

# **Capacity Building Training Workshop on Open Source Geospatial Tools in Integrated Water Resources Management (IWRM) (19<sup>th</sup> – 21<sup>st</sup> April, 2011 at IIIT – Hyderabad)**

## **A Technical Report**

### **Background**

In countries like India, where informal water economy is the most prevalent form, IWRM models of developed countries will not hold good. IWRM models are in serious danger of being counter-productive, unless integration of the local resources in a highly local context happens. Since most of the components are location specific and has a strong temporal dimension too, there is a strong requirement for highly appropriate and cost effective tools and technologies, especially in the Geospatial information Technology domain.

There is a great need in harnessing modern Information & Communication Technologies (ICT) tools, especially location based geospatial tools, for introducing efficient, transparent and multiple user based systems for IWRM activities on a wider scale and on a functional basis. These demand that the techniques and tools are available to a large number of stakeholders and the community, in general. This is only possible by adopting suitable Open Source geospatial tools rather than the license-based proprietary and other expensive tools. OSGeo-India along with like-minded organisations and agencies has been able to show that the adoption of FOSS4G tools has a positive effect. An example of this is the successful project by Sálim Ali Centre for Ornithology and Natural History (SACON) on wetlands information system.

In general, there are two classes of geospatial tools in use - one in desktop and the other in a web enabled environment. For effective governance at multiple levels, both these suites of tools are required. The capacity building programme planned will provide in-depth knowledge on the watershed delineation and other theoretical concepts along with a fully-hands-on practice session. It is hoped that this combination will provide the right level of appreciation for using Free and Open Source Geospatial software (FOSS4G) tools in Integrated Water Resources Management (IWRM) and build awareness on its effective adoption. As part of this course, the appropriate functions of SAGA, OpenJump, basics of databases such as PostgreSQL and PostGIS and OpenGeoSuite (including Geoserver for webGIS) will be introduced and practiced. The expected outcome is a trained cadre of stakeholders of IWRM who can harness the geospatial tools for IWRM activities on a routine basis without have to involve specialist GIS personnel.

### **Organisers**

- OSGeo-India, Hyderabad, India
- International Institute of Information Technology (IIIT), Hyderabad, India
- Sálim Ali Centre for Ornithology and Natural History (SACON), Hyderabad, India
- SaciWATERs-CapNet Network, Hyderabad, India

### **Participants**

There were 18 participants who were professionals associated with NGOs, CBOs, government and private sectors working in the field of water resources management. The participants were expected to have some proficiency/experience in the use of computers. Preference was given to female candidates during selection. However, there were only three female applicants and all of them were selected for the training.

### **Workshop Summary**

The workshop's main aim was to provide a hands-on tutorial on understanding and deriving the watershed hydrology, estimating water supply and water demand, and publishing the data to help decision makers and stakeholders get a better understanding of the resources and help build sustainable development plans. To achieve this, the major activity components of this training workshop were as follows:

1. Watershed Hydrology and its understanding using Geospatial concepts
2. Spatial Analytical techniques for Drainage network validation, Water demand estimation
3. Spatial database concepts – to store and manage spatial data
4. Concepts of WebGIS and publishing one's geospatial data on the internet

The primary resource persons were:

- a. Dr. K S Rajan, Associate Professor, IIIT Hyderabad and Treasurer, OSGeo-India(rajan@iiit.ac.in)
- b. Dr. S N Prasad, Senior Scientist, SACON (Salim Ali Centre for Ornithology and Natural History) and Secretary, OSGeo-India(snarendra.prasad@gmail.com)
- c. Mr. Santosh Gaikwad, Geoinformatics Officer, SACON(santosh@osgeo.in)
- d. Dr. Rama Chandra Prasad, Research Associate, IIIT Hyderabad(rcprasad@iiit.ac.in)

In addition, there were other people from OSGeo-India and SACON who assisted the primary resource persons during the training programme.

The sessions started with an overview of both the geospatial technologies and the rationale behind the workshop. Participants were encouraged to actively participate and interact with the resource persons to achieve the outcomes as envisaged and help build their skills in effectively using the geospatial technologies in their water resource management activities at local and regional levels. This was followed by an overview of OSGeo-India and its activities. Later, Dr. Jayathi Chourey, Network Manager, SCaN, asked the participants to effectively use this workshop to upgrade their skills and familiarised the participants to SCaN and its activities in the South Asian region.

The first session on “Geospatial concepts and Watershed Hydrology” had two major components: a review of the theoretical concepts of water flow accumulation and the use of SAGA open source tool in deriving all the parameters. This was necessitated as the participants were from different backgrounds and different organizations. Dr. Rama Chandra Prasad introduced the features of the SAGA (System Automated Geoscientific Analysis) tool, including deriving Aspect, Slope, Flow direction, Flow accumulation, Contour creation from DEM, Stream order, Channel network, Channel direction, Sink route, Sink filling, Catchments area, Catchments slope, Watershed basins and Sub basins. In this session, the raster and vector concepts and when to use which data model for effective outcomes were also explained. Participants had to do assignments using all the new data, apart from a hands-on practice session to help prepare suitable data.

The second day began with a review of the assignments done by the participants. OpenJUMP, the open source vector GIS tool was then introduced with functions ranging from importing data, generating/digitizing data to creating good output maps. Participants digitized the river network from the satellite imagery and compared it with the drainage channel network created using SAGA – this was done to validate the channel network created by DEM with respect to the real ground information. In addition, they learnt how to register and match different coordinate/projection systems in this session – an important step when collating data from diverse sources. Integrating the work done till now, provided a good way to estimate the water supply situation for a given watershed or region of interest.

Estimation of water demand and satisfying this, is one of the important aspects of IWRM. Keeping this in mind, participants were shown how to integrate raster, vector and other socio economic data (census data) for the demand and supply estimation of water distribution. For this participants used land use land cover map, and other data to estimate both sectoral and region-wise (watershed or administrative boundary) water demands in selected talukas of Mahabubnagar district. Further, they were asked to identify the talukas with water surplus and water deficit areas. However, only some participants were able to perform the assignment.

The next session on “Spatial database concepts” was devoted to explaining the concepts of RDBMS with specific focus on PostgreSQL and its PostGIS extension module. In addition to storing and managing spatial data using a database, various functions on how it can be directly used by various desktop and webGIS platforms were demonstrated. Also, the participants used some of the spatial functions for effective building of spatial queries and spatial indexes. Though participants learnt the basics and appreciated the content in this session, they were of the view that more time could have been devoted to this session. But, they agreed to practice and interact with the resource persons after the training workshop as well.

The final session was on “WebGIS – Geoserver suite” with the purpose of orienting participants on publishing their geospatial data on the internet. The session focused on WMS (Web Map Service), WFS (Web Feature Service) and WCS (Web Coverage Service). Participants were shown how to configure the spatial data with GeoServer; how to view, edit and publish the data as services using GeoExplorer; and how to style the data using Styler and uDig. The hands-on experience on OpenGeoSuite helped the participants realize the potential and use of Web-GIS in the IWRM domain.

## **Results**

Overall, the workshop was able to achieve all its stated objectives with positive feedback on the content and the delivery from the participants and co-sponsors. But, given that the participants were from a range of backgrounds, considerable effort was spent in the earlier sessions to bring all of them at par, and some additional foundation-level content was explained. This implied that for imparting similar content, more practice-sessions will need to be incorporated. The participants appreciated the atmosphere of the workshop, especially its interactive and hands-on sessions. The practice-theory combination of the sessions helped provide the right balance between tool usage and its conceptual underpinnings. We expect that the trainees, armed with key open source geospatial tools, can contribute to their respective organizations in the following ways: (i) in use of these important class of tools for effective IWRM programmes; (ii) in watershed assessment; and (iii) effective use of these tools in participatory involvement of various stakeholders.

## **Conclusion**

The capacity building workshop was able to expose to the users the potential power of Open Source Geospatial technologies in Integrated Water Resources Management practices and how it can scientifically help in estimating the water availability, water demand, and assess the impacts of some potential actions. This programme was one of the few thematic oriented workshops conducted by OSGeo-India in coordination with a theme-focused organisation like SCaN, and it was a great experience for the OSGeo-India community as well. Also, it helped bring a suite of tools to IWRM practitioners and managers who can use these tools to effectively build analytical capabilities at different levels and scales.

## **Lead Facilitators**

- Dr. K S Rajan, Associate Professor, IIIT Hyderabad and Treasurer, OSGeo-India(rajan@iit.ac.in)
- Dr. S N Prasad, Senior Scientist, SACON (Salim Ali Centre for Ornithology and Natural History) and Secretary, OSGeo-India(snarendra.prasad@gmail.com)

## **Workshop Coordination**

- Dr. Jayati Chourey, Senior Fellow (Education and Networking), SaciWATERs, Hyderabad (jayati@saciwaters.org)
- Dr. Rama Chandra Prasad, Research Associate, IIIT Hyderabad (rcprasad@iit.ac.in)

**Workshop Website:** <http://lsi.iit.ac.in/iwrm/index.html>

## **Annexures**

Annexure-I : Training Evaluation Report

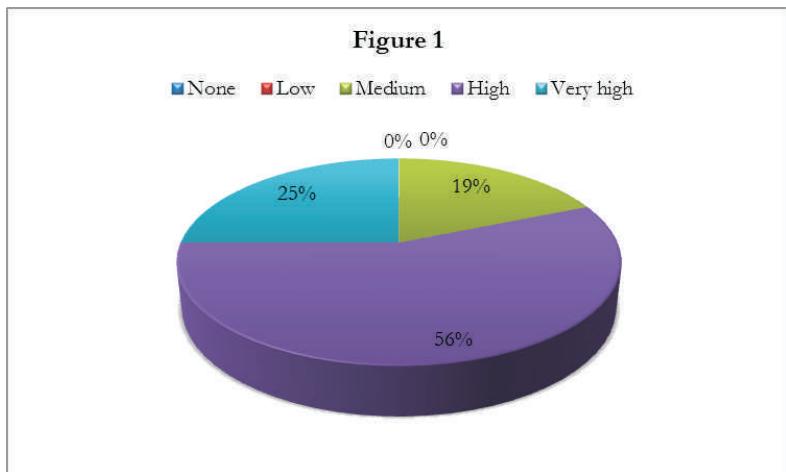
Annexure-II : Programme Schedule

Annexure-III : List of Participants

## Annexure-I Training Evaluation Report

The following section provides an overview of the feedback provided by the participants. The detailed responses can be referred from Annexure I and II.

### 1. Relevance of the course to current work or function of the participants

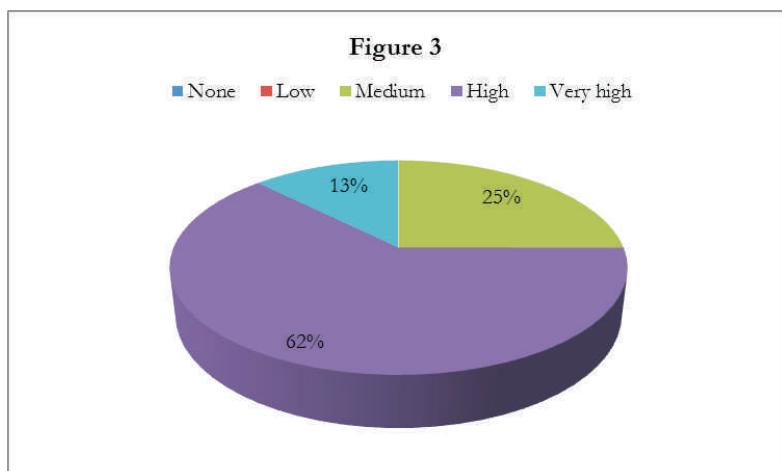


While providing feedback on the relevance of the workshop to their present job profiles, almost 56% of the respondents rated the workshop to be very highly relevant. Another 25% responded to the workshop being highly relevant while the remaining 19% felt the workshop to be moderately relevant. None of the respondents felt the programme to be irrelevant (Please see Figure 1).

### 2. Extent to which participants have acquired new information / content

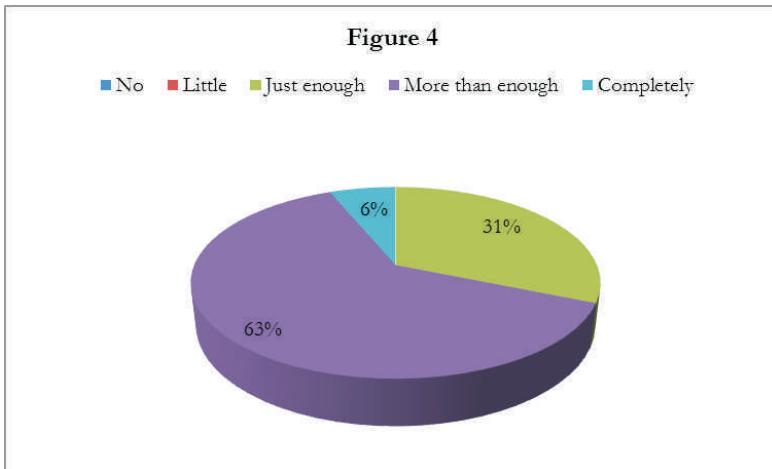
Figure 2 displays the amount of new information / content that the respondents acquired by the from the workshop. While 25% of the respondents rated very high in having attained some new information / content, another 50% rated the parameter as high. The remaining 25% rated the parameter as medium. Overall, none of the respondents rated less than medium, when it came to acquiring new information / content from the workshop.

### 3. Relevance of the information / content that participants acquired for their work



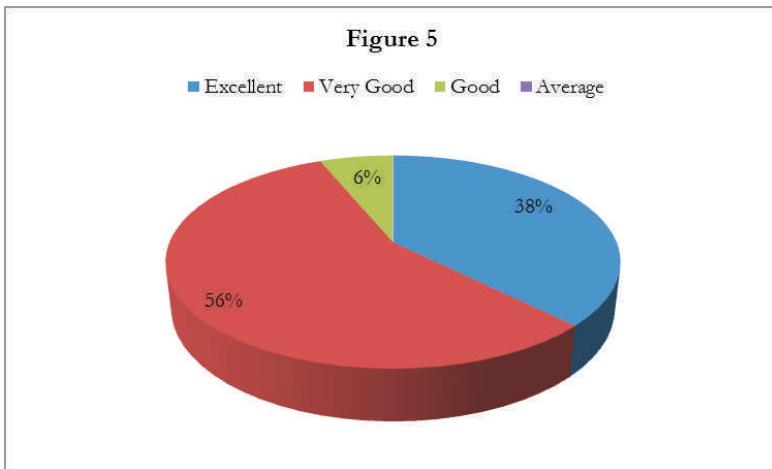
The third question forming part of the feedback process was on the relevance of the information / content, which was disseminated to the respondents in the workshop. While 13% of the respondents rated this parameter as very high, an overwhelming 62% rated it as high. The remaining 25% rated the parameter as medium. None of the respondents rated the parameter less than medium (Please refer to Figure 3).

4. Did the course reach participants' expectations and objectives?



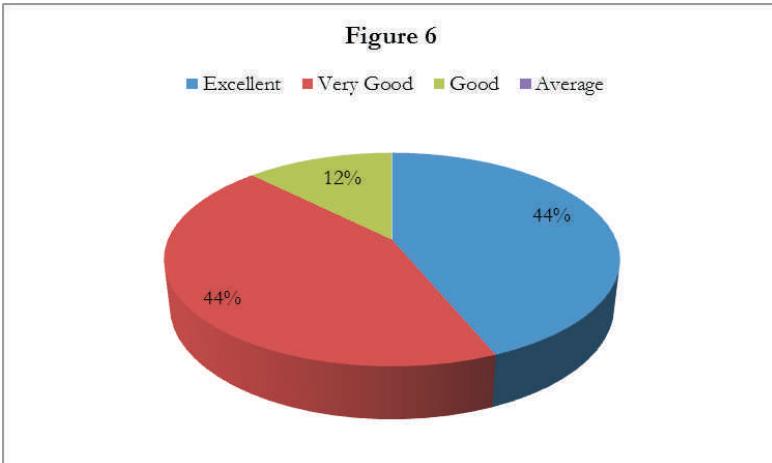
The above pie chart (Figure 4) shows the feedback of respondents on whether the workshop was able to meet the participants' expectations and overall objectives. While 6% agreed completely with this query, almost 63% of the respondents felt it more than met their set expectations and objectives. The remaining 31% felt that the workshop was just able to meet their expectations and objectives. None of the respondents felt that the workshop did not or met only a bit of their expectations and objectives.

5. Presentation of the different sessions



The fifth question in the feedback process was on how the respondents felt about the presentations included in the various sessions of the workshop. While 38% of the respondents rated the presentations to be excellent, the majority forming about 56% of the respondents felt them to be very good. The remainder 6% of the respondents rated the presentations to be good. None of the respondents rated the presentations as less than good (Please refer Figure 5).

6. Participation possibilities during the course

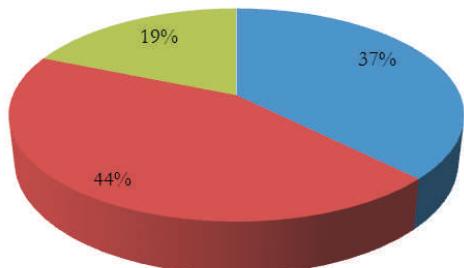


The sixth question queried was regarding the participation possibilities of the respondents in the workshop. While 44% of the respondents felt that the participation possibilities provided were excellent an equal number responded to them being very good. The remaining 12% responded that the participation possibilities were good. None of the respondents rated the parameter as less than good (Please refer Figure 6).

#### 7 Supporting materials for the different sessions

Figure 7

■ Excellent ■ Very Good ■ Good ■ Average



The seventh question was on the adequacy of supporting materials which had been provided to the respondents in the workshop. While 37% felt that the material provided was excellent, another 44% responded that they were very good. The remaining 19% felt that the supporting materials provided were good. None of the respondents rated the supporting materials less than good (Please refer Figure 7).

#### 8. What action will you take now to implement the knowledge gained from this course?

Some specific responses to this question put to the respondents included, using the lessons learned to avoid data loss; implementing GIS in their areas of work; continuing practice in the area of GIS and acquiring more knowledge. There was also a response of using the open source tools to work and publish the research results.

- 9a. The specific responses on the course content of the workshop included providing for hard copies of the supporting materials provided, inclusion of basics of GIS & PS for participants who might be beginners. Most of the respondents found the material provided to be excellent and very useful.
- 9b. Regarding facilitation in the workshop almost all the respondents found it to be excellent. Two specific comments on the facilitation included the course being a good one for beginners to GIS and for presence of 1-2 more support persons during the first and second days of the workshop.
- 9c. All the respondents found the support material provided to be excellent or very good. There were also specific responses for hard copies of the support material and for additional papers apart from the supporting material provided.
- 9d. On the point of course organisation, respondents found it to be very good or excellent. Some specific responses included increasing the time of training days, the course being practice oriented, well structured and flexible in terms of extending the evening session timing.
- 9e. Other remarks included planning the training programme for different level of learners viz., basic, intermediate, experienced and demand for a few more such training programmes in the future.

## Annexure-II

### **Training on Use of Open Source Geospatial Tools in Integrated Water Resources Management (IWRM)**

Co-organized by OSGeo India-, SCaN, IIIT-H, SACON and Cap-Net

(April 19 – 21, 2011 at IIIT – Hyderabad)

#### Programme schedule

##### **April 19, 2011**

09 .00 am – 10.00 am	Registration for the training
10 .00 am – 10.45 am	Inaugural session
10 .45 am – 11.15 am	Tea break

##### **Session - 1**

11 .15 am – 13.15 pm	Basic concepts of GIS (Vector and Raster) Software Installation
13 .15 am – 14.30 pm	Lunch

##### **Session - 2**

14.30 pm – 16.00 pm	Watershed Delineation
16 .00 am – 16.15 pm	Tea break

##### **Session - 3**

16 .15 am – 17.45 pm	Volume estimations
17.45 pm	End of the first day

##### **April 20, 2011**

09 .30 am – 11.00 am	Admin boundary matching, Spatial analysis to identify surplus and deficit areas for supply
11 .00 am – 11.15 am	Tea break

##### **Session - 5**

11 .15 am – 13.00 pm	Demand estimations (use of census, agricultural, industrial and other relevant data)
13 .00 pm – 14.00 pm	Lunch

##### **Session - 6**

14 .00 pm – 15.45 pm	Balancing water needs and distribution (includes Reservoir planning, Network analysis for flow)
15.45 pm – 16.00 pm	Tea break

##### **Session - 7**

16.00 pm – 17.45 pm	Spatial database concepts, PostGIS (storing vector data, etc.)
17.45 pm	End of the second day

**April 21, 2011**

**Session - 8**

09 .30 am – 11.00 am	Concepts of Web GIS
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11 .00 am – 11.15 am	Tea break
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**Session - 9**

11 .15 am – 13.00 pm	Web GIS – Project data application
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13 .00 pm – 14.00 pm	Lunch
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**Session - 10**

14 .00 am – 15.45 pm	Valedictory session
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15.45 pm – 16.00 pm	High Tea
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16.00 pm	End of the programme
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**Annexure-III**  
**List of Participants**

Name	Sex	Organisation/ Institution	Designation	City	Country	Email Id	Educational Qualification
Arvind Kumar	Male	Infrastructure Professional Enterprise (p) Ltd.,	WATSAN coordinator	Patna	India	jnu_arvind@rediffmail.com	M.Sc
Bimal Prasad Pandia	Male	Regional Centre for Development Cooperation	Programme Manager	Sambalpur	India	bimalpandia@gmail.com / bimal@rcdcindia.org	BA,LLB
M Inayathulla	Male	Bangalore University	Assistant Professor	Bangalore	India	drinayath@gmail.com	PhD
K. Avil Kumar	Male	Water Techology Centre, Acharya	Senior Scientist	Hyderabad	India	avil2k@rediffmail.com / avil2k@gmail.com	PhD
M.Uma Devi	Female	Water Techology Centre, Acharya	Principal Scientist	Hyderabad	India	baby_makam@rediffmail.co m	PhD
Padma Keshari Sahoo	Male	CTRAN Consulting	Consultant	Bhubaneswar	India	padmakeshari@gmail.com / padma.keshari@ctransconsul ting .com	M.Tech
Sachin Warghade	Male	PRAYAS	Senior Research Associate	Pune	India	sachinwarghade@gmail.co m	BE, MBA, PhD student
Sakunda Ojha	Male	Sanima Hydro and Engineering (p) Ltd.,	Environmental Officer	Kathmandu	Nepal	sakunda@sanimahydra.co.n p / env.sakunda@gmail.com	M.Sc
Sreedhar Acharya	Male	Intemational Water Management Institute	Senior Officer	Hyderabad	India	s.acharya@cgiar.org	MCA
Vinit Raskar	Male	Society for Promoting Participative Ecosystem	Research Assistant	Pune	India	smartvintoo@gmail.com	PG BSc
M. Pavan Kumar	Male	WASSAN	Sr. Programme Officer	Secunderabad	India	pavanwsn@gmail.com	MSW
Neeli Srinivasa Rajamani	Male	Environment Protection Training and Research Institute	Project Faculty	Secunderabad	India	nsrajamani@yahoo.com	M.Sc
Vasundhara Das	Female	SaciWATERs	Research Associate	Secunderabad	India	vasundhara@saciwaters.org	M.Sc
Dr. Syamasundar Reddy	Male	IIIT Hyderabad	Assistant Professor	Hyderabad	India		
P. Prasad	Male	Irrigation Dep. Govt. of A.P.	DEE	Hyderabad	India	prasadspl@yahoo.com	M.Tech
Srishti Srivastava	Female	IIIT Hyderabad	Research Student	Hyderabad	India	shrishty@gmail.com	pursuing MS (Research)