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# Environmental Planning In Urban Areas through GIS Spatial and Temporal Planning

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## ABSTRACT

The use of GIS in environmental planning is increasingly being sought to address problems of spatial and temporal modeling. It has been proved for such task more useful highly and appreciated. Apart from that GIS aids in providing information regarding the nature of contamination and environmental suitability of a land and its level. It can also be used to ascertain the probability of an area for treatment and waste disposal. Factors such as physical, biological, topographical and chemical properties of the area should be examined and taken into attention. Well-known issues like that of wetlands can be easily addressed with the help of GIS and remote sensing technologies. GIS has been used to monitor changed geographical features for change of environment. Technologists exploit the monitoring properties of GIS to trace changes of pattern or manners of a land over a specified time. It helps professionals make cognizant decisions about the improvement condition of an area and work out a plan. The first generation had to rely on the thinking and opinion of sociologists, working towards urban planning designers and economists to achieve their objectives .With the advent of GIS, the scenario changed with professionals reaping the utmost benefits of urban design and planning. Today GIS is investigating tool but a valuable asset in spatial modeling, catching and decision making and a lot of other disciplines.

***Keywords: -*** Urban Planning, Remote Sensing, GIS, Spatial Planning, Temporal Planning.

## I. INTRODUCTION

Urban planners play a critical role in ensuring that urban areas are able to function sustainably. Since resources are finite and addressing environmental issues insufficiently has severe consequences: loss of biodiversity, health hazards, and a lower quality of life, ultimately. The poorest cities and the weakest strata of the urban population are likely to suffer the most from those impacts. A few cities are able to maximize benefits to their residents while reducing the impact on the environment. The majority, however, plan, develop infrastructure and support the rapidly growing population, faces a growing challenge to effectively govern and urbanization of their communities. The typically of urban and regional planners may be categories as follows:

I. Interacting with various concerned persons like public officials, developers, and the public regarding urbanization and land use.
II. Gather and analyze different available data to economic and environmental aspect, censuses, and market research data.
III. Field work investigations to analyze factors affecting land use.
IV. Analyzing site plans submitted by developers and studying there feasibility and submitted a critical reports to concerned.
V. Implementation of legal issues related to various developments in urban areas.

The above five task generated data of various fields. These data will available for GIS tools for simulation and planning. (See Fig.1) GIS used for the storage of land use socio economic data, environmental data, maps and plans. Planners can extract useful information from database through spatial query. This data may be visualized through maps using GIS tools. These tools provided spatial statistical study, site selection and identification of planning active area etc.

A very serious problem of urban planner facing is modeling urban land use change has been the lack of spatially detailed data and information. GIS and remote sensing have the potential to provision such models, by providing data and analytical tools for the study of urban planning and environments. The urban planning may have spatial relationships between various, land-use, geospatial and demographic variables characterizing fine zones across and around regions. Land use change is a complex process that encounters sophisticated parameters. In India Government is planning to build up land use maps on a regular timetable and store and manage this information in a GIS. GIS are becoming widespread in management and their focus and form is beginning to affect the organization and planning and operation of policy-making. Address the problems and potential of such systems, mainly in relation to the logical, prescriptive and predictive basis on which such planning processes are founded. [1]

GIS are the formalized computer-based information systems provide the information necessary for effective decision making in urban planning and capable of integrating data from various sources. The other information systems for urban planning include decision support system (DSS), expert systems and database management systems (DBMS).GIS serve both as database and as a toolbox for urban planning (Figure 1). Current GIS support efficient data repossession, query and mapping. Planners can also extract data from their databases and input them to other modeling and spatial inspection programs. When combined with data from other tabular databases or specially conducted surveys, geospatial information can be used for effective planning decision. As a toolbox, GIS allows planners to perform spatial analysis using geoprocessing functions such as map overlay, and and buffering connectivity measurement of all the geoprocessing functions, map overlay is probably the more useful tool. This is because planners have a long tradition of using map overlay in land suitability analysis which itself is an important component in urban planning.

Database management, spatial analysis and spatial modeling, visualization are the main uses of GIS in urban planning. GIS are used for the stowage of land use maps and plans, environmental data and planning applications, socio-economic data. Planners can extract useful information from the database through spatial query. Mapping provides the most power full visualization tools in GIS. It can be used to explore the scattering of socio-economic and environmental data, display the results of spatial analysis and modeling exercises. Spatial analysis and modeling are used for spatial statistical analysis and land use transport modeling and impact assessment site selection, and identification of planning action area, land suitability analysis. Connectivity measurement, map overlay, buffering and Interpolation are the most frequently used GIS functions in spatial analysis and modeling. Use of the above functions varies according to different stages of urban planning and tasks.

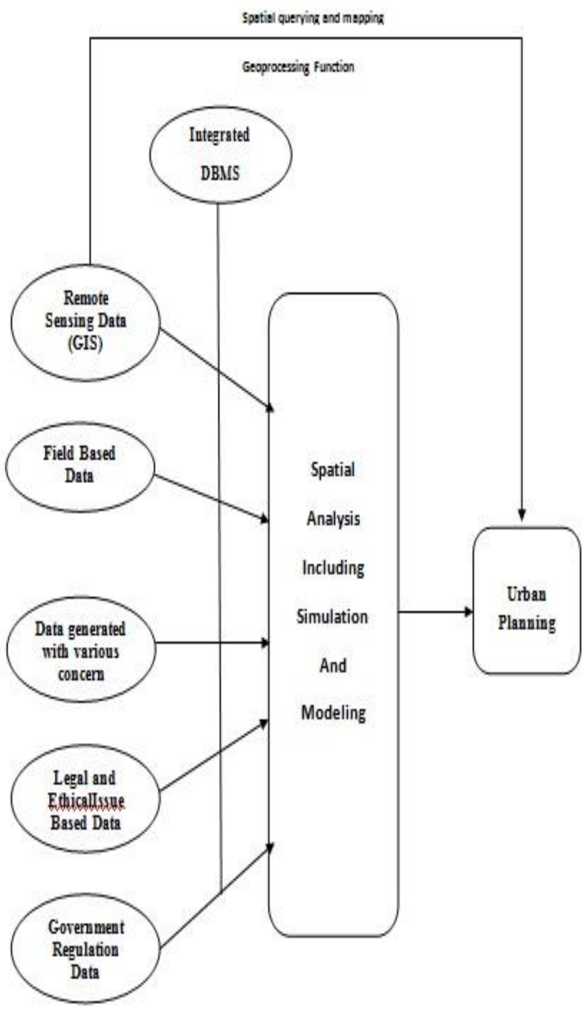


fig 1: urban planning and spatial GIs

## II. RELATED WORK

Injury related to violent acts is a problem in all society. Although some authors have examined the geography of violent crime, few people have focused on the spatio-temporal patterns of violent injury and none have used an ambulance dataset to explore the spatial characteristics of injury. The purpose of this study is to describe the combined spatial and temporal characteristics of violent injury in a large urban center. [5, 12]

Climate change has influenced on various environmental and public area. Particularly, it has significant impact on water resource, such as water management, drought and flood. In this study, we assessed the Susceptibility of water management, flood, and drought to climate change using GIS-based spatio-temporal information. Susceptibility is assessed in terms of sensitivity, exposure and adaptation. [6, 10, 12]

A hybrid agent-based modeling framework is introduced that aims to balance the demands of behavioral realism and computational capacity, integrating a descriptive representation of driver behavior with a simplified, collective model of traffic flow. The hybridization of these approaches within an agent-based modeling framework yields a representation of urban traffic flow that is driven by individual behavior, yet, in reducing the computational intensity of simulated physical interface, enables the scalable expansion to large numbers of proxies. Result addressing model might be extended, and exploring the rolehybrid agent-based modeling approaches may hold in the simulation of other complex urban phenomena by using DEPTHMAP. [13]

UrbanSim is a new model system that has been developed to respond link planning of land use in area, transportation, and environmental quality; and from citizen concerns about managing the side effects of growth such as sprawl, congestion, house area affordability, and loss of open space. These has describes the model system and its application to Eugene-Springfield, Oregon. The urbanism is new urban planning software. The urbanism is simulation based model system which is used for Transportation, land use, environmental planning in urban area. This tool is open source so user can be as his requirement. [17, 18]

Many countries have experienced accelerated urbanization day to day. Its urbanization level (ratio of people living in the cities to the total population) increased 27.76 percent in the population rival to population as per 2001. In the previous census of India 2001, Aurangabad District recorded increase of 30.83 percent to its population rival to 1991. In this process, cities underwent fast growth due to the prosperous economy and population grows up. [18]

In remote sensing imagery, GIS-based neuron-fuzzy approach and variety of social and environmental factors for simulating land use change. Metropolitan Area with twenty year time interval and user-selected socio-economic and environmental variables have been employed in order to simulate land use change. Supervised classification was used to classify the images to different land use categories. Four classes were identified: road, residential area, service center, administrative area. This work introduces a simulation experiment on urban land use change in which a supervised back propagation neural network has been employed in the parameterization of the simulation model, while GIS is used to model and monitor land use change and perform spatial analysis on the results. In the case of the Tehran Metropolitan Area, 800 km 2 of non-urban lands were converted to urban areas over the 20-year interval between 1980 and 2000. Having urban land use change between 1980 and 2000 and assuming the existence of the same rate of urban change, urban land use of Tehran has been predicted for 2020.

Investigate land use change at the county level in Beijing-Tianjin-Hebei Metropolitan Region. By assessing the urban-rural linkages three land use patterns are identified: urban, peri-urban and periphery areas. Empirical analysis shows that land use change in the urban areas is faster than that in the peri-urban and periphery areas. Economic conditions are significant to the land use change in the urban areas while the accessibility is the major driving force to the land use change in the peri-urban areas. However, weak factor influence is found in the periphery areas. Finally emphasizes the role of peri-urban areas as the interface between urban and periphery areas for coordinating land use this region in the future.

STARS are used to analyses land-use changes in metropolitan Detroit between 1990 and 2000. The Detroit case study indicates that the CTSPA statistics are effective in describing urban spatial pattern changes and in characterizing the evolution of discrete urban landscapes over selected periods.

## III. EVALUATION THROUGH GIS SPATIAL AND TEMPORAL PLANNING

Urban growth remains a major topic concerning GIS and remote sensing applications. Remote sensing and GIS have proved to be effective means for processing varied resolutions of spatial information for monitoring urban growth and extracting. GIS has gradually shifted its emphasis from system-oriented to science-oriented (e.g. International Journal of Geographical Information Science). Apart from key techniques, GIS needs to more fundamental scientific concepts in order to better understand geographical phenomena such as process, pattern, heterogeneity, scale and incorporate broader etc. Urban growth is the projection of political, social and economic activities onto a land system at the level of the urban area. The spatial and temporal dimensions are major concerns of GIS and remote sensing. Modeling spatial and temporal urban growth enriches the spatial science of GIS. Methodological research into urban growth can contribute to improving current GIS, in particular its spatial analysis and modeling functions such as spatial econometrics and exploratory spatial data analysis.

### 1. *Spatial GIS model*

Spatial planning is concerned with 'the problem of coordination or integration of the spatial dimension of sectorial policies through a territorially-based strategy', More complex than simple land-use regulation and contradictions among sectorial policies, it addresses the tensions for example for conflicts between environmental social cohesion policies and economic development. The key role of spatial planning is to promote to reconcile competing policy goals and more rational arrangement of activities. The scope of spatial planning differs greatly from one country to another, but most share a number of resemblances. In nearly all countries, spatial planning is concerned with identifying long- or medium-term objectives and strategies for zones, dealing with land use and physical development as a distinct sector of government activity, and organizing sectorial policies such as agriculture, transport and environment.

Various types of definitions of spatial planning stability exist. For example, the Compendium of European Spatial Planning defines spatial planning as methods used largely by the public sector to influence the future distribution of activities in space. The Compendium states that spatial planning is undertaken with the aims of creating a more rational territorial organization of land uses and the linkages between them, to stability weights for development with the need to protect the environment, to reach social and economic development objectives. It embraces measures to coordinate the spatial impacts of other sectorial policies to achieve a more even distribution of economic development between regions than would otherwise be created by market services, and to regulate the condyle of land and property uses.

Spatial planning is critical for delivering economic, social and predictable conditions for investment, environmental benefits by creating more stable and development, by securing community advantages from development and by promoting prudent use of land and natural resources for development. Spatial planning is thus an important pedal for promoting sustainable development and improving quality of life. This is befitting increasingly recognized in international policy documents. The growing commitment to the increasing interest in spatial planning systems, sustainable development in many countries and policies means that there is currently considerable opportunity to reshape. Some countries have already made progress in introducing new spatial planning systems but there is still considerable scope for further improvement. [2]

**Benefits of Spatial Planning**

***a. Economic benefits***

This can be categorized as follows:

- Providing more stability and sureness for investment;
- Identifying land in suitable locations to meet the need for economic development;
- Ensuring that land for progress is well placed in relation to the transport network and the labor force;
- Promoting environmental quality in both urban and rural areas, which can then create more favorable conditions for investment and development;
- Identifying development that chances the needs of local communities;
- Promoting regeneration and renewal;
- Making decisions in a more efficient and consistent way.

***b. Social benefits***

We may consider the following benefits

- Considering the requirements of the local communities in policy development;
- Improving user-friendliness when considering the location of new development;
- Supporting the provision of local services where they are lacking;
- Promoting the re-use of vacant and neglected land, particularly where it has a negative impact on quality of life and economic development imaginable;
- Facilitating the creation and maintenance of pleasant, healthy and safe environments.

***c. Environmental benefits***

These benefits are as follows

- Promoting regeneration and the suitable use of land, buildings and infrastructure;
- Promoting the use of previously developed (“Brownfield”) land and minimizing development on “Greenfield” land;
- Preserving important environmental, historic and cultural assets;
- Addressing imaginable environmental risks (e.g. flooding, air quality);
- Protecting and attractive areas for recreation and natural heritage;
- Promoting access to developments by all modes of transport (e.g. walking, cycling and unrestricted transport), not just by car;

### 2. *Temporal GIS model*

A temporal GIS must be able to record temporal changes in both attributes and their spatial objects. Two time dimensions are important in constructing a temporal database: the database time and the world time or the valid time. The database time is the time when a database transaction is terminated. Database time is important not only for maintaining database history but also for maintaining a history of the usage of the data for analyses and, successively, decision making. Other time proportions are also possible depending on particular applications. These time proportions are used in a temporal GIS database to time-stamp every datum to give it temporality. The valid time is the time period for which a spatial phenomenon is considered to be of the foremost concern to the GIS users, because it is the time-based information that supports spatio-temporal analysis. Many data models have been proposed for recording changes in spatial objects. The snapshot model stores spatio-temporal evidence by a series of map layers depicting the same phenomenon over the each time slice, one for entire space.

The update model stores only one full type of a data set and with new information added as updates (stored separately) whenever changes. The space-time composite model is similar to the update model but stores both past and maintains the topology constantly and present data in the same layer. This model allows historical information to be preserved by identifying spatial units that have unique attributes and existence in terms of the time, but runs into the problem of spatial objects being decomposed progressively into smaller objects and their identifiers having to be changed retroactively. The integrated model combines some of the aforementioned models to take their individual advantages and overcome some of their disadvantages. The three-domain model incorporates three domains (temporal, semantic and spatial) and is designed to represent Energetic features that change characteristics and locations continually. These data models have their particular attractiveness, shortcomings and the theories have been better developed for some than for others. For example, the snapshot model is what current GIS technology supports. Bring updated model may be implemented as an extension to the current GIS. The 3D/4D model is requires a GIS to be developed from scratch and much more complex. [3]

To record temporal changes in the attributes, more schemes have been developed and Every time there is a change in the database, a new type of the information will be made for that, which is referred to as type in temporal database literature. Apparently, generating a new type for the entire database for every change is impractical. For relational databases, information is organized and stored in a set of related tables with each pillars in a table containing values of a given attribute for different instances of an object or feature and each row a complete description or record of an object. Accordingly, new types may be created for tables, attributes records or pillarsu. In other words, type at the table, record, or attribute stages requires associating one set of time stamps with the entire table, with each row or pillars in a table, or each attribute in a table, respectively. Type at the relation level often results in a high degree of repetition, particularly when only a few records are changed. The database operations such as queries will be, however, the humblest, since an entire database table may be retrieved based on a given time slice. Type at the record or pillars level will reduce the degree of repetition, although data repetition is still not completely circumvented. This is because if only one piece of information in a record is changed, the complete record, which may contain a few dozens of attributes, will be repeated and the rest of the record will be copied. The query now requires a little more processing. Finally, type at attribute level results in the most compact database but the associated operations are also the most complex. Speciously, the fundamental problem is the space and time trade-off. A database, therefore, must be cautiously designed to achieve the balance between processing and luggage compartment. [4, 5]

**Benefits of Temporal GIS**

### a. *Epidemiology*

Temporal GIS can be used to assess the management and prevention of infectious diseases and other epidemiological singularities. The study of epidemiology led to one of the early uses of cartographic data to analyze disease outbreak and dissemination. In 1854, John Snow studied an outbreak of cholera in London and plotted the locations of individual cases on a map of the city. By examining spatial attentions of data, he was able to trace the source of the disease to a contaminated water pump.

A more recent study found that spatio-temporal patterns of violent injury in an urban setting were revealed by GIS analysis of ambulance data. During the day, locations of hurt and locations of dwellings are similar. However, later at night, the injury location of highest density shifted to a "nightlife" district, whereas the dwellings locations of those most at risk of injury did not change. Spatio-temporal modeling in a GIS has also been used to study the outbreak of "Sudden Oak Death" in California, and communicable plant disease thought to be caused by a non-native, invasive pathogen, Phytophthoraramorum.

GIS, remote sensing and global positioning systems (GPS) have enabled the development of spatio-temporal models that can characterize the distribution patterns of infectious disease epidemics, recognize the mechanisms of diffusion and evaluate the effectiveness of disease containment and mechanism techniques. Moreover, these same tools have been used to study the occurrence of non-infectious diseases such as cancer and sudden infant death syndrome (SIDS), and they can also be used to study the implications of biological terror attacks to help public health agencies and emergency response organizations develop and employ effective countermeasures.[6]

***b. Disaster management***

The Temporal GIS tool has important role for disaster planning, mitigation and monitoring. Last few year, Geospatial technology and remote sensing has helpful for disaster mapping and flood risk assessment. GIS spatio-temporal data technique is useful for the prediction to analyze and estimate to probable damage after flooding, fires, cyclone, earthquake, structural damage and disease outbreak. The most part time natural disaster cannot be predicted, but often the associated effect of those disasters can be assessed in term of spatial and temporal. The following are the some disaster estimated changes and impact of disaster for Indian city due to various reasons.[7]

1. In the 16th and 17th June 2013, Kedarnath floods and landslides situated in Uttarakhand state at India. The kedarnath is important place due to kedarnath temple located latitude of 30.13 and longitude of 79.06 [8, 9]. To investigation impact of damage assessment useful for temporal and spatial mapping of flood affected area likes as road, settlement, agriculture forestry, etc. Effect of cmistover the past event LISS IV used for extraction of foot print has 20% mist area. The author has result listed as follows:

| **Sr. No.** | **Affected area** | **Impaction** | | **LISS IV/LISS III** |
|---|---|---|---|---|
| | | Min | Max | |
| 1 | Roads | 228.44 Km | 404 Km | LISS IV |
| 2 | Village | 203 | 259 | LISS IV |
| 3 | Bridges | 311 Km | 543 Km | LISS IV |
| 4 | Agriculture | 4696.08 $Km^2$ | 8043.61 $Km^2$ | LISS III |
| 5 | Forestry | 7959K $m^2$ | 21989$Km^2$ | LISS III |

table 1. result of affected area in kedarnath floods

2. The Jammu and Kashmir state experienced catastrophic rainfall from 1st to 6th of September 2014. On September 4th, 2014 J&K experienced 30hour long rainfall that has broken the record of many decades; the major parts of the state recorded an average of more than some aspects of catastrophic up to 650mm of rainfall in 3 days in J&K. The conventional methods of investigation and surveys are time taking and luxurious. So, Remote sensing and GIS techniques were used which is time and cost effective. The launching of advanced satellites like CARTOSAT-2, RISAT-1, RESOURCESAT-2, etc., with erudite programmers has revolutionized the mapping. The multi temporal information from satellites have proved to be very valuable in the identification of the sites ideal for taking up structural events to control floods. Though the timely availability of flood area maps become a crucial factor both for taking appropriate remedial measures to mitigate the sufferings of the affected people and for making reliable estimates of damages.[8,9,10]

3. At end very severe cyclonic storm (VSCS) named PHAILIN, crossed Gopalpur coast on 12th October 2013 causing catastrophe after 14 years. The current VSCS (HUDHUD) though crossed north Andhra coast but influenced severely the south Odisha coast on 12th October 2014. To identify the imaginable mosquito larval habitats by using satellite images of IRS-LISS-IV digital data which will reveal the information on false color composition. Analyses of this image through their pixel values captured at different substances are evaluated by ground trothing. The pixel values shows 79% of mosquito larval sites are positive. The pixel values at the maximum points are found to be same as that of image. Majority of the pixel values at the point 95 indicates that the mosquito larvae are existed along the study area. The characters found after image analyses and Ground truthing are statistically correlated and high significant. The last very severe cyclonic storm (VSCS) named PHAILIN, crossed Gopalpur coast on 12th October 2013 causing catastrophe after 14 years. The recent VSCS (HUDHUD) though crossed north Andhra coast but influenced severely the south Odisha coast on 12th October 2014. To identify the imaginable mosquito larval habitats by using satellite images of IRS-LISS-IV digital data which will reveal the information on false color composition. Analyses of this image through their pixel values captured at different substances are evaluated by ground trothing. The pixel values shows 79% of mosquito larval sites are positive. The pixel values at the maximum points are found to be same as that of image. mass of the pixel values at the point 95 indicates that the mosquito larvae are existed along the study area. The characters bring into being

after image analyses and Ground trothing are statistically correlated and high significant.[11]

### *c. Environmental science*

Environmental science is one of the most important scientific disciplines that can derive benefit from temporal GIS. Extensive applications of this technology may include hazard assessment of localized characterization of the regional resource use, or the evaluation of the global performs of climate change, chemical spills; spatio-temporal analysis has the imaginable to advance the understanding of environmental trends and the impact of change [6, 12]. Temporal GIS has been used to study:

- Water resource monitoring
- The things of drought and precipitation

*a. Spatio-temporal representation of urban environments for the past, present, and future*

The need to study town Energetics has been recognized in the field of urban analysis and planning for some time, but the methods developed so remote have trusted heavily on a static and 2D representation of one point in break. Spatial patterns in cities today are amalgams of the past and the current. While accurate parts of cities follow their natural route of development, changes in other parts may be planned and designed. In circumstance, it is our ability to transmit out effective urban planning that will significantly affect urban form and land uses. To make a knowledgeable planning choice, together the planners and the local stakeholders need to understand the spatial as well as the temporal dimensions of the urban space and land-use changes. We are crucial a tool to visualize and understand the past and the present states of the urban form as well as its possible form in the imminent. With the advantage of the time dimension and the perpendicular dimension, a spatio-temporal 3D GIS model can make an effort a solution to this; because it has the capacity to help us better understand the growth and changes in an urban setting by providing a chronological account of how a city was formed and how it has been developed. It would also settle to us to study how cities and buildings evolve over time by studying the changes in socio-economic conditions and the amount of time required for such changes.

Many observers of cities generalize by focusing on a method of sensing. As large-scale spatial data become increasingly available, producing a reliable visual representation of the changes in an urban environment becomes more and more effective, thus presenting the past, present, and future of a city; i.e., as long as persons an intuitive understanding of how, when, and where in the metropolitan deviations have acquired place. In this admiration, 3D spatio-temporal GIS models can offer an effective technique of observing that expands our perception of urban space and helps to trace the evolution of the building process and physical urban form in an intuitive and indiscriminate form [13]. By watching at the documented urban forms of the past and their changes over cities, period, and communities are growth informed in planning and preparing for a better future. Our education purposes to provide a method that can offer this function through an iconic representation that is combined with the analytical dimensions of GIS. [14]

## IV. IMPORTANT APPLICATION AND TOOLS OF GIS USED IN URBAN PLANNING

The below table gives the important tools used for environment planning in urban area;

| Sr. No. | Product Name | Type | Description | Suppliers |
|---|---|---|---|---|
| 1 | DEPTHMAP | Telecommunications/ Visibility | Visibility analysis of architectural and urban systems. In addition, the most recent type of Complexity map includes the original visibility analysis, generation and analysis of x-y axis maps as well as segment analysis, and lastly agent-based analysis. A related product, CONFEEGO, is also available and runs within the MAPINFO GIS | Space Syntax Laboratory, Bartlett School of Architecture, UCL, London, UK (http://www.spacesyntax.org/software/depthmap.asp ) |
| 2 | Crimestat III | Crime analysis | Crime Stat is a spatial statistics program for the analysis of crime incident locations. Crime event analysis, vector (N Levine). Tools include spatial | National Institute of Justice, USA (http://www.icpsr.umich.edu |

| | | | | |
|---|---|---|---|---|
| | | | supply analysis (basic statistical measures and many distance statistics (e.g. nearest neighbor tools, Ripley Ketc); kernel density analysis; hot spot analysis; plus a range of new modeling tools (trip distribution based). | /CRIMESTAT/) |
| 3 | GeoData | Exploratory data analysis | Exploratory spatial data analysis, vector (L Anselin). Geodata is the latest incarnation of a collection of software tools designed to implement techniques for exploratory spatial data analysis (ESDA) on structure data.1 It is intended to provide a user friendly andv graphical interface to methods of descriptive spatial data analysis, such as global and local (LISA) autocorrelation statistics and indicators of spatial outliers, in addition to some more advanced regression analysis facilities. | Spatial Analysis Laboratory, Univ of Conneticut, USA (http://geodacenter.asu.edu/software) |
| s4 | Hawth's Tools | GIS tools | ArcGIS extension for spatial analysis, particularly ecological applications. Includes tools for animal crusade analyses and spatial sampling, amongst others. To be updated/replaced by the Spatial Modeling Environment | Hawthorne Beyer Spatial Information Systems Consultant (http://www.spatialecology.com/) |
| 6 | Map Comparison Kit | Spatio-temporal analysis | Space-time map analysis (http://www.riks.nl/products/Map_Comparison_Kit) | Research Institute for Knowledge Systems, Maastricht, Netherlands |
| 7 | MATSim | Geosimulation | MATSim is an open source (Java) toolkit for building multi-agent transport simulations. Programming now managed on Sourceforge, see: (http://matsim.org/) | IVT Swiss Federal Instituteof Technology Zurich and Institute for Land and Sea Transport Systems, TechnischeUniversität Berlin |
| 8 | R Spatial | Mathematical/ Statistical library | International Opensource project based on the R Project/language. The main areas enclosed include: Classes for spatial data; Handling spatial data; Reading and writing spatial data; Point pattern analysis; Geostatistics; Disease mapping and areal data analysis; Spatial regression; Ecological analysis. | (http://cran.r-project.org/web/views/Spatial.html) |
| 9 | SaTScan | Cluster analysis | Spatial, temporal and spatio-temporal analysis of geographic data. Mainly designed for disease pattern analysis and surveillance.SaTScan can be used to: Perform geographical investigation of disease, to detect spatial or space-time disease clusters, and to see if they are statistically important; Test whether a disease is randomly distributed settled space, over time or over space and time; Evaluate the statistical significance of disease cluster alarms; Perform repeated time-periodic disease surveillance for early detection of disease outbreaks | Sat Scan/Harvard University, USA http://www.satscan.org/ |

| | | | | |
|---|---|---|---|---|
| 10 | STARS | Spatio-temporal analysis | Space-time analysis of regional systems. Some techniques mirror those in Geodata (unrelated to the STARS logistics package). STARS are an open source environment written in Python that supports exploratory Energetic spatial data analysis. Energetic takes on two meanings in STARS. The first redirects a strong emphasis on the incorporation of time into the exploratory analysis of space-time data. To do so, STARS combines two sets of components, visualization and estimating. The visualization module consists of a family of geographical, temporal and statistical opinions that are interactive and interdependent. That is, they accept the user to explore patterns through various interfaces and the views are Energetically integrated with one another, giving enlargement to the second meaning of Energetic spatial data examination. On the computational front, STARS holds a set of exploratory spatial data analysis components, together with numerous newly developed measures for space-time analysis. | Regional Analysis Lab, San Diego Univ., CA, USA |
| 11 | TAUDEM | Terrain analysis | Terrain Analysis Using Digital Elevation Models - ArcGIS Add-in/toolbar. Provides wide assortment of terrain analysis/hydrological analysis functions and index computations | http://hydrology.usu.edu/taudem/taudem5.0/ |
| 12 | UrbanSim | Geosimulation | UrbanSim is a software-based simulation model for integrated planning and analysis of urban development, integrating the interactions between land use, public policy and transportation. It is proposed for use by Metropolitan Planning Organizations and others needing to interface existing travel models with new land use forecasting and analysis capabilities. | Univ of Washington, Center for Urban Simulation<br><br>http://www.urbansim.org/ |
| 13 | Virtual Terrain Project | Visualization (2D and 3D) | 3-D Terrain Modeling/Virtual Experience software. The goal of VTP is to foster the creation of tools for easily constructing any part of the real world in interactive, 3D digital form. | VTP<br>http://vterrain.org |

Table 2: tools of GIs for urban planning.

## V. MODIFICATIONS IN THE URBAN PLANNING APPROACH

For a more energetic urban planning exercise, the following modifications in the planning approach are recommended:

*1. Flexibility*

Plans must have flexibility for provide the always-growing, always-expanding city precincts and provide quality of life to entirety inhabitants. The plan should be flexible to changing conditions in foreseeable future.

*2. Role of Actors*

People’s participation in preparation of side plan, development plan, policies and annual plans should be ensured through elected representatives in the municipal council/corporation and ward committees.

### a. Information system

A well keep up data system can make possible plan proposals at the various stages of implementation of the plan according to the changing urban scenario.

### b. Urban sable Areas

The development imaginable may be assessed for the areas which are located in the periphery of the developed areas. An rough draft of the development imaginable and the possibility of optimizing the existing infrastructure should determine the prioritisation of development of these areas.

### c. Growth Centers

Given the paucity of resources, it would be more feasible and desirable to promote strategic development initiatives in the certain secondary cities, growth centre and their nearby area. In the growth centres, the placce of infrastructural and environmental services could form the core of the Development Plan.

## VI. CONCLUSION

In this article, we have presented studies about complexity for urban planner or city managers in environmental planning. By using GIS tools we can solving various problem of urban planner. The GIS spatial and temporal modelled will be very useful for solving complexity in simulation of urban space. It is difficult job to simulations on land use and transportation other environmental problems with respect to time work. Spatial planning was related to interplanetary and temporal planning was related to change in interval. So GIS will be obliging for resulting scenario and simulation on urban space. There is some tricky in environmental planning yet not resolved. In future urban planner resolves that problem and by using these two modelled gets maximum correctness in prediction.

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## REFERENCES

[1] Locational models, Geographic information, and planning support system (1992).by Britton Harris, Michal Batty.

[2] Tayyebi, A., M.R. Delavar, S. Saeedi, J. Amini and H. Alinia (2008), “Monitoring Land Use Change By Multi-Temporal Landsat Remote Sensing Imagery”, The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences. Vol. XXXVII. Part B7. Beijing.

[3] Fröhlich, B. and Plate, J. 2000. The cubic mouse: a new device for three-dimensional input. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.

[4] Britton Harris,Michael Batty (1992) “Locational Models, Geographic Information, and Planning Support Systems”, National Center for Geographic Information and Analysis.

[5] Cusimano M, Marshall S, Rinner C, Jiang D, Chipman M (2010) ” Patterns of Urban Violent Injury: A Spatio-Temporal Analysis”. PLoS ONE 5(1): e8669. doi:10.1371/journal.pone.0008669.

[6] Cui, GuishanLee, Woo-Kyun Lee, SangchulChung, Jiwoong (2006),”Susceptibility assessment of water resources to Climate change using GIS”.

[7] Fang Zhao “Transportation Applications of Temporal GIS”.

[8] Sharma Manish, Mishra Sunil K. and Tyagi Shuchi, “The Impact of Torrential Rainfall in Kedarnath, Uttarakhand, India duringJune, 2013” ,International Research Journal of Environment Sciences, Vol. 2(9), 34-37, September (2013).

[9] Gujju Gandhi, N.Srinivasulu, K.GopiNaik and B.ReddyaNaik (2013), “Remote Sensing and Geographical Information System Application for Mosquito Intervention- A Case Study of Grater Hyderabad”, Int.J.Curr.Microbiol.App.Sci 2(12): 560-568.

[10] Hilal Ahmad Ganaie1, Haseena Hashia2 and Dheera Kalota3 (2013),” Delineation of Flood Prone Area using Normalized Difference Water Index (NDWI) and Transect Method: A Case Study of Kashmir Valley “,International Journal of Remote Sensing Applications Volume 3 Issue 2, June .

[11] A Satellite Based Rapid Assessment On Floods In Jammu & Kashmir – September, 2014.

[12] Y. Xie & X. Ye (2007) Comparative tempo-spatial pattern analysis: CTSPA, International Journal of Geographical Information Science, 21:1, 49-69, DOI: 10.1080/13658810600894265.

[13] Manley, E; Cheng, T; Penn, A; Emmonds, A; (2014) A framework for simulating large-scale complex urban traffic Energetics through hybrid agent-based modelling. Computers Environment and Urban

Systems, 44 27 - 36. 10.1016/j.compenvurbsys.2013.11.003.

[14] Ashok Kumar Nayak,"Significance of GIS and remote sensing in cyclone management".

[15] Siba Prasad Mishra1, Dr Ramakanta Panigrahi2," Storm Impact On South Odisha Coast, India", International Journal of Advance Research In Science And Engineering, IJARSE, Vol. No.3, Issue No.11, November 2014.

[16] Hilal Ahmad Ganaie1, Haseena Hashia2 and Dheera Kalota3," Delineation of Flood Prone Area using Normalized Difference Water Index (NDWI) and Transect Method: A Case Study of Kashmir Valley", International Journal of Remote Sensing Applications Volume 3 Issue 2, June 2013.

[17] Paul Waddell, "UrbanSim: Modeling Urban Development for Land Use, Transportation and Environmental Planning".

[18] Nilesh Shingne, Deepa Rramteke, Sagarkumar Meshram, "Simulation of Urban Area through Opus: Open Platform for Urban Simulation", International Journal of Computer Science and Information Technologies, Vol. 6 (1), 2015, 689-693.