

REPORT ON UNU-INRA AND GLOWA VOLTA TRAINING WORKSHOP



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

AT
Sasakawa Centre, University of Cape Coast
FROM
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1.0 INTRODUCTION

Assessment of future socio-ecological consequences of land-use policies is useful for supporting decisions about what and where to invest for the best overall environmental and developmental outcomes. However, policy makers are challenged with inherent complexity of coupled human-landscape systems and the long-term perspective required for sustainability assessment. Multi-agent system models have been recognized to be well suited to express the complex dynamics of land-use change in response to policy interventions.

This short training course aims at providing trainees with basic concepts, principal and practical steps of multi-agent based modeling of land/water use change. Different versions of GLOWA-Volta Land Use Dynamics Simulator (GV-LUDAS) were used as show-cases. With an exploratory modeling strategy for complex integrated systems, researchers with the GLOWA-Volta project in ZEF, developed GV-LUDAS's to enable the assessment of relative impacts of policy interventions by measuring the long-term landscape and community divergences driven from the widest plausible range of options for given policies.

Thirty-one participants from various institutions in Ghana and Burkina Faso took part in the 3-day training workshop on the use of Multi Agent model at the Sasakawa Centre, located in the University of Cape Coast, Ghana, from 26-28 May, 2009. The training workshop involved presentations from resources persons Dr. Quang Bao Le and Julina Schindler of the Centre for Development Research (ZEF), University of Bonn, Germany. The workshop was opened by Prof. Karl Harmsen, he welcomed participants and asked them to critically evaluate the model for the resource person to have some feedback that will help them improve it.

Workshop Process

At the start of the workshop participants' were asked to introduce themselves, after which their views were sorted about their expectation and what they tend to achieve at the end of the training workshop. These are the views expressed by the participants:

- To see how the computer system can be used in the modeling of land use processes (wants to see the demo of the simulation project)
- Find out what the model is about and how it can be incorporated into the various fields of work.
- Learn how habitat suitability model can be used within the context of this model.
- As a key partner in the GLOWA project, the training workshop would help keep institutional linkages. Also, we want to learn about this model and how it can shape policy, which would lead to an improvement in livelihoods.
- See how information is provided on land use dynamics.
- How LUDAS can be applied on the field.
- See if mathematical equations such as partial differentials can be used in this particular modeling.
- See the effects of policy, water, climate change on land use change.
- I would want to know how user friendly this particular model would be and how easy it would be to get this software to purchase.

- What LUDAS has to offer in terms of sustainability, and whether it has anything to offer practically on the ground.



Figure 1. Participants at the workshop

After each participant expressing his expectation of the workshop, the resources persons continued with a presentation on land use and land cover change in the basin looking at the magnitude, causes, consequence and complexity. It was explained that degradation in the basin may affect the country's GDP. Some of the impact of degradation identified are disease risk, biodiversity loss, climate change and water stress.

A lecture was given on the approaches of land use and land cover change modeling. During this lecture, the resource person presented a wide range of definition of a model, its characteristics, gave reasons why we model and key characteristics of model simulation. Additionally, concepts of multi-agents modeling, methodological problem and requirement of a model was presented. However, it was iterated that land use change is a complex process but in modeling, it's possible to look at the agent, environment and community involve in the process. The pro and cons of multi-agent simulation were examined.

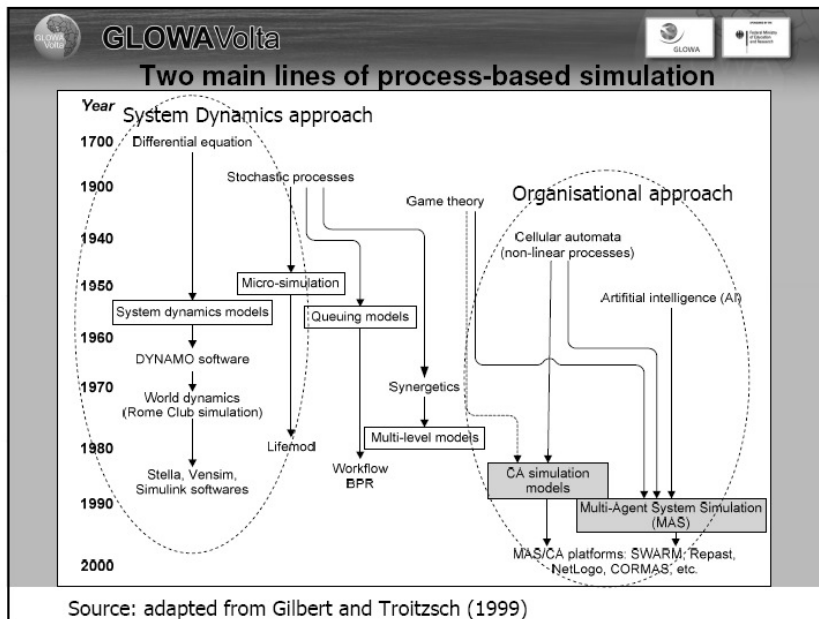


Figure 2. Lines of process-based simulation

Participants were introduced to object oriented programming, the complexity, fundamentals and the ability of object oriented programming to represent complex systems using NETLOGO software.

The overall LUDAS framework was presented and demonstrated to participants. LUDAS is a land use dynamic simulation modeling framework. LUDAS attempts to couple human and environment systems, by examining state variables at different scale. LUDAS model is interdisciplinary in character; it combines social and biophysical processes to model land use dynamics. LUDAS prototype (GV-LUDAS) on the Atankwidi basin in the Volta Basin was presented.

On the last day of the workshop, participants continued with lecture and hands-on training in modeling with LUDAS for half a day. The rest of the day, a trip was organized to Kakum Forest reserve, Cape Coast and Elmina Castle. The workshop came to an end with evaluation of the course and some suggestion.

Suggestions

The model and questionnaires would be sent to experts. What /who should be contacted

- Since participants are from institutions with expert knowledge on these issues, they would be able to suggest people and organizations.
- In the absence of projects, questionnaires would yield no results. These participants are the ideal group to contact since they have been introduced to the model in its early stages of development. This group has an interest so should be contacted in the future. Policy makers have not yet been invited because this stage is still too technical that is why universities have been invited at this stage

- At a point in time, when this project is continued, policy makers should be involved in it before the outputs are generated.
- Within the context of the project in the Volta basin, use VBA as a root contact with projects within the basin, since they have common interest in the basin.
- If email addresses, names, institutions of participants can be generated, this platform can be used to foster further discussions.

Subsequent training programme should be organized for people in the programming of NetLogo?

A. That will be dependent on funding.

- Can you use LUDAS without having any knowledge in programming?

Conclusion

Prof. Harmsen closed the workshop and thanked all the participants for their active contribution. He wished them a safe journey back to their respective destination.

2.0 Question, Discussion and Issues

Talk 1- Land Use and Land Cover Change (LULC) In the Volta Basin

Discussions on the Presentation

Q. Definition of land use. The human factor had been made central or the focus to the definition. Would the situation have been different if the human factor is not made central to the definition?

A. Land use land cover dynamics are very complex. The animal element can also be considered because it is intertwined. However, in the context of this model, the emphasis is on the human factor, hence the definition given. The anthill illustration that was given was to emphasize the complexity in land use land cover issues and how difficult it is to predict the nature of the outcomes of these issues.

C. Land use land cover is a term that is relative. A land cover to a particular time could also be seen as a function of land use. An example is a bare ground and a fallow ground.

Talk 2- Multi Agent Simulation Modeling, Concepts, Principles and Direction of Application

Discussions on the Presentation

Q. Apart from the issues of participation, what is the difference between multi agent approach and system approach?

A. System approach does not emphasize agent role.

Q. Approaches to limiting error propagation. In the event of limited data, can this model be used?

Q. How do you use this modeling approach to determine the impact of generations of human and the type of technologies they used on the current state of a piece of land?

Q. Considering the heterogeneity as a major factor in MAS, what is the desired sample size?

A. It is dependent on the objectives of the research or the specific community in question.

Q. What amount of data is needed in terms of time and space in simulation for the MAS?

Q. Do you use the model for predictions and if yes, how accurate are these predictions?

Talk 3- Object Oriented Programming (OOP) Languages. An Approach for Modeling Complex Systems

Discussions on the Presentation

Q. Any reasons for choosing the netLogo over the other computer programmes?

A. It is user friendly.

Q. Is it an open source?

Lab Work 1 (Net Logo)

Q. When do you say modeling is complete?

A. It is dependent upon the one using it. It must be programmed based upon what the research seeks to achieve. The time period can also be specified.

Q. How long does it take to run the programme?

A. It is dependent on how your work has been conceptualized. Smaller areas take shorter times as compared to larger areas.

Q. Can the pixel size be determined?

A. Yes, the number can be changed in the settings. The size is based on what is being study.

- Q. What does it mean by having maximum metabolism of 1 or 5?
- Q. Why is life expectancy within a range and not as a single figure?
- Q. Are there any formulae governing the metabolism and can the equations be gone through?
- A. Yes, but the equations might not be understood by all the participants.
- Q. What do the colours in the diagram indicate?
- A. Red – poor
Green – better off
Yellow – medium income
- Q. How do you save your output?
- A. You can save it in text files. The print screen can be imported.
- Q. What goes in to the determination of the average wealth of a person?
- Q. How do you access the average wealth of an individual?
- A. It is derived from a abstract model which indicates that some are born more wealthier than others.

Talk 1- Ex-Ante Policy Impact Assessment with GH- LUDAS

Discussions on the Presentation

- Q. Is the credit of GHC 20 realistic? And what is this money used for?
- A. Basically for trading
- C. The assumptions on number of dams that can be at a particular place should be done in conjunction with an irrigation expert who will be in the position to do the variations. This will indicate realistically how many dams can be placed at a particular place.
- If the model allows you to increase the number of dams to a particular number and it reflects an improvement in the livelihood of the farmers but in reality, it can not be so, then it is too abstract
- Diversity of the dam's purposes can lead to an increment on the returns on the investment. In the future other purposes such as recreation, fishing among others can be associated with the dams.
- Q. What were the sizes of the dams and inter dam distances in the study area?
- A. The sizes and inter dam distances vary depending on the topography of the land.
- Q. How many dams were in the study area in 2006?
- A. None. Those constructed were non functional.
- Q. The emphasis on the model from the beginning of the training workshop was that the model should be done on things that actually exist in the study area but it looks like things can be imported from other areas to fit into the model.
- A. Importation can be done if the area from which the importation is been done is similar to the study area. If this is done, assumptions would be made and not the actual issues that could exist would be recorded. Hence, the real issues would not be well covered.
- Q. Were there assumptions that the dams could have both positive and negative impacts and issues of rehabilitation?
- A. Yes, rehabilitation issues have been considered but health issues are not.
- S. The assumptions in the model should be highlighted so to aid in the understanding of the model.
- Q. Did the dams fulfill the needs of livestock use in the study?
- A. No
- Q. It was said the LUDAS was not for prediction but it looks like that the scenarios are being discussed are predicting the possible outcomes in the future.

A. The model is not used for prediction or forecasting but as a source of feedback for testing policies.

The scenario being discussed shows the flexibility of the model so that other disciplines can use it to model things that can suit policy issues in other fields. This model is able to test policies which, others are not in the position to do. The focus on the model should be its flexibility.

Q. What was the main purpose of this exercise?

A.

- To provide a decision support mode
- To discover or understand the interrelationships in the human environment system
- Comparison of policy decisions is possible when the model is well calibrated for that purpose.
- The model is still in its developing stages. The recommendations gotten would be inculcated in the further development of the model

Validation Process

Validation is a series of tests that could increase the user's confidence in the usefulness of the model

Discussions on the Presentation

Historical data can be gotten up to the time of the study. This can help to tell whether changes that exist today are as a result of things that happened in the past, based upon that predictions into the future can be done.

The living standard surveys have been made in the past. Some of these data may be useful to the work.

Q. Can't a simple development model be inculcated into this model so as to be able to predict the state of people in future?

A. Model to model comparison is possible. But care must be taken on the quantification of details and what kind of matrix index should be used.

Q. Would this project be continued after the thesis on PhD is completed and how will this model be modeled for other projects? If the project is stopped now, it has not generated enough information which can be worked on.

A. Funding would determine the next course of action.

UNU-INRA and GLOWA Volta

Training Workshop

Title: Supporting Sustainable Land/Water-Use Management in Semi-arid Landscapes of Volta Basin Using Multi-Agent-Based Simulation

Resources Persons: Quang Bao Le (ZEF) and Julia Schindler (ZEF)

May 26th

Course introduction (09:00 – 09:30):

- Background and rationales
- Objectives of the training
- Introduction of lecturers and participants
- Introduction of the training program

Theoretical input I (10:00 – 13:00, including breaks):

- Land-use and land-cover change in Volta basin
- Approaches to modeling land-use changes
- Multi-agent based simulation
- Object-oriented programming paradigm

Lab work I (14:00 -18:00, including breaks)

- Understanding coupled human-environmental system and its complexity through playing with Wealth Distribution model (NetLogo platform)

May 27th

Theoretical input II (08:00 – 12:00, including breaks)

- Overall framework of GV-LUDAS, its use and simple demonstration model
- Regional specification of GV-LUDAS: GN-LUDAS for Upper Eastern Ghana
- Regional specification of GV-LUDAS: BF-LUDAS for villages in Ioba province, Burkina Faso
- Open discussion and planning for lab work in the afternoon

Lab work II (13:30 – 17:00, including breaks)

- Step-by-step extending Wealth Distribution model to represent real community and landscape

May 28th

Applications (08:00 – 10:00, including breaks)

- Policy use-cases
- Ex-ante policy impact assessment with gh-LUDAS (Upper East Region, Ghana)
- Ex-ante policy impact assessment with bf-LUDAS (Ioba province, Burkina Faso)

Lab work III (10:00 – 12:00, including breaks)

- Operation of GV-LUDAS models

Open discussion (13:30 – 16:00, including breaks):

- Feedback on GV-LUDAS: strength, weakness, potential application, possible extensions
- Identification of further training needs related to GV-LUDAS and its related topics

Course evaluation (16:00 – 16:30)

LUDAS TRAINING WORKSHOP
26-28 May, 2009

Participant list

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