# دور مركز البحوث الهيدروليكية في توطين البحث العلمي السمنار العلمي للعام ١٧:٢٠١ ديسمبر - الخرطوم

## Water Accounting in the Eastern Nile Basin

المحاسبة المائية بحوض النيل الشرقي

Dr. Khalid G. Biro

Khalidturk76@yahoo.co.uk







#### **Overview**

- Project Objectives and Partners
- Remote Sensing Data
- Land-use/Land-cover
- Water Accounting (Approach & SEBAL)
- Evapotranspiration, Biomass and Water Productivity
- Remaining Activities

### **Project Objectives**

The general objective is to assess the spatial changes in water use and productivity, which makes use of the latest advances in water accounting analyses. Also, try to relate these changes with the social and ecosystem services.

#### The specific objectives are to:

- Produce high resolution Evapotranspiration (ET), Biomass and Water Productivity (WP) maps for the Eastern Nile Basin.
- ➤ Make detailed water use maps based on water productivity (i.e. use value per unit biomass: USD/ha and USD/m3).

19-Dec-15 Khartoum - Sudan

### **Project Parteners**

The Project is funded by the Research Program on: Water, Land and Ecosystems (WLE)

- ✓ Led institute is the UNESCO-IHE
- ✓ The International Water Management Institute (IWMI) in Cairo and Addis Ababa
- ✓ Research Institute for a Sustainable Environment (RISE) of the American University in Cairo
- ✓ University of Khartoum, Department of Social Science & Anthropology
- ✓ Eastern Nile Basin Technical Regional Office (ENRTO)







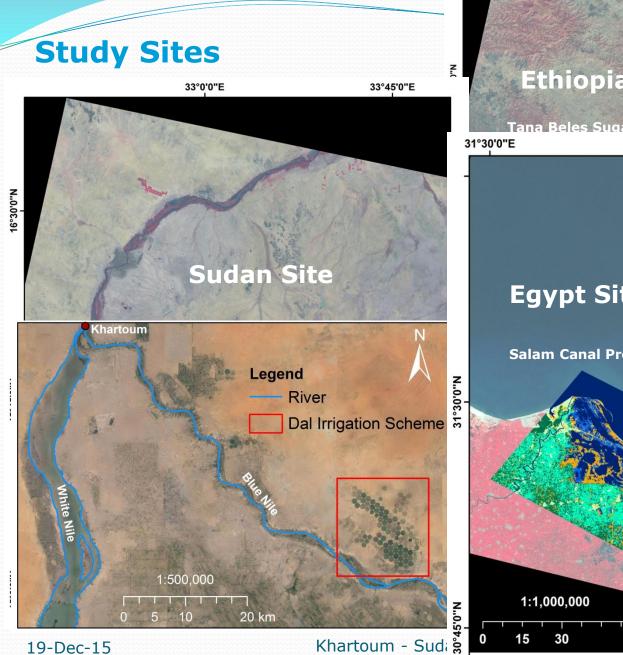
### **Project Parteners**

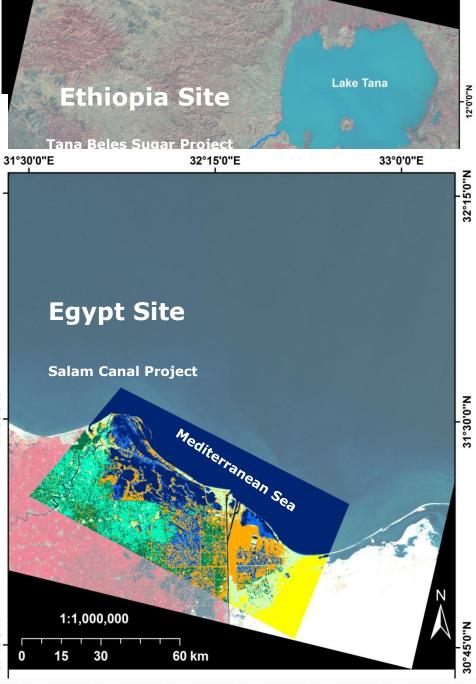
The Kickoff Workshop of the project was hosted by the HRC during: 9-11 March, 2015











36°45'0"E

36°0'0"E

37°30'0"E

### Remote Sensing Data: Landsat (4 – 8)

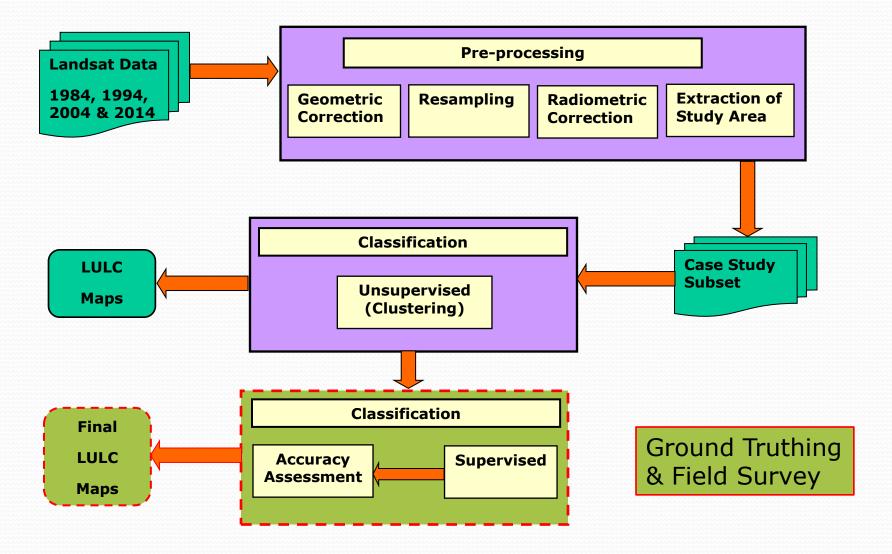
Satellite (Time)	Sensor	Bands	Spectral Range	Pixel Resolution
1982 - 2012	TM multi-spectral	6	0.45 - 2.35 μm	30 m
1982 - 2012	TM thermal	1	10.40 - 12.50 μm	120 m
1999 -2003	TM multi-spectral	6	0.45 - 2.35 μm	30 m
1999 -2003	TM thermal	2	10.40 - 12.50 μm	60 m
1999 -2003	Panchromatic	1	0.52 - 0.90 μm	15 m
Up 2014	Multi-spectral (OLI)	8	0.40 - 2.45 μm	30 m
Up 2014	Panchromatic (OLI)	1	0.50 - 0.650 μm	15 m
Up 2014	Thermal (TIRS)	2	10.50 - 12.50 μm	100 m

OLI = Operational Land Imager

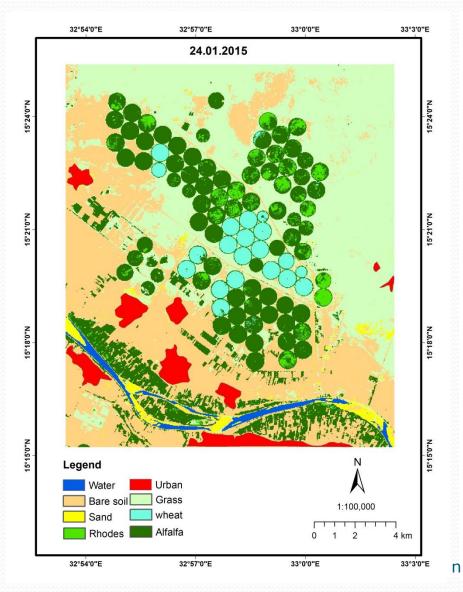
TIRS = Thermal Infrared Sensor instruments

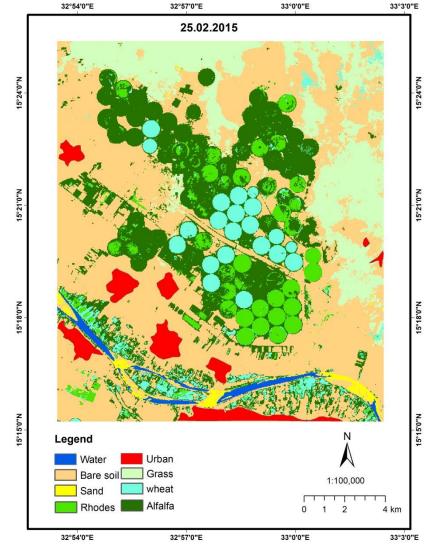
Source: http://glcf.umd.edu/data/landsat/

### Land-Use/Land-Cover (LULC)

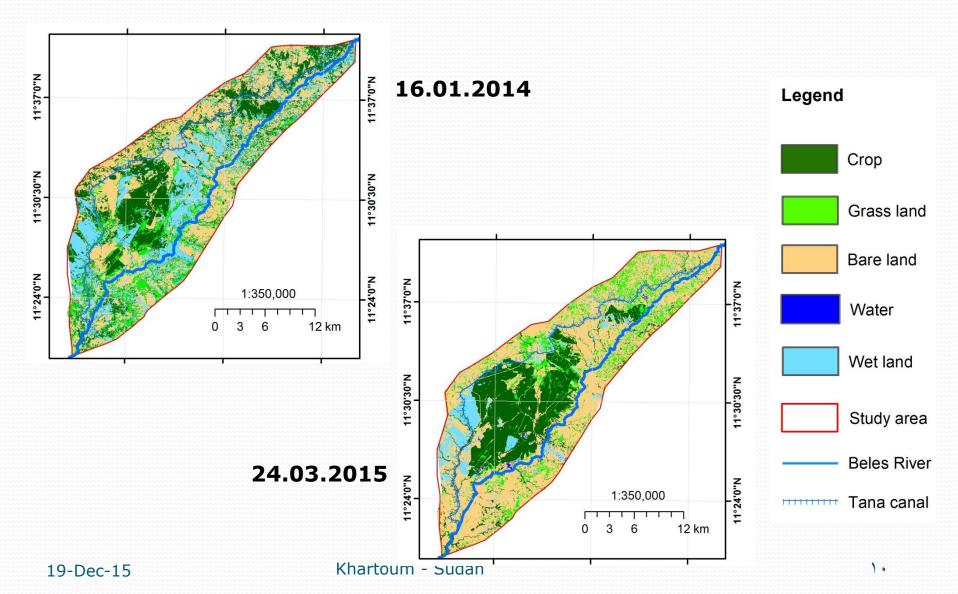


### Land-use/Land-cover Maps: Sudan Site - DAL Farm

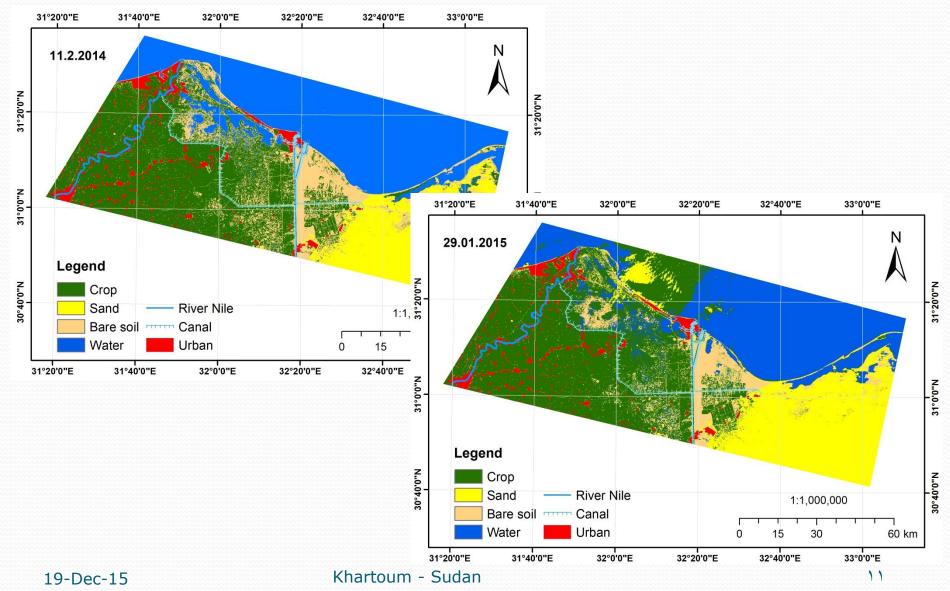




### Land-use/Land-cover Maps: Ethiopia Site – Tana Beles

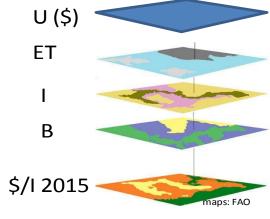


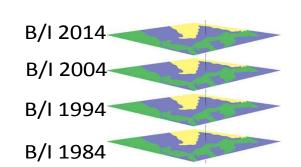
### Land-use/Land-cover Maps: Egypt Site - Salam Canal



# 3. Improved water productivity map 2015 & add WA+ maps 1984, 1994, 2004

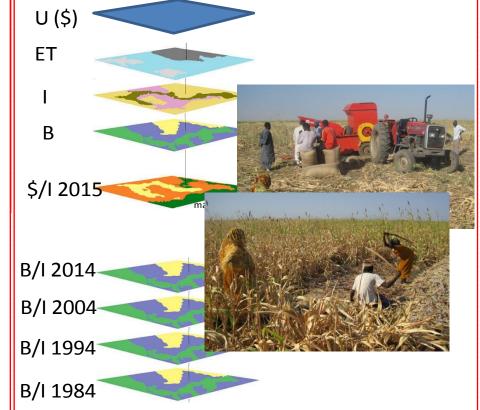
3A. A detailed water use map is compiled and values are assigned per unit of biomass for 2015 3B. Use value based water productivity map (\$/I) for 2014 & B/I maps for 1984, 1994, 2004 to assess change over time





#### 4. Inclusive water accounting

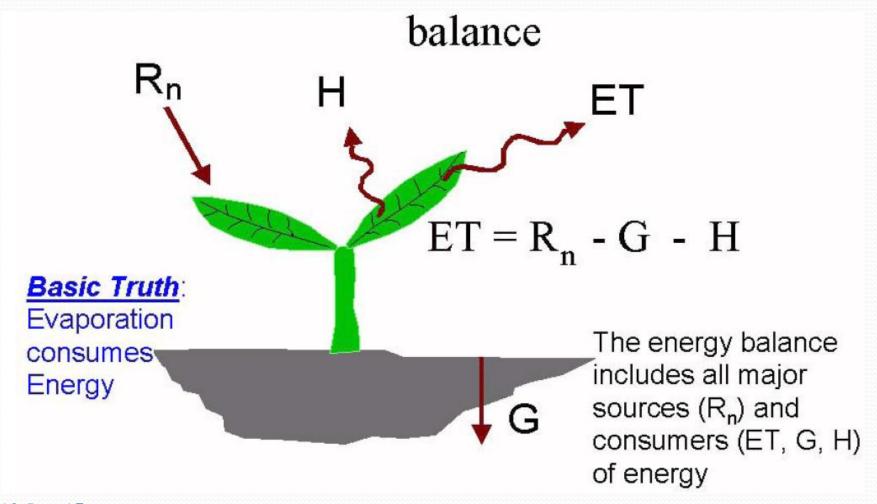
Further analysis of transformation of gendered labor and water tenure / ESS relations to account for variations in the water distribution over space in time, and meaning of (re)distributions for different water user groups



### **SEBAL** (Surface Energy Balance Algorithm for Land):

- RS has great potential for improving irrigation management, along with other types of water management by providing ET estimations for large land surface areas using a minimal amount of ground data.
- □ SEBAL can use images from:
- ✓ Landsat (30 m, each 16 days) since 1982.
- ✓ MODIS (Moderate Resolution Imaging Spectroradiometer) (500 m, daily) –
  since 1999.

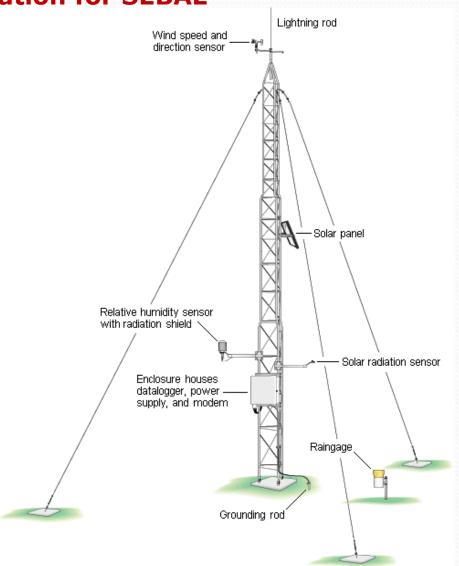
#### The Theoretical Base of SEBAL



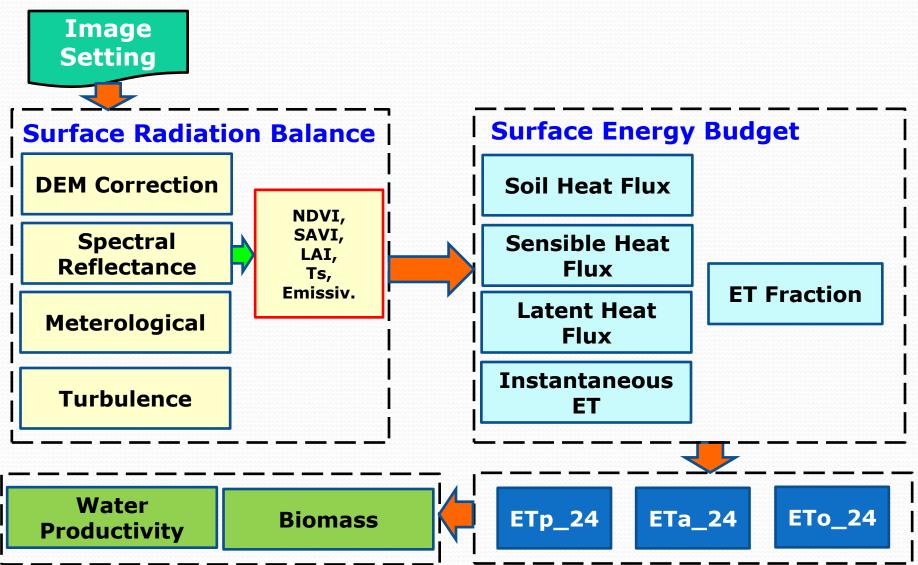
**Data Requirement and Preparation for SEBAL** 

A. Cloudy Free Conditions "Satellite images"

- **B.** Header File Information
- C. Land-Use Map
- D. Weather Data

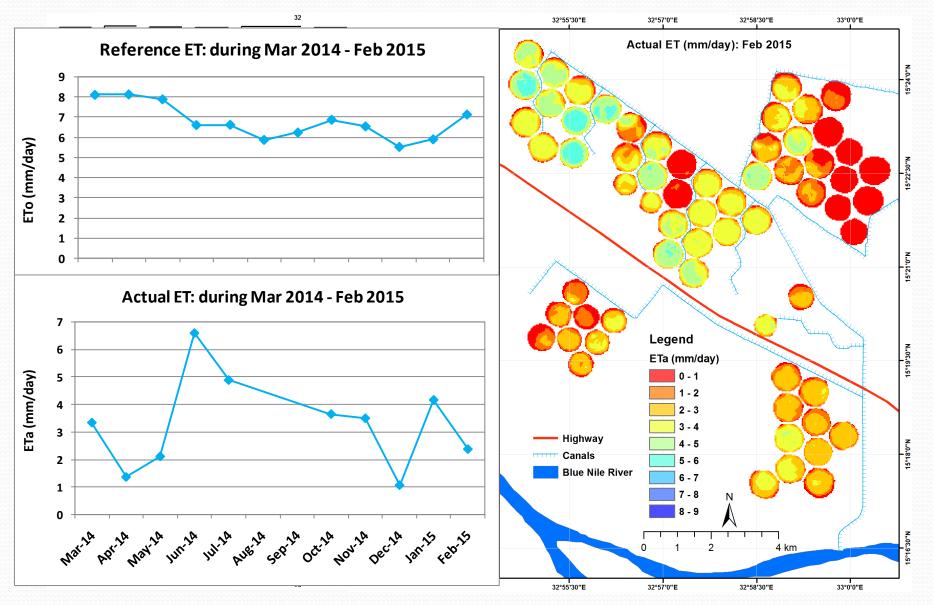


### **SEBAL Model Steps**

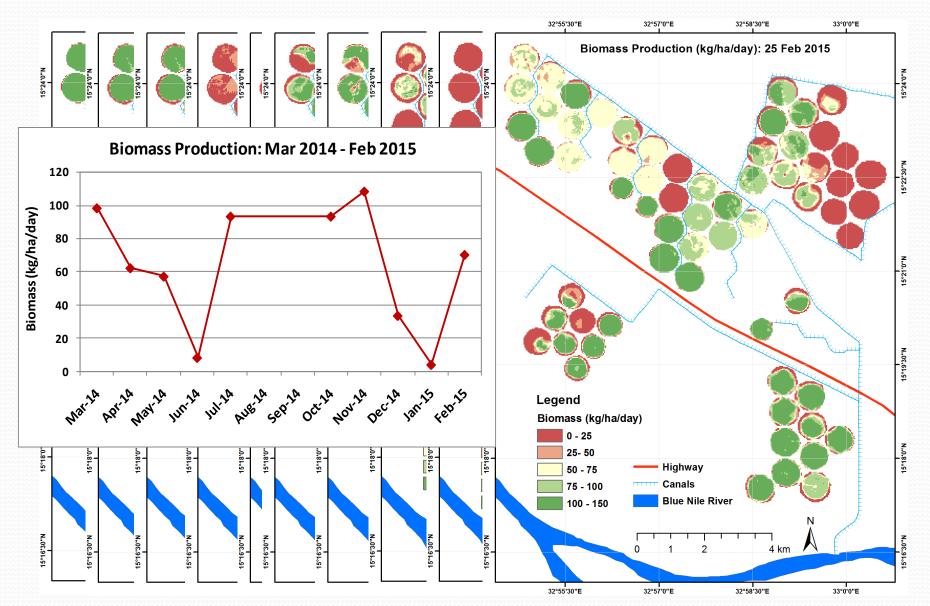


19-Dec-15 Khartoum - Sudan

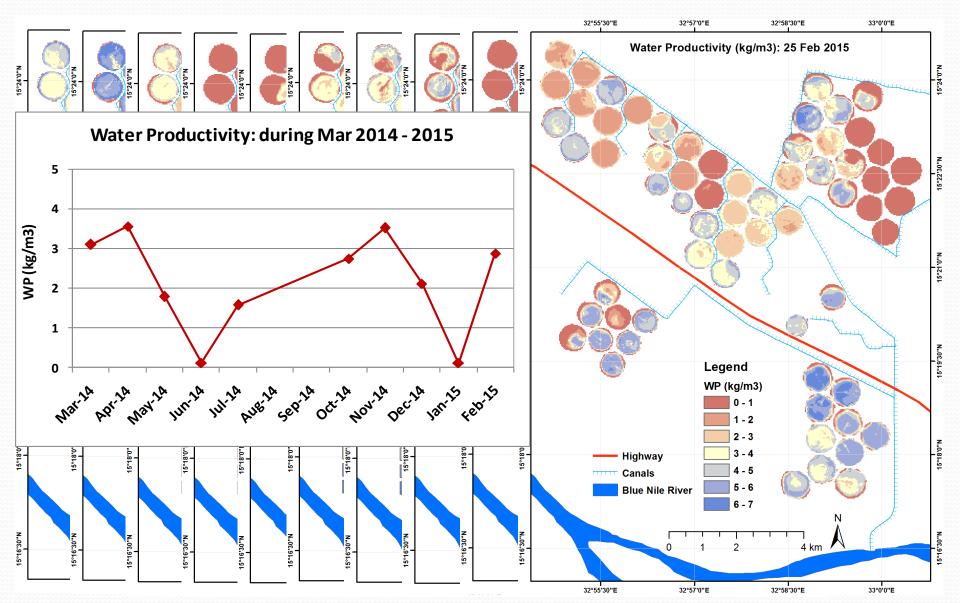
### **Evapotranspiration:** DAL Farm (Alfalfa during Mar 2014 – Feb 2015)



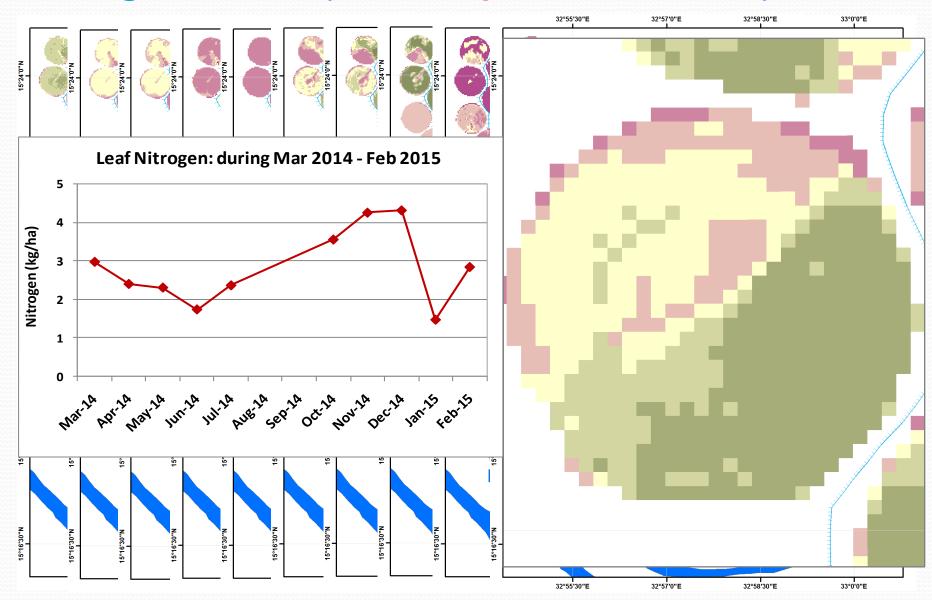
#### Biomass: DAL Farm (Alfalfa during Mar 2014 – Feb 2015)



### Water Productivity: DAL Farm (Alfalfa during Mar 2014 - Feb 2015)



### Nitrogen: DAL Farm (Alfalfa during Mar 2014 - Feb 2015)



### **Remaining Activities**

- ✓ Complete the Water Accounting (WA) products fro Ethiopia and Egypt cases
- ✓ Produce the value maps based on water productivity (USD/m3)
- ✓ Update the WA products for the season 2015/2016 in the three case studies
- ✓ Provide the SEBAL UNESCO-IHE Manual and releasing the code online
- ✓ Regional Training on "SEBAL UNESCO-IHE"
- ✓ Publications

19-Dec-15 Khartoum - Sudan

# **Thank You**