Prospects of FOSS for Geoinformatics (FOSS4G) in Urban Planning

Dr. T.V. Ramachandra

Energy & Wetlands Research Group, CES TE 15, Indian Institute of Science, Bangalore 560012

Email: tvr@iisc.ac.in; energy.ces@iisc.ac.in, Phone No:080-22933099/22933503 extn 107

Over the last years the paradigm of Free and Open Source Software (FOSS) development has taken root in the scientific community, resulting in the creation of several software projects whose aim is to develop free software for numerous purposes. FOSS have proved to be promising tools that allow us to see and change the software codes written in any programming language. FOSS is generally synonymous with free software and open source software, and describes similar development models, but with differing cultures and philosophies. Because of the way it is licensed, it has the potential to be legally given away for free or for very little cost and copied and shared with others. Geographic Information Systems (GIS) are increasingly being used as the principal tool for digital exploration of variation in landscapes, as they provide the necessary functions for spatial data collection, management, analysis and representation. Geoinformatics constitute a vital component of information science for addressing the problems of geography, geosciences and related branches of engineering. This domain combines geospatial analysis and modeling, development of geospatial databases, information systems design, human-computer interaction and both wired and wireless networking technologies. Geoinformatics uses geocomputation for analysing geoinformation. One of the major applications of geoinformatics in recent times is the study of variation in landscapes over multiple spatial and temporal scales encompassing a variety of domains – land use and land cover change, climate change, water resources, urban development, natural disaster mitigation, etc. Geoinformatics include geographic information systems, spatial decision support systems, global positioning systems (GPS), and remote sensing. GIS software fulfilling the specific requirements have been distributed with licenses that grant more freedoms of use and that support openness, such as licenses used by FOSS GIS (for example: http://grass.itc.it/; http://wgbis.ces.iisc.ernet.in/grass). My talk would focus on FOSS4G in urban planning.

Bangalore is experiencing unprecedented urbanisation and sprawl in recent times due to concentrated developmental activities with impetus on industrialisation for the economic development of the region. This concentrated growth has resulted in the increase in population and consequent pressure on infrastructure, natural resources and ultimately giving rise to a plethora of serious challenges such as climate change, enhanced green-house gases emissions, lack of appropriate infrastructure, traffic congestion, and lack of basic amenities (electricity, water, and sanitation) in many localities, etc. During past few decades, the quantum and composition of urban solid waste generation has changed due to the rise in the senseless behaviour (dependence on plastics), economic level, change in the demographic structure, consumer attitude and lifestyle of the residents. Mis-management of natural resources is evident from (i) sustained inflow of untreated sewage and industrial effluents to lakes; (ii) dumping of solid waste (with 70% being organic) in lake beds and storm water drains; (iii) transport of untreated wastewater in storm water drains (water drains are essentially arteries of a landscape carrying water), etc. These ad-hoc approaches have led to the transport of pollutants through leaching to groundwater resources. Higher values of nitrates and heavy metal with instances of kidney failures highlights the gravity of the situation and deteriorating human health.

Unplanned rapid urbanisation during late nineties, witnessed large-scale unrealistic, uncontrolled developmental activities in the neighbourhood of wetlands. Land use analysis using temporal remote sensing data of Bangalore City reveals of unrealistic and irresponsible urbanisation with 1028% increase in urban (built-up) area between 1973 and 2017 (i.e., from 8.0% (in 1973) to 78% (in 2017) with a decline of 88% tree cover and 79% water bodies. Land use prediction using Agent Based Model showed that built up area would increase to 93.3% by 2020 and 98.5% by 2025, and the landscape is almost at the verge of saturation. Current erroneous design for optimisation of land for construction (or concretisation, paved surfaces) has resulted in GHG rich, water scarce, non-resilient and unlivable, while depriving the city dwellers of clean air, water and environment.

Reference: **Bangalore's Reality: towards unlivable status with unplanned urban trajectory (Guest Editorial in June 2016, Current Science)**

https://www.researchgate.net/publication/304251846_Bangalore%27s_Reality_towards_unlivable_status_with_unplanned_urban_trajectory_-_Guest_Editorial_Current_Science_11012_June_2016

Prospects of FOSS for Geoinformatics (FOSS4G) in Urban Planning

Dr. T.V. Ramachandra[1,2,3]

[1] *Co-ordinator, Energy & Wetlands Research Group, Center for Ecological Sciences [CES]*
Convenor, Environmental Information System [ENVIS], CES TE 15, Indian Institute of Science
[2] *Associate Faculty, Centre for Sustainable Technologies (astra)*
[3] *Centre for infrastructure, Sustainable Transportation and Urban Planning [CiSTUP]*
Indian Institute of Science, Bangalore, Karnataka, 560 012, India
Web URL: http://ces.iisc.ernet.in/energy; http://ces.iisc.ernet.in/foss
Email: tvr@iisc.ac.in; energy.ces@iisc.ac.in
Phone No:080-22933099/22933503 extn 107
Web URL: http://ces.iisc.ernet.in/energy

E Mail: tvr@iisc.ac.in; energy.ces@iisc.ac.in
https://www.researchgate.net/profile/T_V_Ramachandra/publications

Dr. T.V. Ramachandra, FIE, FIEE (UK), FNIE obtained Ph.D. in Ecology and Energy from Indian Institute of Science. At present, Coordinator of Energy and Wetlands Research Group (EWRG), Convener of Environmental Information System (ENVIS) at Centre for Ecological Sciences (CES). During the past twenty years he has established an active school of research in the area of energy and environment (http://ces.iisc.ernet.in/energy). He is a member of Karnataka State Wetland Authority (2018), Karnataka State Audit Advisory Committee. He was a Member of Karnataka State level Environment Expert Appraisal Committee (2007-2010), appointed by the Ministry of Environment and Forests, Government of India and a member of Western Ghats task force appointed by the Government of Karnataka. Apart from this TVR is serving in many committees of NGT (National Green Tribunal) related to wetlands of Bangalore.

He is a recipient of Johny Biosphere Award for Ecology and Environment (2004), Satish Dhawan Young Scientist Award, 2007 of Karnataka State Government, ENVIS Award (2004, 2014), The Ministry of Environment, Forests and Climate Change, GoI, Namma Bangalorean, 2016 award (Namma Bengaluru Foundation) and Rotary Exemplars 2017- Citizen Extraordinaire award (Rotary Club of Bangalore) **Karnataka State Parisara Award**, 2017-18, GoK, Khadri Achuathan Memorial Samvahana Award (Environment) 2018, on World Communicators Day by PRCI. Recently chosen as a research advisor at the NanYang Academy of Sciences, Singapore (2019).

He is *an Elected Fellow* of National Institute of Ecology (2011), Indian Association of Hydrologists (India; 2006), the Institution of Electrical Engineers (IEE, UK; 2005), Institution of Engineers (IE, India; 2003), and a Senior Member, IEEE (USA; 2000) and Association of Energy Engineers (USA; 2000).

TVR's research interests are in the area of aquatic ecosystems, biodiversity, ecological modeling, Western Ghats ecology, energy systems, renewable energy, energy conservation, energy planning, geo-informatics, environmental engineering education research and curriculum development at the tertiary level. He has published over 303 research papers in reputed peer reviewed international and national journals, 62 book chapters, 333 papers in the international and national symposiums as well as 18 books. In addition, he has delivered a number of plenary lectures at national and international conferences. Publication "Milking diatoms for energy" is seminal work in biofuel research evident from reports in Scientific American, BBC, national dailies, etc.

He has guided 134 students for Master's dissertation and ten students for Doctoral degrees. TVR has travelled widely across the country for field research and also for delivering lectures at Schools and Colleges. He has taken initiatives through biennial symposium (popular as Lake series), training programmes and workshops for capacity building at various levels. Publications are available at

https://www.researchgate.net/profile/T_V_Ramachandra/publications