



CGIAR Challenge Program on
WATER & FOOD

Nile

Report

Topic Working Group on Spatial Analysis
and Modeling (TWG-SAM)

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1. Introduction and objectives

Many modelers and spatial analysts engaged in the Mekong, Ganges, Andes, Volta, Limpopo and Nile basins are grappling with similar issues:

- How do we get hold of and share quality information?
- How do we integrate bio-physical and socio-economic data?
- What are the best methods to fill data gaps and move across scales?
- How do we select the most appropriate models from the plethora available and transfer these tools and technologies to partners with limited means?
- How do we link different models and build feed-back loops...?

Informal discussions and ad-hoc data exchange have added value to the development of conceptual frameworks and the initial implementation of basin level analyses.

In response to this, a Topic Working Group on Spatial Analysis and Modeling (SAM TWG) has been created. The group is currently led by Charlotte MacAlister, An Notenbaert and Catherine Pfeifer from the Nile Basin. Members from all 6 basins are sharing information, comparing methods, examining and critically appraising each other's work.

The main objective of SAM TWG is to strengthen this community of practice. It facilitates cross-fertilization of approaches thereby strengthening the methodologies applied in the different basins

2. Activities 2011

Activities of the SAM TWG focused on a kick-off meeting in Ethiopia in November 2011, which brought together spatial and hydrological modelers from all the 6 basins, along with key invited experts in the fields of hydrological, spatial and agro-economic modeling. This was followed by two sessions during the 3rd International Forum on Water and Food (IFWF3).

2.1 Meeting in Ethiopia

The meeting in Addis was meant to initiate the activities of the TWG and bring together hydrological and spatial modelers. The objectives of the meeting were the following:

- Identify current spatial analysis and modeling challenges in the different basins;
- Get an overview of approaches used in the different basins and increase the understanding of strengths, weaknesses and limitations;
- Discuss the application and adaptation of existing methods to the specific basin challenges (linking socio-economic / institutional data to the bio-physical world, adjusting hydrological models to the particular basin dynamics);
- Create a community of practice, i.e. network of scientists sharing knowledge, working together and helping each other;
- Come up with a list of cross cutting issues to be taken to the IFWF3.

The meeting had two distinctive parts: a field trip around the Lake Tana Basin, and a more formal meeting in Addis. The complete program can be found in the appendix and the field trip guide can be found on the SAM-TWG wiki.

Field trip

The field trip used field observations as a springboard to launch discussions on particular issues in modeling and spatial analysis. On the first day, the group visited hydrometrological monitoring sites within an experimental catchment and discussed how information from these sources will be used as model input parameters. The group also visited a reservoir constructed for irrigation purposes, of which the whole watershed has been managed to avoid sedimentation. The group observed and discussed in the field, a number of different rainwater management practices that were experienced first-hand.

On the second day, visits included: a traditionally managed irrigation scheme; the Nile Falls close to two hydropower schemes where flow from Lake Tana is managed for hydropower and environmental flow over the falls; and a boat trip to the outlet of Lake Tana close to the Tana-Beles hydropower scheme. Discussions focused on irrigation schemes, hydropower and livelihoods.

The field visit stimulated discussion on data sources, data quality, dealing with groundwater in modeling, the importance of a landscape approach in understanding water and sediment flow, and issues in understanding and quantifying ecosystem service consequences of change.

Meeting in Addis

The more formal meeting started with a plenary session. This first session was very much a knowledge-sharing session. Several participants presented a particular state-of-the art spatial or hydrological technique with potential applications in the basins. All the presentations can be found under “method session” on the wiki.

After the plenary, two separate technical sessions were held, one on spatial analysis and one on hydrological modeling. Both groups came up with an overview of what is done in each of the basins and the major challenges. It was noted that pretty much all of our basins are using SWAT for some purpose and most basins are also using WEAP. A lot of the spatial analysis discussion centered around approaches for ‘targeting and scaling out’. The Volta and Limpopo teams use a Bayesian network approach; Nile uses a statistical approach; whereas Ganges uses a maximum entropy approach. All struggle with workable definitions of and data on ‘success’ and ‘adoption’. See ppt’s on the wiki.

On the second day, the linkage between models was discussed as well as how to include socio-economics. The Nile approach using the Andes ECOSAUT model, building on SWAT and including economic optimization and productivity models, were all presented. Finally the following cross cutting issues were identified:

- Data management

- Uncertainty
- Linking different models
- Scenarios
- SWAT/WEAP models

In this regard several “break-out” group discussions were held. One group focused on ways to go beyond single model use towards linking models. There is indeed a marked interest in introducing economic and social analysis into the spatial analysis and modeling work. There was a session on data management and uncertainty. A last group talked about scenarios. They had an interesting discussion of the Rand Corporation “XLRM” scenario approach:

- X – exogenous factors and risk factors
- L – levers for change, strategies, scenarios
- R - relationships
- M – performance measures

2.2 Sessions at the 3rd International Forum on Water and Food

The SAM TWG led two different sessions at the International Water Forum. The first was a **parallel session**, aiming to:

- presenting the SAM TWG to a broader interest group;
- getting the people who did not join the TWG kick-off meeting involved;
- discuss cross-cutting issues emerging from the meeting in Addis.

The second session was a **share fair session**, in which everybody who had submitted an abstract had the opportunity to present make a poster presentation of their work. All poster were accompanied by a 5-minute introduction from the author’s. This session aimed to:

- knowing what different basins are doing;
- offer a space to exchange ideas;
- expand the topic working group objectives to include the broader CPWF community.

2.2.1 Parallel session

During this session, a summary of the TWG meeting was given. Furthermore 3 cross-cutting issues were discussed:

1. Data management and uncertainty;
2. Scenarios;

3. Landscape dynamics.

These topics were presented by participants of the TWG meeting and then split into smaller discussion group. See IWF3 ppt on the wiki.

For the discussion groups the topic landscape dynamics was split in two: modeling water flow and sedimentation correctly; and integrating socio-economics into bio-physical models.

Data and uncertainty management

This group discussed the data challenges from each basin. In the Mekong the major challenges are the fact that data is hold by private companies and that not all season have images. The Andes has evolved from local based to global data from remote sensing to overcome lack of data.

The discussion focused around global dataset and how to better make use of them. Issues discussed were agreement to share existing global datasets for the major basin? How to improve communication, connections and share approaches? The need of a database system of CPWF as platform to access and share phase 1 data was mentioned as well as the need for tools/metadata standards to facilitate the sharing.

Scenarios

The scenarios group started with defining scenarios as ‘stories about the future to improve decision making’ and ‘a tool to examine alternatives (future)’. In order to build scenarios different tools, such as visioning or storytelling, can be used. It is important to involve different stakeholders in the process so that the scenarios are more likely to be accepted. This is fundamentally different from examining extreme situations.

The group also discussed the XLRM approach.

Landscape dynamics / SWAT

This group discussed what are the new approaches in SWAT in order to better represent the runoff. They came up with the following points :

- The relationship of runoff with topography
- Key message for targeting humid regions in Africa
- Try easier methods, less complicated and most suitable for Africa

Landscape dynamics / linking bio-physical and socio-economic models

This group discussed the different approaches that are used in the different basins, as well as how farmers are modeled within that approach. The Mekong uses a land use optimization model that is run per farming system. Volta and Limpopo use a Bayesian believe network model which at current stage

used two farmer typologies. The Nile uses a multi criteria analysis in which socio-economics are introduced through the mapping of “willingness of adoption”. This is built in a similar way than poverty mapping technique. Then the discussion focused on the difference between the Bayesian and the statistical approach. The approaches to make these methods more dynamic have been discussed. Approaches such as “homologue” or the use of hydro-ecological indicators or the analysis of asset over time can give a hint if the system is near to critical point and therefore dynamic modeling is necessary.

2.2.2 Share fair session

In the share fair session, people were asked to put their posters under the different topics. This approach allowed to identify those topics that would not be covered by the currently identified cross-cutting issues. With the exception of the analysis of multiple reservoirs, all the posters were classified in one of the 3 categories. This session allowed everyone to shortly present their work and deepen their conversation with others depending on one’s interests. This session was a great networking opportunity.

3. Current and planned output

Field guide: a field guide has been produced. It gives an overview of the issues of the Nile.

Community of practice: the TWG has been a great opportunity to discuss approaches, find commonalities, exchange ideas. Lots of interesting discussion already went on and will continue in the future. A mail list of group members has been compiled and these individuals will be subscribed to the wiki-based mail service.

Exchange platform (up-coming): a platform that allows people to exchange information, links and meta-data is in process of being set up. In this way the group can exchange information, data and knowledge.

4. Ideas for 2012

Overview paper

During the meeting in Ethiopia, the idea emerged to develop an overview paper of the different SAM approaches in the CPWF basins. Online discussions are ongoing to develop this idea further.

Explore the development of shared multi-scale scenarios

Discussion around the XLRM approach strengthened the idea of developing common multi-scale scenarios. These scenarios would include elements at global scale which then linked to the six basin-scale scenarios. Each of the scenarios would then be addressed within the respective modeling approaches. Having some common linking factors would enable us to compare findings across basins in a more meaningful way. To develop this idea further, the linkage with global driver TWG should be explored.

Test and improve the ILRI targeting framework

ILRI is developing a framework for targeting and scaling out. This generic framework will be applied in the Nile basin but could be used and tested in the other basins too.

Developing and sharing global data sets

It was agreed, in principle, during the Ethiopia meeting that several members of the group would work together to produce and share new global data sets including climate reanalysis and soils coverage. This is ongoing.

2012 Meeting

The CPWF Andes group have agreed to host the next SAM TWG meeting, planned for July 2012 in CIAT, Cali. Planning and development of an outline budget is now underway.

Training

A lot of interest was shown in a short training on R for spatial analysis and modeling. This could be organized back-to-back with the SAM TWG meeting in the Andes.

Appendix

a. Program of the SAM-TWG meeting in Addis

November 7	In Addis Ababa	who
During the day	Arrival of the participant, pick up at the airport	
16	Deposit luggage (that does not go to Bahir Dar) in Tukul 12	
20	Screening Aljazeera documentary “a legacy of despute” form the “ struggle over the Nile series”	To be announced
November 8	In Bahir Dar	who
5	Pick up to airport (deposit luggage in Tukul 12)	
7	Flight to Bahir Dar	
8.30	Deposit luggage at Ethio-star	
9	Breakfast at Lake Shore	
10	Introduction departure to the Aramba community	Charlotte
11	River measurement (road near to Aramba)	Birhanu
11.30	Aramba community	
	Landscape dynamics	Mulugeta
12	Walk to the meteorological station, lunch on the way	Birhanu
	Farming systems in Ethiopia and the role of livestock (area enclosure, destocking, cut and carry – zero grazing, ...	Amare
	Soil erosion	Teklu
15	Departure to Hamusit	
16	Hamusit micro dam	Solomon/Essayas
17	Departure to Bahir Dar	
18	Check-in Ethio-star	
19	Dinner at lake shore (walk 5 min from the hotel towards the lake) summarizing up the day	Charlotte/An
November 9	In Bahir Dar	
	Breakfast and check out (note the hotel service is not very fast)	
8.	Departure to the Nile Falls (take all luggage)	
8.30	River diversion schemes	Essayas/Seifu
9	Arrival at Nile Falls	
	Historical background of the Nile agreements	Seifu
9.30	Nile fall walk	
	dams and big irrigation schemes in Ethiopia	Solomon
	Hydropower in Ethiopia	Seifu
11	Departure to Bahir Dar	
12	Lunch at Lake Shore	
13	Lake trip	
	Water regulation of Lake Tana	Amy
15	Transfer to the airport	

17	Flight to Addis	
18	Transfer to ILRI/hotel	
Evening	Carlos Sere's goodbye event on ILRI campus	
November 10	In Addis Ababa, ILRI campus	
8.30	Introduction	Charlotte/An
8.45-10.15	Hydrological and spatial methods presentation and "method world café"	5-10 min per presentation see program below
10.15-10.30	Coffee	
10.30-12.30	Methods discussion in small discussion group	
12.30-12.45	Introduction to the basin session	An/Charlotte
12.45-14	Lunch	
14.00-16.30	In two groups, group 1 : hydrological modeling group 2 : spatial modeling Basin presentation Basin discussion and methods Includes coffee break	10-15 min per presentation See program below
16.30- 17	Report from the groups	All
19	Departure to Sishu for dinner	
November 11	In Addis Ababa, ILRI campus	
8.30-9	Identifying between hydrological and spatial modeling	Simon ?
9-10	Break out in groups per identified topic	
10-10.30	Coffee break	
10.30-11	Report from groups	
11-12.30	Up take and partner involvement	Simon ?
12.30-13.30	Lunch	
13.30-14.30	Future of the TWG Wrap-up (lessons learnt, evaluation, closing)	all
13.30-16	Prepare the TWG session, identify topics and speaker for the panel discussion Include coffee break	Only for participants that join the IWF3 in South Africa

b. List of participants

Nile
Charlotte Macalister
Solomon Seyoum
Birhanu Zemadim
Teklu Erkossa
Kindie Getnet
Amare Hailelassie
Catherine Pfeifer
Lisa-Marie Rebelo

An Notenbaert

Jens Heinke

Nancy Johnson

Seifu Tilahun

Essayas Kaba Ayana

Tammo Steenhuis (Cornell)

Dan Fuka (Cornell)

Zach Easton (Virginia Tech)

Andes :

German Escobar

Wouter Buytaert

Natalia Uribe

Volta:

Fred Kizito

Frank Ohene Annor

Ganga:

Andrew Nelson

Martin Van Brakel

Nowsher Ali Sarder

Limpopo:

Manuel Magombeyi

Jean-Marie Kileshye Onema

Patricia Masikati

Victor Kongo

Mekong:

Matti Kumu

CPWF:

Larry Harrington

External:

David Purkey (SEI)

Allan Jones (TAMU)

Dr. Ann van Griensven (UNESCO)

Jetse Stoorvogel (Wageningen University)

Diego Valbuena (ILRI)
