REDEO – GIS tool

for rural electrification planning – a project supported by the European Commission[24], Web-based GIS Tool, [25] and DGUC – Department of Geography University of Copenhagen (DGUC) a project on GIS and Cartography [26] 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. For several GIS applications refer to [27]. 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 [28], 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 [29], CATS – Consequence Assessment Tool Set (CATS), MIDAS-AT, and several Biostatistics and Health GIS applications [30] 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 [23][31] [32][33]. 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 [34] 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 [35][36]. Great Migration – a Web-based GIS tools [37], Macsimum Migration Kit – GIS software for Mac user [38] and Migratool – a Web-based spatial database migration tool [39] 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 [40][41]. IMF WEO and World GIS Tool – using Common GIS software supplied to

intute by ESDS International [42] and 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 [43] 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 [44][45]. FGGD – part of Poverty Mapping Project for global analysis of food insecurity and poverty in relation to environment [46], GIEWS – the Global Information and Early Warning Systems (GIEWS) an internet GIS mapping tool for food security and early warning data management system [47] and Poverty Mapping – a tool to improve effectiveness of agricultural development activities [48] 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 [49][50][51]. Several applications from various researchers can be found at [50]. NIPR – is the primary source for material produced by the World Bank’s Economics of Industrial Pollution Control Research Project [52], PLOAD – an ArcView GIS tools to calculate nonpoint sources of pollution in watershed and storm-water projects [53], MANAGE Method – pollution risk assessment methods [54] 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 [55] 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 [6][56][57]. CAPERS – Crime Analysis Program and Event Reporting (CAPERS) is a tool with a spatial component to many aspects of crime analysis [58], 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 [59] 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 [60] are few outstanding examples of GIS applications related to transactional crime.

5. Conclusion & Future Work

Important feature of GIS is its 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. However, there are still many areas where researchers need to focus on, and where GIS can be utilized more efficiently and effectively - among these areas are corruption and terrorism. Corruption is seriously affecting democratic political institutions and the public and private sectors, and weakening the economic growth of countries. Terrorism, on the other hand, has changed the world and became a serious challenge for many governments. To combat corruption and terrorism we not only need political solutions, but also in need to apply latest technological tools and techniques. A GIS-based database is the main solution for fighting against these threats. The authors are of the view that the use of GIS applications is crucial to combat non-traditional security threats and challenges. We believe that the trend in both the underdeveloped and developed countries of the world will be to develop more sophisticated applications that incorporate GIS technology for the purpose of overcoming these threats and challenges.

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