

GLOWA-VOLTA PROJECT (GVP)

Report of the training workshop

ON

“Data Management and Applications of GIS and Remote Sensing in Natural Resources Management”

ORGANISED BY

**UNITED NATIONS UNIVERSITY (UNU)-
INSTITUTE FOR NATURAL RESOURCES IN
AFRICA (INRA) &
CENTRE FOR DEVELOPMENT RESEARCH (ZEF),
UNI-BONN**

AT

**CENTER FOR AFRICAN WETLANDS, UNIVERSITY OF
GHANA, LEGON**

FROM

26th to 28th September 2007





GROUP PHOTOGRAPH OF PARTICIPANTS

1. Introduction/ Objectives (What was the workshop?)

After assessing the report on the workshop of the GLOWA-Volta Project (GVP) - Partners Capacity Needs Assessment Workshop held at the Noguchi Centre, University of Ghana, Legon, Accra last May, it was identified three major capacity needs areas. These are:

- a) Hydro-Meteorological data management and Applications of GIS and Remote Sensing in Natural Resources Management,
- b) Computer modeling in hydrology, meteorology, etc.
- c) Water management scenario analysis and policy consequences

In order to address the first capacity need UNU-INRA and GVP organized a two and half days training workshop with the following objectives:

- To acquaint participants with the hydro-meteorological data available with the Hydrological Services Department (HSD) and Ghana Meteorological Agency (GMA), their quality and the tools used by the two organisations in collecting and managing the databases.
- To acquaint participants with the hydro-meteorological data available with the GLOWA Volta Project and the tools used in collecting and managing the databases.
- To introduce some tools in handling of missing data
- To demonstrate the applications of GIS and RS tools and techniques in natural resources management by CERSGIS and GVP

2. Where workshop was held? Period of workshop

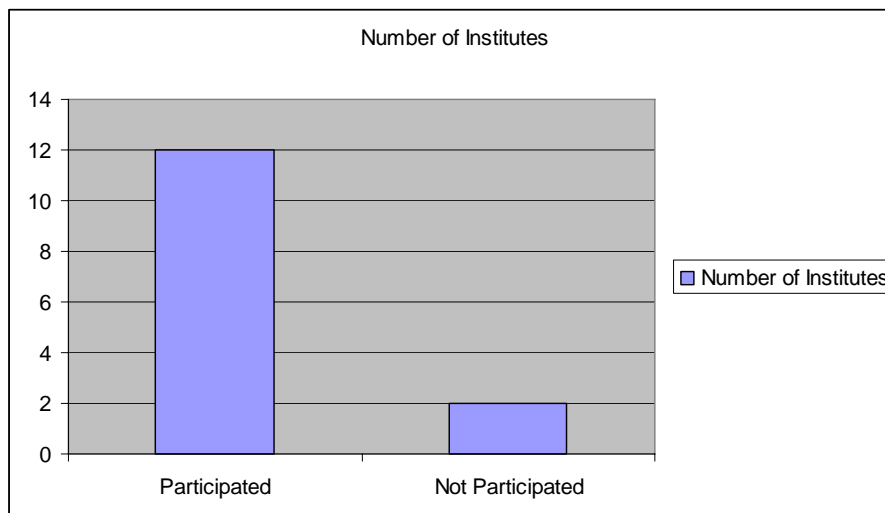
The workshop was held at the Centre for African Wetlands (CAW), University of Ghana, Legon, Accra from 26 to 28 September 2007

3. Attendance

The invited institutes, which are listed below are mainly from research and data gathering institutes but some institutions from water management and regulating bodies and activities were also invited.

- 1) Volta Basin Research Project
- 2) Environmental Protection Agency
- 3) Savanna Agricultural Research Institute
- 4) Ghana Meteorological Agency
- 5) Center for Remote Sensing and Geographic Information Systems
- 6) Water Research Institute
- 7) Water Resources Commission
- 8) Center for African Wetlands
- 9) Hydrological Services Department
- 10) Institute of Mathematical Sciences
- 11) Soil Research Institute
- 12) Ghana Irrigation Development Authority
- 13) Training, Research and Network for Development
- 14) Community Water & Sanitation Agency

Twelve out of fourteen invited institutes participated in workshop (Fig 1)



About 30 persons attended this training workshop.

4. Opening

The training workshop was opened at 9:15 am with a welcome and an introductory speech by the Director of UNU-INRA, Professor Dr. Karl Harmsen

Highlights of his speech are:

- the outcomes of the capacity needs assessment
- that this training workshop will address the need to acquaint different data management system
- this training workshop will provide how to deal with the missing data
- applications of some tools and in spatial data generation for natural resources management

Finally he wished all participants a good and successful training workshop

The workshop was chaired by Dr. Barry Boubacar (IWMI/ Coordinator , GVP)

5. Workshop sessions

The training workshop was held in two main sessions over the two and half days. The first session dealt with the following points:

- I). Data collection and management
 - a) Hydro-meteorological Data Collection
 - Type of Data
 - Equipment and methods used
 - Data transmission methods
 - b) Data Storage
 - c) Data management including quality control
 - Data management software used
 - Statistical methods for data quality control
 - Use of the data
- II). Handling of missing data

In the second session the following three topics were handled

- I) Application of GIS and Remote sensing in natural resources management in Ghana by CERSGIS
- II) Remote sensing and GIS application in GVP
- III) Data assessment for soil erosion in Ghana

6. First session's presentations

a. Areas of the presentations

Meteorological data collection, storage and management by GMA **Mr. Minia (Ag. Director General, GMA)**

In this presentation the presenter introduced GMA and stated their mission as *GMA exists to provide cost effective weather and climate services by collecting, processing, archiving and disseminating meteorological information to support end-users contributing to the management of Ghana's economy with special regard to protection of life and property and safeguarding of the environment and recovering the costs of the services so rendered so that its expenditure will not exceed its income.*

- Specifically, meteorological information is provided in support of activities such as the development and management of water resources, hydro-power generation, agricultural production and storage, pollution monitoring and control, construction, the management and operation of both marine and air transport services, fire prevention and control, and recreation and tourism.
- The Agency thus maintains a comprehensive dataset of climatic variables such as rainfall, temperature, cloud cover and wind direction and speed, for a wide network of stations spread over the entire country. This dataset is frequently accessed by our clients for purposes ranging from design and construction of stadiums for CAN 2008 to the processing of insurance claims.
- Collect, process, store and disseminate meteorological information both nationally and internationally in accordance with rules practices and procedures established under the WMO Convention, the Convention of the International Civil Aviation Organization (ICAO) and other relevant conventions of the United Nations systems such as the Framework Convention on Climate Change (FCCC), and Convention to Combat Desertification and Drought (CCD),

The type of data collected are

- Rainfall
- Max. and Min. Temp.
- Grass Minimum
- Air Temperature
- Wet-Bulb Temp.
- Relative Humidity (06, 09, 1200 etc.)
- Sunshine Hours
- Wind Speed/Direction
- ETC.

He mentioned also that these data are collected manually are automatically.

Equipment and Methods

- Thermometers
- Hygrometers
- Raingauges
- Pyranometers
- Barometers
- Anemometers
- Sunshine Recorders, ETC.

Data Transmission Methods

- Radio Telephones
- Telephones
- Faxes
- E-Mail
- Use of the Internet (New Approach)

Data Storage

- Paper Archives
- Electronic Data Base

(With a weekly backup on CDs and kept in Safe outside the Data Section)

Data Management

- Scrutiny and Validation
- Soft Ware: Clidata (From Chec. Republic) and Excel

Data Use

- Agriculture
- Aviation
- Water Resources
- Public Weather Services
- Insurance Companies
- Construction Firms

Hydrological data collection, storage and management by HSD: **Mr. Wellens Mensa (Director, HSD)**

- ☞ Functions of the Dept.:
- ❖ River stage/ discharge measurement, data processing and storage
- ❖ Flood control and drainage
- ❖ Restoration and maintenance of lagoons, estuaries, dams (for water supply and irrigation)
- ❖ Sewerage
- ❖ Coastal protection works.

- ☞ Hydrological zones:
- ❖ Volta River Basin
- ❖ Coastal Rivers
- ❖ South-Western Rivers
- ☞ Regional Offices & Hydrometric stations

	No of stations	operating	AWLR	only staff gauge
❖ Volta (Hohoe)	- 48	23	12	11
❖ Central (Cape Coast)	- 28	24	9	15
❖ Western (Takoradi)	- 29	26	12	14
❖ Eastern&Greater Accra (Accra)	- 41	20	8	12
❖ Ashanti&Brong Ahafo (Kumasi)	- 56	33	17	16
❖ Northern (Tamale)	- 33	18	10	8
❖ Upper West& East (Bolgatanga)	- 30	20	8	12

Hydrological Data Collection (Data Type)

- ☞ Station file :
 - ▲ Location of station(coordinates of the station etc.)
 - ▲ Geometric characteristic(type of river bed & banks, existing natural or artificial obstacle e.g curves, junctions, bridges, dam, concrete slab etc.)
 - ▲ History of the station(opening date, damages & repairs, floods, drying out rivers etc.)
 - ▲ The history of monitoring(observer changes, reports of the field teams etc)

- ☞ Water levels:
 - ▲ Observer readings of staff guage(6am,12 noon,6pm)
 - ▲ Chat from Automatic water level recorder

- ☞ Discharge :
 - ▲ Next slide summarised data

Hydrological Data Collection (Equipment and methods used)

- ☞ Water levels:
 - ▲ Staff guage (Voluntary Observer reading-3 times daily)
 - ▲ 30 days automatic water level recorder (abstraction from chart)
- ☞ Discharge:
 - ▲ Current meter and counter(2pts. Method)
 - ▲ Wading rod
 - ▲ Winch
 - ▲ Measuring tape
 - ▲ Leveling Instrument
 - ▲ Divers
 - ▲ Boat with outboard-motor

Hydrological Data Collection (Data Transmission methods)

- ☞ Regions:
 - ▲ Monthly collection of observer records
 - ▲ Changing & abstraction of water level reading from chat.
 - ▲ Taken flow measurement as and when necessary
 - ▲ Quality control the data
 - ▲ Store data
 - ▲ Both hard and soft copies of data including field report are sent to head office per post.
- ☞ Head Office:
 - ▲ Quality control all data
 - ▲ Rectify errors if any in consultation with the regional head
 - ▲ Store data

Data Storage

- ☞ Flat file: Hard copies including observer records.
- ☞ External hard disc: Soft-copy back-up
- ☞ Hydata Software
- ☞ In-house software (developed with the help of I.T specialist from Danida)

Data Management

- ☞ Hydata software:
 - ▲ Quality control all data imported to head office.
 - ▲ Used to compute daily means, monthly means and annual means.
 - ▲ Used to compute maximum and minimum monthly and annual flows.
 - ▲ Used to develop rating curves and tables for each station.
 - ▲ It uses the Logarithmic method of developing rating curve with index falling within 1.5 to 2.5.

Uses of the Data

- ☞ Water resource consultant for projects.
- ☞ Research works by students (both local and foreign).
- ☞ In-house request specific (for mini-dams , bridges, culverts, flood control structures etc)
- ☞ Policy makers (WRC)

Hydro-Meteorological data collection, storage and management by GVP
Mr. Raymond Kasei (GVP)

Dealing with missing data I
Dr. P. Gyau-Boakye (Chief Executive, CWSA)

Dealing with missing data II
Dr. Barnabas A. Amisigo (GVP/WRI/UNU-INRA)

b. Concerns from participants

7. Second session's presentations

c. Areas of the presentations

Remote Sensing in Monitoring Tropical Forest and Savanna Environment:

- Cocoa landscape in Ghana's Development
- Fuel-wood as traditional energy in Ghana's Savanna Economy.

Dr. E. Amamoo-Otchere (Director, CERSGIS), Mr. Foster Mensah (CERSGIS) and Mr. Benjamin Akuetteh(CERSGIS)

Pan African Tsetsefly and Trypanosomiasis Eradication and Control (PATTEC) programme: Initial habitat mapping and image map development for aerial spraying expedition.

Dr. E. Amamoo-Otchere (Director, CERSGIS), Mr. Foster Asante (CERSGIS),
Dr. Benita Anderson (CERSGIS) and Mr. George Owusu (CERSGIS)

Ethnobotanical and Physiographic Surveys for site appraisal in selecting suitable rice production sites in the Inland Valleys: Initial Image Map and GPS data integration for multidisciplinary study of the sites.

Dr. E. Amamoo-Otchere (Director, CERSGIS), Mr. Foster Mensah (CERSGIS), Mrs. Jennifer Asiedu-Dartey (CERSGIS) and Mr. Henry Wallace (CERSGIS).

Towards Sustainable Community Planning: Developing a national database on the community's identity and associated infrastructure.

Dr. E. Amamoo-Otchere (Director, CERSGIS), Mr. Benjamin Akuetteh (CERSGIS), Mrs. Jennifer Asiedu-Dartey (CERSGIS).

Horticultural Export Crop Management Information System for Ghana's pineapple industry: Remote Sensing and GIS processes for establishing the baseline database for traceability system development.

Dr. E. Amamoo-Otchere (Director, CERSGIS), Mr. Benjamin Akuetteh (CERSGIS) and Mr. George Owusu (CERSGIS).

A GIS-Driven Community-based watershed characterization for rehabilitating degraded watersheds.

Dr. E. Amamoo-Otchere (Director, CERSGIS) & Mr. George Owusu (CERSGIS).

Remote sensing and GIS application in GVP I: Overview of satellite imagery/products

Dr. Tobias Landmann (GVP/DLR/University of Würzburg)

Remote sensing and GIS application in GVP II: Utility & constraints of satellite data sets for key hydrology applications

Dr. Tobias Landmann (GVP/DLR/University of Würzburg)

Demonstration of utilities in hydro-meteorological models

Dr. Tobias Landmann (GVP/DLR/University of Würzburg)

Satellite Data acquisition/download Demonstration (MODIS, Landsat) (edcims:

www.cr.usgs.gov/pub/imswelcome)

Dr. Tobias Landmann (GVP/DLR/University of Würzburg)

Showing the usage and characteristics of the GVP remote sensing data sets

Dr. Tobias Landmann (GVP/DLR/University of Würzburg)

Data assessment for soil erosion in Ghana

8. Closing

Dr. Barry thanked all the participants and the presenters and the workshop was 3:00 Pm officially closed.

Questions and Answers during the presentations on the second day.

Q) Samuel Koranteng –VBRP UG/Legon,

Why were participants not taken through some basic remote sensing appreciation to understand some of the output displayed?

A) Mr. Foster Mensah (CERSGIS)

The presentation meant for demonstration of application of GIS and Remote Sensing in natural resources management. However, a training course for basic GIS and Remote Sensing would be arranged at a later date.

Second presentation

No. questions

Third Presentation

By Mr. Henry Wallace (CERSGIS)

Q) Dr. Barry Boubacar (IWMI, GVP)

Have all the project been cropped and what happens to the crops when the project takes off.

A) Dr. E. Amamoo-Otchere

Some portions have been cropped and that the exercise was to get database of which decisions can be made. However, the owner will be involved before the project takes off

Q) Mr. Isaac Asamoah (WRC)

Has the water to be used for the rice project been tested for quality?

A) Dr. E. Amamoo-Otchere

Hydrologists are part of the project team and they will advise accordingly when the implementation starts.

Q) Samuel Koranteng (VBRP)

Would valuable plant species be destroyed when the project takes?

A) Dr. E. Amamoo-Otchere

The plant species will be thoroughly studied and valuable ones will be maintained

Q) Prof. Dr. Karl Harmsen - UNU

Will the project consider market centers accessibility?

A) Dr. E. Amamoo-Otchere

Yes, this will be taken care of under the socio-economic data collection and analysis.

Q) Mr. Allotey -Hydro

Why is there no information on animal species.

A) Dr. E. Amamoo-Otchere

This is yet to be obtained.

Q) Dr. Konadu Achaempong UNU-INRA

Was CERSGIS involved in the Konongo project for rice cultivation which was later turned to tomato farming?

A) Dr. E. Amamoo-Otchere

No, but this project was to get all the available data for future analysis.

Fourth Presentation

By Mrs. Jennifer Ascidu-Dartey (CERSGIS)

Q) Mr. Isaac Asamoah (WRC)

How often will the database be updated?

A) Dr. E. Amamoo-Otchere

The database is updated continuously because data are constantly being gathered by trained personnel on the field.

Q) Raymond Kisen (GVP)

Have data for the whole country been captured and how accessible are the data?

A) Dr. E. Amamoo-Otchere

The data isn't accessible currently because the project is on going. The project has captured 65% as at June 2007 and hope to capture 100% by December 2007. Public accessibility of the data will depend on the government and the donors.

Q) Mr. R. Gamadeku (Hydro)

Will the data be available to the survey department when all work is completed?

A) Dr. E. Amamoo-Otchere

After all corrections are made the data will be available at the survey department.

Fifth –Presentation

By George Owusu (CERSGIS)

Q) Alhassan Abdulai(SARI)

Could smaller time steps be used instead of the 10 year time steps?

A) Dr. E. Amamoo-Otchere

Yes, it can be done when requested

Q) Mr. Isaac Asamoah (WRC)

Why did the consultant limit river catchments to within Districts since rivers transcend districts.

A) Dr. E. Amamoo-Otchere

It was for each district to know the water resources they have at their disposal for decision making in water resources management at the district level.

Q) EPA

You have not captured clearly the extent of degradation for 1990-2000

A) Dr. E. Amamoo-Otchere

The satellite imagery is yet to be confirmed by visiting the site to determine the extent of degradation

Q) Dr. Barry

How did you get the term macro, midi, mini and micro subbasin?

A) Dr. E. Amamoo-Otchere

It is the basic units use in hydrograph which is based on the river Network ordering system, and it will be given to the hydrologists to redefine it appropriately

Q) Mr. Allotey

I haven't seen any GIS- driven community watershed as the title states.

A) Dr. E. Amamoo-Otchere

That is the project ultimate target but for now, the exercise is on data collection.

Q) Prof. Karl.

It is very important to have one legend to classify all the information on the map.

A) Dr. E. Amamoo-Otchere

We have taken note of that.

Sixth Presentation

By Mr. Benjamin Akutteh (CERSGIS)

Q) Prof. Karl.

How often is the information in GIS updated?

A) Mr. Benjamin Akutteh (CERSGIS)

The MOFA staff were involved and trained to pick data for periodic update of the database.

Q) Mr. Allotey

How were the farmers' responses to the data received from them?

A) Mr. Benjamin Akutteh (CERSGIS)

The farmers have been involved from the scratch and everything was well explained to them with assurance of security of the information given. So the responses were excellent.

Q) Mr. Allotey

Has there been any increase in the activities of the farmers after the exercise?

A) Mr. Benjamin Akutteh (CERSGIS)

Yes, there has been tremendous increase and we often hold workshops with them.

Presentation Day 3

By Dr. Antwi,(SRI)

Q) Dr. Barry

Has the output of the erosion model used been compared with the output of RUSLE 2 software.

A) No, because of the high cost of the software it costs about 1000 Us dollars per year

Q) Since the Pb and Cs 137 output differ, how can the result be used to advice farmers against soil erosion measures.

A) The two models need to be run on each soil sample and the best will be used to advice the farmers.

Q) Is there any study which will give the soil formation rate for each soil type in Ghana? If there is then have you tried to compare your soil loss result with the soil formation rate in order to come up with the conclusion whether we need to make conservation measures or not?

A) We don't have a study which shows soil formation rate of each soil in Ghana. We need to undertake such a study.

Q) What is the policy implication of the soil erosion modeling exercise?

A) It helps to identify the hotspots for the erosion control measures

List of Participants and Contact Information

	Name	Organization	E-mail	Phone number
1	Samuel Nortey	Institute of Mathematical Sciences	ssamnot@yahoo.com	0246145490
2	B.O. Antwi	CSIR Soil Research Institute	boantwi2003@yahoo.com	0244848538
3	Gurneesh Bhandal	UNU-INRA	Gurneesh.b@gmail.com	024 530 2615
4	Alhassan Lansah Abdulai	CSIR – SARI	alabdulai@yahoo.co.uk	0244577646
5	Gamadeku Richard	HSD	ygamosgh@yahoo.com	0243236932
6	Foster Mensah	CERGIS	fmensah@ug.edu.gh	0243352468
7	Dr. Kankam-Yeboah	WRI	kyeb59@yahoo.com	287298328
8	Barry Boubacar	GLOWA/IWMI	b.barry@cgiar.org	+233 244272525
9	Tobias Landmann	University of Wuerzburg,	Tobias.landmann@uni-wuerzburg.de	+49-931-8884796
10	Prof. Karl Harmsen	UNU-INRA	karlharmsen@yahoo.com	
11	Konadu Acheampong	UNU-INRA	Acheampong@inra.unu.edu.gh	0244717491
12	Mr. Isaac Asamoah	WRC	gзорis2000@yahoo.com	244266187
13	Samuel S. Koranteng	VBRP	skoranteng@ug.edu.gh	244721188
14	Ebenezer Alloty	HSD	ebenallotey@yahoo.com	0277438230
15	Andoh Harris Francis	Centre for African Wetlands	andoharns@gmail.com	0244672036
16	Kafeu Quashigel	GMET	k-quashigal@yahoo.com	0249924071
17	Z. Minia	GMET	Minia.zin@yahoo.com	0243658291
18	Dilnesaw Alamirew	UNU-INRA/GVP	dilnesaw@yahoo.com	+233246739851
19	Barnabas Amisigo	UNU-INRA/IWMI	barnyy2002@yahoo.co.uk	0243947476
20	Mr. Raymond Kasei	GVP	rkasei@uni-bonn.de	208122243
21	Sheila Ashong	EPA	sashong@epaghana.org	0244440476
22	Emmanuel Obuobie	GLOWA	obuobie@yahoo.com	0249803753
23	Dilys Sefakor Kpongor	UNU-INRA	kpongor@yahoo.com	0244090502
24	Dalohoun N. Daniel	UNU-INRA	dalohoun@merit.unu.edu	0246887731
25	Foster Asante	CERGIS	fosant@yahoo.com	0277404449
26	Henry Wallace	CERGIS	kobbywallace@gmail.com	0243614122
27	George Owusu	CERGIS	georgeseny@gmail.com	0243053574
28	B.O. Antwi	SRI	boantwi@yahoo.com	024848538
29	E. Amammoo-Otchere	CERGIS	eammoo@ug.edu.gh	
30	Benita Anderson	VSD MOFA	btdjagmah@yahoo.com	0244073030
31	Jeniffir A-Darty	Cergis	jadartey@ug.edu.gh	0243450694
32	Benjamin Akuntteh	Cergis	akuetteh@ug.edu.gh	0244375263

Schedule
Data Management and Application of GIS and Remote
Sensing in Natural Resources Management Training
Workshop

Dates: Wednesday, September 26 – Friday, September 28, 2007

Venue: Centre for African Wetlands
University of Ghana, Legon
Accra, Ghana

Chairman,

Dr. Barry Boubacar (IWM/ Coordinator , GVP)

Day 1, Wednesday, September 26, 2007

08:00 Arrival of Guests, Registration, Distribution of Program Materials

09:00 Formal Opening of Meeting
Prof. Dr. Karl Harmsen (Director, UNU-INRA)

09:10 Introduction of Workshop Activities
Dr. Dilnesaw Alamirew (GVP/UNU-INRA)

09:20 Meteorological data collection, storage and management by GMA
Mr. Minia (Ag. Director General , GMA)

10:00 Discussion

10:40 Coffee Break

11:00 Hydrological data collection, storage and management by HSD:
Mr. Wellens Mensa (Director, HSD)

11:40 Discussion

12:20 Hydro-Meteorological data collection, storage and management by GVP
Mr. Raymond Kissea (GVP)

13:00 Lunch

14:00 Discussion on GVP's presentation

14:30 Hydro-Data gap in-filling I
Dr. P. Gyau-Boakye (Chief Executive, CWSA)

15:10 Discussion

15:50 Hydro-Data gap in-filling II
Dr. Barnabas A. Amisigo(GVP/WRI/UNU-INRA)

16:30 Discussions

17:10 End of Day 1

Day 2, Thursday, September 27, 2007

09:00 Application of GIS and Remote sensing in natural resources management in
Ghana
Dr. Amamoo Otchere (Directo, CERGIS, Legon)

10:00 Discussions

10:50 Coffee Break

11:10 Remote sensing and GIS application in GVP I with discussions
Dr. Tobias Landmann (GVP)

13:00 Lunch

14:00 Remote sensing and GIS application in GVP II with discussions
Dr. Tobias Landmann(GVP)

15:30 Coffee Break

16:00 Remote sensing and GIS application in GVP III with discussions
Dr. Tobias Landmann(GVP)

17:00 End of Day 2

Day 3, Friday, September 28, 2007

09:00 Remote sensing and GIS application in GVP - demonstrations with discussions
Dr. Tobias Landmann (GVP)

10:30 Coffee Break

11:00 General Discussions

12:30 Closing Remarks

13:00 Lunch and End of Day 3

