**WATER PRODUCTIVITY USING GIS FOR GHATAPRABHA BASIN**

**INTRODUCTION**

Water productivity is generally defined as crop yield per cubic meter of water consumption, and it became a crucial issue in raising the performance of irrigation, as well as on focusing water saving problems. However, varied ideas are also considering, which needs applicable definitions and analysis. As a result of it represents a ratio between harvesting yield and water use. The main concept of this topic is identifying the factors influencing the Ghataprabha Command area, such as Evapotranspiration (ET act), Normalized Difference Vegetation Index (NDVI), Soil property, Wind Speed, Surface Temperature. These potentials are improving food security by enhancing water productivity.

**Methodology**

**The followings data are important for the research work:**

**Biomass production**

a) Actual Evapotranspiration (ET act)

b) Normalized Difference Vegetation Index (NDVI)

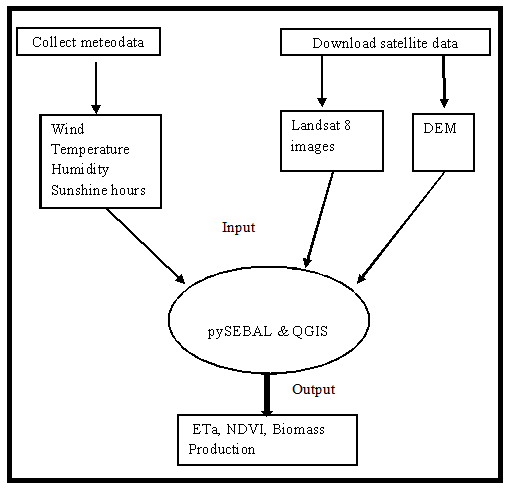
c) Soil Heat Flux

d) Spectral Reflectance

e) Surface Albedo

The above-mentioned information measure vital for distinguishing the condition of space for growing the crop. For getting such information it includes the numerous parameter, which can be 3hrs, daily and monthly information. These parameters downloading through python exploitation scripts.

The pySEBAL of this version automates the image process method. The 3.3.7 version is pySEBAL which contains for brand spanking new development towards up the accessibility by users. The pySEBAL need crop kind map to estimate the particular crop yields and water productivity. A summary of the method chart is given below.

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Flow chart of methodology

**Software Used**

This python software with the version 3.4.0 is instructions to map Evapotranspiration and assess Water Productivity for Landsat imagery (beta version). The pySEBAL model is coded in PYTHON environment and involves heavy image processing. Currently it is being subjected to extensive tests and applications in MS Windows® based system. The recommended system specification is also based on this test:

Hardware

* CPU with 2 cores or above and calculation speed of 2 GHz or above
* Memory of at least 8 GB. 16 GB or above is recommended
* Free storage space of at least 20 GB (frequently exceeding 40 GB) Operation systems
* MS Windows 7 or above (64-bit)

**Installation require for pySEBAL**

OSGeo4W installer is require for this and it is obtain by this link <https://trac.osgeo.org/osgeo4w/>.

Following packages are required to be installed from OSGeo4W: QGIS (LTR), GRASS GIS and qgis- grass plugin. Additional packages required from OSGeo4W: **msys, python-pyproj, python-pandas, python- geopandas, python-scipy, python-tcltk**.

**Setting up Environment variables:**

Setting up the Environmental variables for this Go to “My Computer” properties ->Advanced system settings -> Advanced -> Environment Variables -> System variables

Using with “System variables” add the path if GLDAS data is created and it require to add some more environmental variables

1“PYTHONPATH” set to “C:\OSGeo4W64\apps\Python27\Scripts”

2“PYTHONHOME” set to “C:\OSGeo4W64\apps\Python27”

3“SEBAL” set to “C:\OSGeo4W64\bin”

**Extraction of the Actual Evapotranspiration (ET act) Maps:**

**Actual Evapotranspiration (ET act):**

The actual-evapotranspiration map which is generated monthly wise (Randomly) of Ghataprabha command area for 2017 as shown in figure. The ET act value is mainly depending upon presence of water and Energy available on the surface. Therefore higher value is indicates due to water and lower value indicates due to the dry rock and barren land.

**Normalized Difference Vegetation Index (NDVI):**

The NDVI map is generated monthly wise randomly of Ghataprabha region for 2017 which is shown in figure. The value is mainly depending upon greenery and high chlorophyll content. Vegetation Index in western hill shows higher NDVI and decreases towards northern and southern part due to the less availability of water to grow crops. NDVI is using for knowing the presence of vegetation, near infrared wavelength chlorophyll absorbs more, depending on this condition we identify the greenery areas. Usually the negative values indicate near infrared wavelength.

**Some of the important parameter (Soil and Environmental parameter)**

1. **Instantaneous Soil Heat Flux (G):** The soil heat flux is directly depends on the heat absorption capability of the soil. It is principally relying upon the presence of wetness within the soil. The foremost of the land that is irrigated because of this condition it will increase the value. Northern and Southern region, because of presence of rocky surface value indicated as lower. In the Ghataprabha region the shows about soil heat flux is 202.34 W/m2 and -67.03W/m2.
2. **Instantaneous Net Radiation (Rn):** The amount of incoming solar radiation (Shortwave Radiation) when it enters to the atmosphere from sun, due to the different absorption capacity of features present on the surface of land it absorbs that. After some time the absorbed solar radiation which reflects back (Long wave Radiation) to the atmosphere. Net Radiation is mainly depending upon amount of radiation absorbed by the surface and amount of radiation reflected by the surface. The solar radiation is more due to presence of water bodies and less due to dry rock. The Net Radiation values which indicates higher and lower for ghataprabha region is 602.51 W/m2 and 243.75 W/m2.
3. **Atmospheric Pressure:** Atmospheric pressure is changes differently on Earth, and these variations are necessary for obtaining the weather data. The Atmospheric Pressure for Ghataprabha region maximum is 95.45kPa and minimum is 92.22kPa. The Atmospheric Pressure map shown in figure. Atmospheric pressure is alter by the presence of gases and some of the native effects like wind rate, temperature variations.
4. **Spectral Reflectance:** Different surface regions replicate the sun radiations in several ways. The quantity of reflectivity from a surface will be measured as a perform of wavelength; this is often brought up as Spectral reflectivity. Spectral reflectivity could be a live of what quantity energy (as a percent) a surface reflects at a selected wavelength. Several surfaces replicate completely different quantity of energy in several parts of the spectrum. Maximum and Minimum values of Spectral reflectance is 1 and 0 for Ghataprabha region.
5. **Soil Moisture Wilting Point:** Wilting purpose is that the minimum soil wetness needed by a plant to not wilt. At now, any decrease in soil wetness can end in weakening. Once a plant wilts, its leaves dry out, droop, and wither. Though we have a tendency to typically discuss weakening thanks to lack of water, there also are different causes of wilt to contemplate. Weakening is vital to watch as a plant can die if it passes the weakening purpose. The wilting point values are indicates about high and low are for Ghataprabha region is 0.23m3 and 0.09 m3. The wilting point figure 40 is shown for Ghataprabha Region.
6. **Surface Albedo:** It provides the precious data concerning reflective capability of the realm and conjointly energy consumed by the land. Most significantly lighter color indicates a lot of coefficient and darker color absorb a lot of. Within the Ghataprabha region it's determined that 0.6 could be a higher and lower is 0. The surface albedo can be easily identify due to the higher absorption rate of water and the higher surface albedo are indicated for Dry and rocky surface due to the light color and high reflectivity.

**Extraction of Biomass:**

The Biomass is agricultural waste which is obtaining after the harvesting. This is obtained by the combination of ET act and NDVI. In this only collecting the amount of information about waste. The Biomass of 2017 for Ghataprabha region is shown in figure. For 2017 Biomass value is112.44kg/ha.

**Discussion**

The remote sensing-based approach provides a detailed but also a quick snapshot of what is happening on the ground. To understand the spatial distribution of the results, the information from the field is compared to the pySEBAL outputs. This study collected secondary information to know how WP, yield, ETa changes with each other. The results of CWP assessment are compared with the following factors: administrative boundaries for potential effects on extension services, distance to water bodies, distance to canals and rivers, slope, soil quality, season variations, soil, fertilizer, and seeds.

**Strategies for the future**

* The study can be implement to various crops in the system.
* It gives the idea about Eta, based on this we can take initiative for supplying of water to present year.
* The study can be taken up for both seasons and compare the results with various seasons.
* Along with this modeling (pySEBAL) we can combine different agricultural techniques.