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The Nile Basin Decision Support System

Keynote at the workshop on Information Technologies for a Smarter Water Future

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The Nile Basin Decision Support System

(*Developed during 2007 – 2012*)

The ***Nile Basin Decision Support System*** *is a water resources*

Modeling and decision making software framework that offers:

- ***Tools for storage, processing, interpretation and visualization of water and related data***
- ***Suite of models for simulating river-lake - reservoir systems***
- ***Toolset for analyses of water resources problems, evaluate alternative scenarios***
- ***Suite of tools for generating information needed for decision making***
- ***Toolsets for collaborative decision making in water resources***

The Vision of the Nile Basin DSS *(2001)*

Nile Basin DSS has been envisaged to be a common, computer-based platform for communication, information management, and analysis of Nile Basin water resources.

Coupled with human resources development and institutional strengthening, it will provide a framework for sharing knowledge, understanding river system behavior, evaluating alternative development and management schemes, and supporting informed decision making from a regional perspective

Setting the vision ….

Policy and Strategy Level

- *Provide the Knowledgebase*
- *Serve as informed basis for policy and strategic analyses and dialogues*
- *A platform for communication to facilitate the joint identification of development strategies*
- *Rational support for decision making*

Planning and Management Level: *to support*

- *Identification of cooperative projects that provide mutual benefits*
- *Evaluation of impacts/benefits of alternative plans*
- *Assessments of trade-offs and investment sequencing*
- *Trend analysis and forecasts of the development of hot-spots,*
- *Provide Baseline data and support for environmental management.*

- *Nile Basin DSS is a collaborative effort involving:*
  - *Core team: over 40 experts from Nile Basin riparian countries*
  - *Senior water resources experts from Nile Basin riparian countries (steering committee, regional DSS network, NBI staff)*
  - *National DSS networks: more than 100 multi-disciplinary experts (involved in national applications and testing)*
  - *three major consultancies: development of tool; testing and application of the tool*
  - *World renowned experts (Panel of Experts) and technical advisors*

Setting the Expectations right …. the NB-DSS

1. The DSS: as a communication tool … enabling countries dialogue about the status, future of their WR … creating a common knowledge base
2. The DSS: as a confidence building tool … making all data and information transparent and accessible…. emergence of epistemic community ….
3. The DSS: as an envisioning tool -- enabling countries to imagine their common future on the basis of different scenarios about the state of their most precious common asset - Nile waters
4. The DSS: as a counseling tool -- bringing science closer to the political process -- informing national interests with facts;
5. The DSS: a cultural tool -- reasoned debates; informed disagreements; options generation… expanding the range of choices and possibilities

The End-Users' requirements …

The DSS designed to support water resources planning and management decision making in the focus areas

Water resources development:
Focus on infrastructure (e.g. new dams)

Coping with floods:
focus on flood protection and impacts

Optimal water resources utilization:
Focus on optimal use (e.g. reservoir operation rules)

Energy development (hydropower):
focus on development of hydropower potentials

Rain-fed and irrigated agriculture:
focuses on crop-production and irrigation

Navigation:
Focus on impacts on river navigation

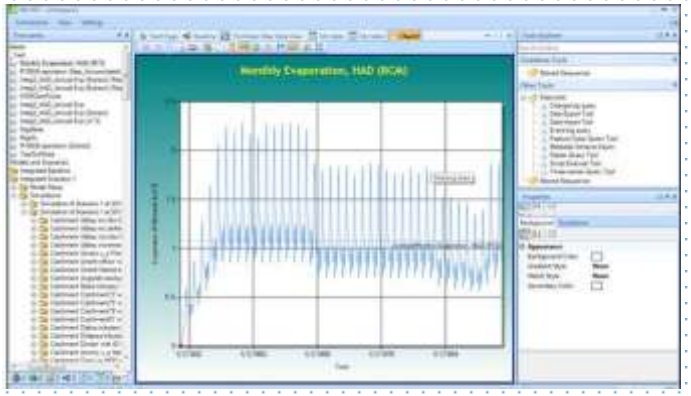
Coping with droughts:
Focus on drought management

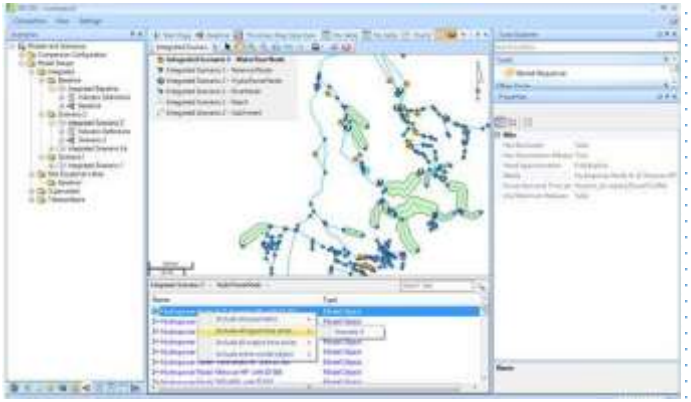
Watershed and Sediment Management:
Focus on land-use, soil erosion, sediment loads

Cross cutting issues :
Climate change and Water quality

Translating the end users requirements into technical design details… is there a limit?

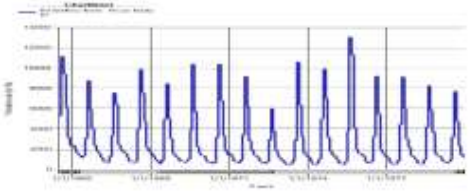
- **Data/information management system:** *Time Series analysis toolkit; Basic GIS functionality; Integrated database; Ensemble generator (for probabilistic analysis);*
- **Modeling System (suite of modeling tools):** *Water balance and allocation model; Rainfall-runoff modeling tools; Hydrodynamic modeling; Soil erosion process model; Crop water requirement; Model linking/nesting tool*
- **Decision making/Analysis tools:** *Scenario management (including indicator calculation); Multi-objective optimization; Economic analysis tools; Multi-criteria analysis tool; tradeoff analyses*

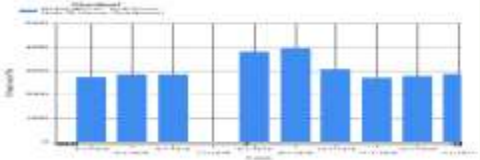


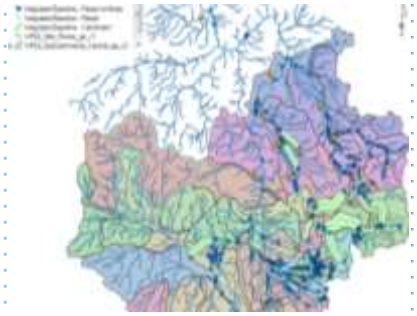


NB Decision Support System ….
not just another modeling tool

Basin hydrology and Changes







Environmental, Social Economics Indicators

Environmental indicators

- **Footprint Areas**. :
  - -Ecologically Sensitive Areas
  - -Carbon emissions
  - -Fisheries Production
- **Downstream Areas**.:
  - -Floodplain/Wetland Area Inundated
  - -Biological Production
  - -Abundance of Pest Black flies
  - -Bank Stability
  - -Recovery Distance
  - -Seasonal Shift
- **Water Quality**. :
  - -Phytoplankton Growth Potential
  - -Aquatic Macrophytes Growth Potential

Water pollution d/s;

Food security and Livelihoods:

Impact on Recession agriculture;

Fish Productivity;

Displacement

Multi-Criteria Decision Matrix, tradeoffs, etc

	Criteria1	Criteria2	Overall	
Score	score	score	Score	Rank
SC 1_1 Baseline	0.655	0.254	0.909	3
SC 1_2 Baseline CC 90 ft flow	0.633	0.220	0.854	4
SC 1_4 Baseline CC 110 flow	0.663	0.291	0.955	2
SC 1_5 Baseline CC 120 flow	0.667	0.333	1.000	1
SC 1_3 Baseline CC 80 ft flow	0.000	0.000	0.000	

Process is vs. the end product … striking the balance?

Needs Assessment and Conceptual Design

DSS Needs Assessment

- Priority focus areas agreed

Conceptual Design

Key components of DSS and their features identified

DSS development plan

- Terms of reference
- Development schedule and budget

Jul 2007 — Jan 2008 — Jun 2008

PSC Approval

Detailed design, development, testing, training, applicatio

Inception | Release 1 | Release 2 | Release 3 | Consolidation

May 2009 — Nov 2010 — Oct 2011 — June 2012 — Oct 2012

Data Compilation and processing, Training, pilot application (national/regional)

Software development process

Development in 3 cycles

Requirements & Release Plan → Design → Development & Testing → Delivery & Acceptance Testing (Client)

Core team inputs

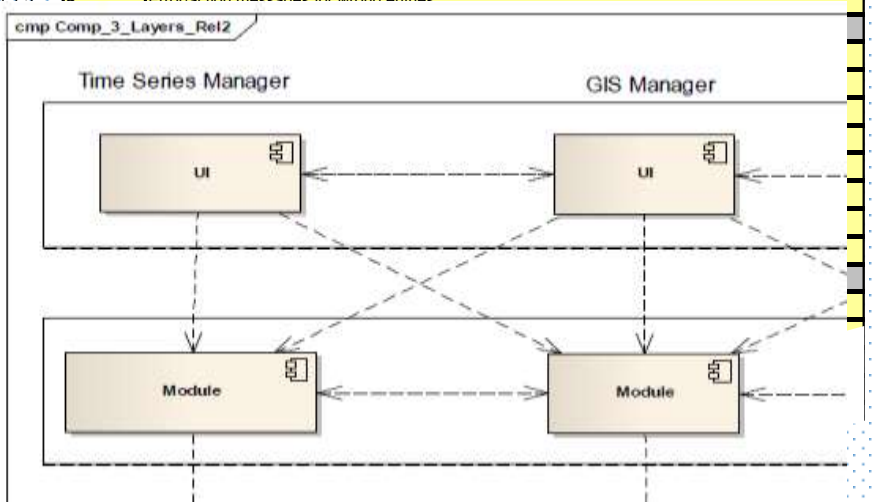
Core team Inputs; Approval

Client monitors

Client responsible

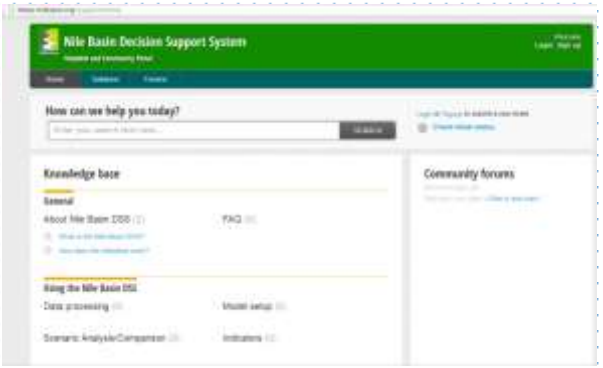
- DSS features described by a list of User Requirements
- These requirements are analyzed and elaborated further together with the client
- Requirements linked to software components
- Design reviewed and approved by client

2		Functional and Non-functional Requirements and Feature Description
2.1		Functional Requirements
2.1.1		Graphical User Interface
2.1.1.1	R	Interactive, fully menu driven graphical, hyperlinked
2.1.1.2	R	Multi-language support (English, French)
2.1.1.3	R	On-line, context-sensitive help facility with an online hierarchical & cross-linked help system in HTML
2.1.1.4	R	Consistent throughout the system



Development of the tool … not an end by itself

- **Support decision making**: respond to the needs of decision makers in addressing key water management challenges. *It should make a difference!*



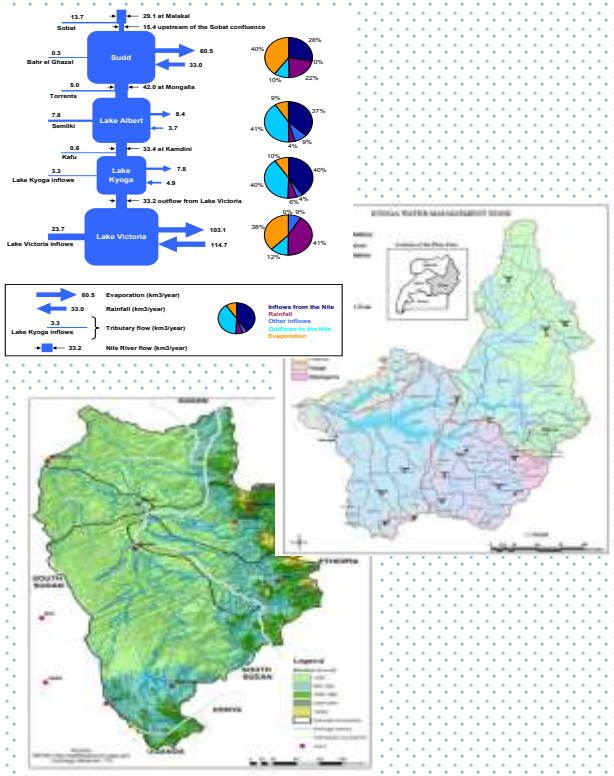
- **Software needs to be maintained to support its continued use**: new operating platforms; ***Maintenance and support arrangements are vital!***

- **Expandable/open software architecture**: to meet emerging user requirements,

- **Continuous user support**: Training – Training – Training; community of practice

Use of the DSS in real life … what do we learn

- DSS licenses distributed to NBI countries
- A few real-life applications of the DSS: modeling framework for NEL region multi-sector investment plan development
- Uganda: Awoja catchment management plan development
- *Currently*: use in development of integrated water resources management and development plan for the Baro-Akobo-Sobat basin; strategic analyses of water resources issues by Nile-SEC



- Persistent efforts needed to champion the tool, demonstrate its use,
- Having a good tool is not enough! continuously provide user support → *need to have a dedicated user support team (Nile-SEC)*
- Success not guaranteed → *get ready for occasional disappointments*
- Improve data, tools and be open to respond to emerging user needs → *the software as a living organism that must be nurtured to keep it alive*

Conclusion and way forward …

- The Nile Basin Decision Support System is a comprehensive analytic framework jointly developed by the Nile riparian countries
- It comprises of software toolsets for information management, modeling and decision making
- A number of DSS applications demonstrated its usefulness
- The software system enjoys a multi-year maintenance and support arrangement
- It has undergone a number of upgrades since it was first delivered in 2012
- A nascent team of DSS users created in NBI countries
- Continuous user support and maintenance of the software system is equally important as the original development of the tool
- **Current efforts of Nile-SEC focus on expanding the DSS user circle through:**
  - DSS web-service
  - Possibly, Mobile Apps for accessing data and analyses results ..