

Water requirement of riparian vegetation in a semi-arid environment

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THESIS PLAN

M.SC. ECOHYDROLOGY

My background

- ▶ B.Sc. Geography
- ▶ Erasmus Mundus M.Sc. in Ecohydrology
 - ▶ "a trans-disciplinary and applied science, is a sub-discipline of hydrology that seeks to understand the ecological processes controlled by the hydrological cycle" (Zalewski 2000)
 - ▶ focused on "an integrated understanding of biological and hydrological processes at a catchment scale in order to create a scientific basis for a socially acceptable, cost-effective and systemic approach to the sustainable management of freshwater resources in a variety of ecosystems and climatic zones" (UNESCO IHP)



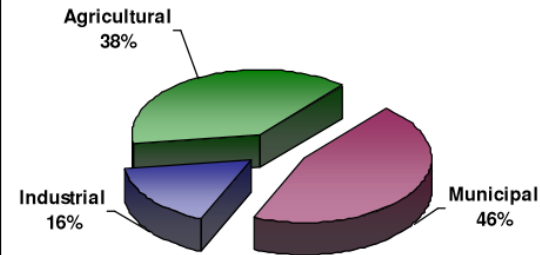
<http://www.ecohyd.org/>

<http://www.unesco-ihe.org/msc-programmes/specialization/ecohydrology-0>

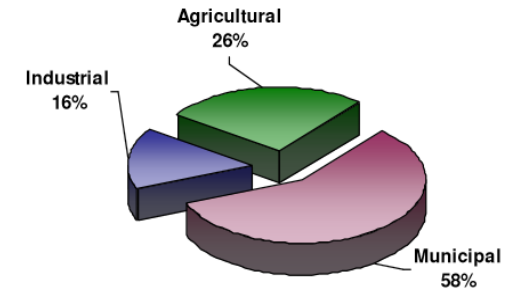
Problem statement

- ▶ Wide parts of the Santa Cruz are fully dependent on the recharge of effluent that supports riparian vegetation
- ▶ effluent is expected to be an even more important part of water resource management in the future
- ▶ the evaluation of water consumption by vegetation can be an important tool for future allocation and trade-off decisions and to ensure water requirements are met to sustain riparian ecosystems and their services

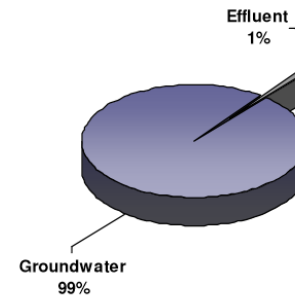
1986 USE BY SECTOR



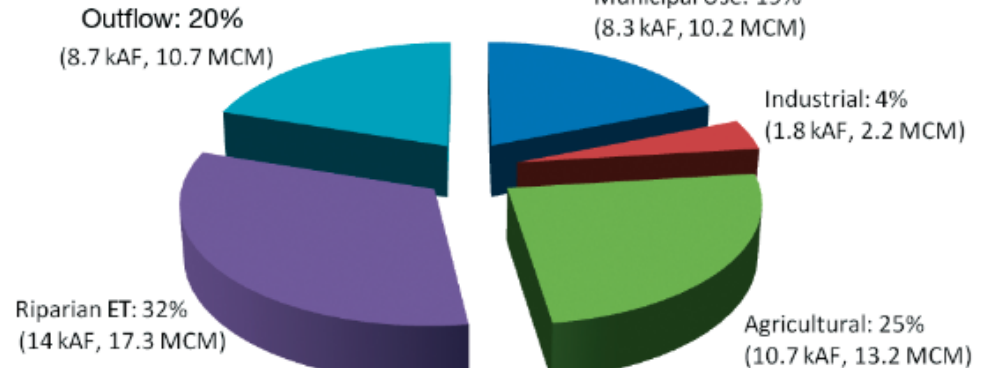
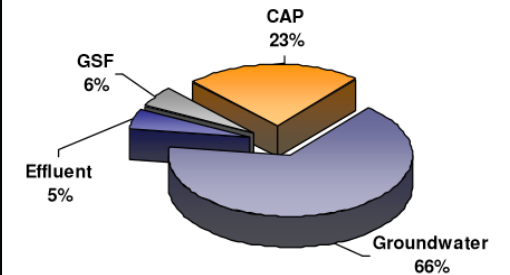
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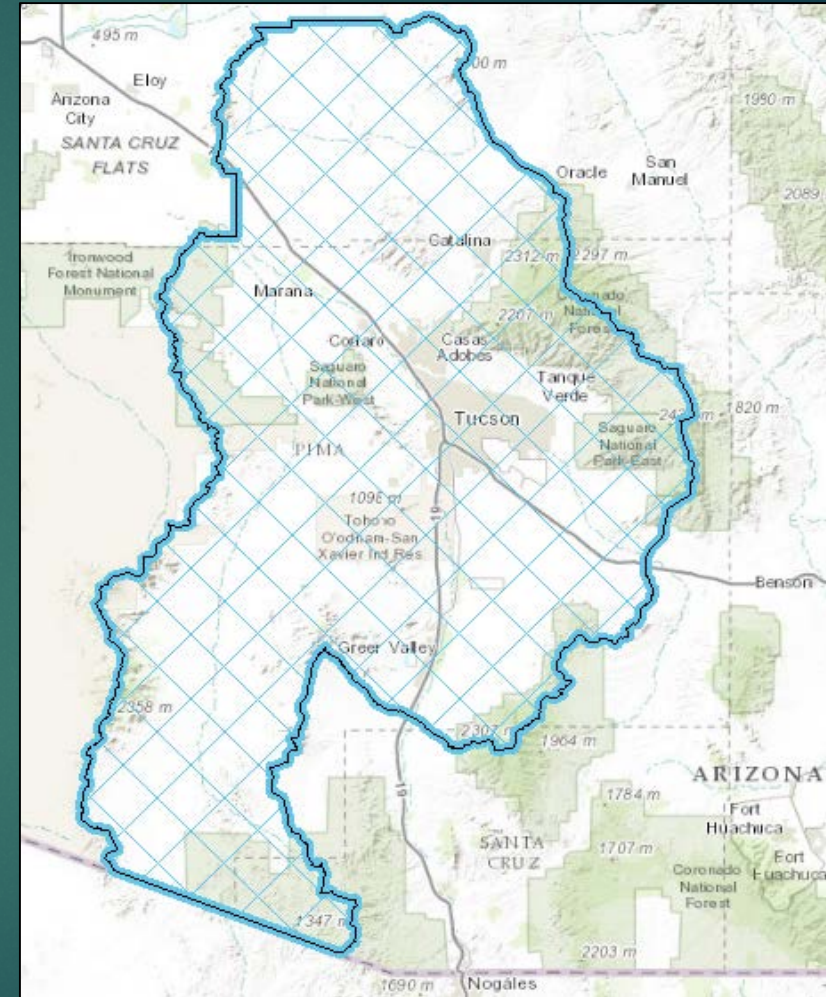
1986 USE BY SOURCE



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LOCATION OF THE SANTA CRUZ RIVER



Overall objective

- quantify the water requirements of riparian vegetation along the Santo Cruz with a special focus on the relevance of effluent for the system in comparison to more natural conditions

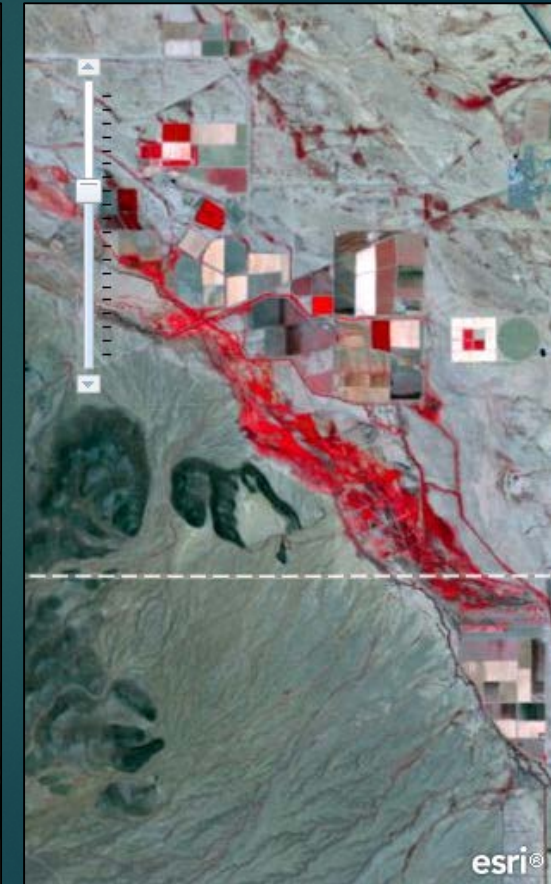
Research questions

- What are the temporal and spatial distributions of actual evapotranspiration throughout the riparian area of the two sections and how do evapotranspiration and therefore vegetation distribution and composition differ between the two sections that are focused on?
- What are the reasons for different evapotranspiration distribution in the section if such are observed?
- What are the hydrological requirements and which predictions can be made about future vegetation development within the riparian corridor of the effluent driven section assuming reduced effluent recharge?

SANTA CRUZ RIVER NORTH OF TUCSON



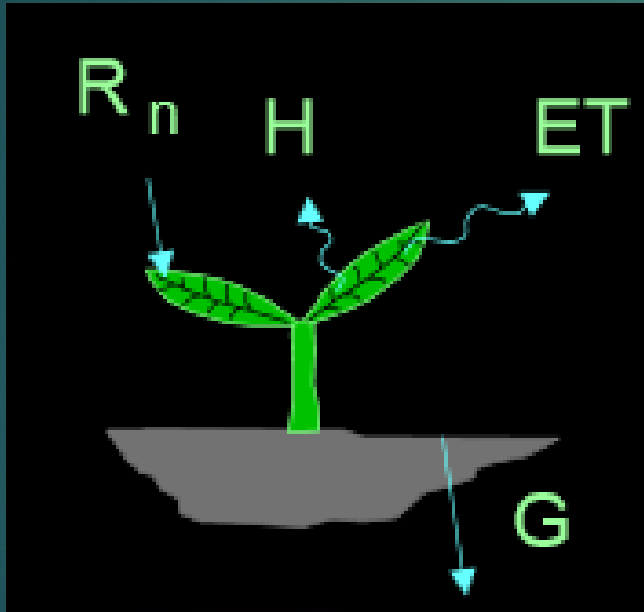
Landsat Infrared



Landsat Infrared

SEBAL- SURFACE ENERGY BALANCE ALGORITHM FOR LAND

- Estimations based on the surface energy balance equation
- Developed by Bastiaanssen in 1990s in the Netherlands
- Widely applied for irrigated farmland

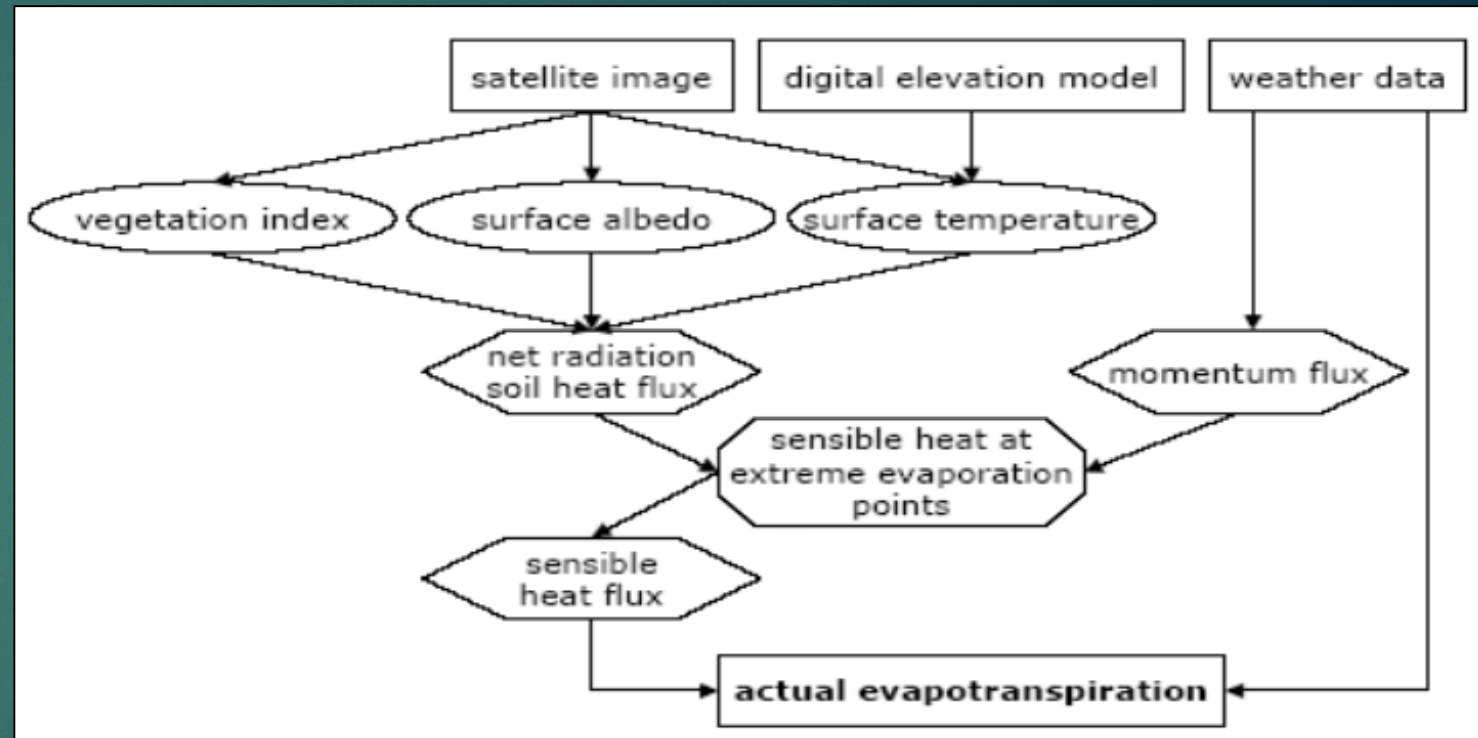


- ▶ $ET = R_n - G - H$
 - ▶ ET = latent heat flux (W/m^2)
 - ▶ R_n = net radiation flux at the surface (W/m^2)
 - ▶ G = soil heat flux (W/m^2)
 - ▶ H = sensible heat flux to the air (W/m^2)

SEBAL- SURFACE ENERGY BALANCE ALGORITHM FOR LAND

▶ Data requirements

- ▶ Satellite data
- ▶ Digital elevation model
- ▶ Meteorological data
 - ▶ Wind speed
 - ▶ Air Temperature
 - ▶ (Humidity, solar radiation)
- ▶ Land use data are recommended



WHAT COMES NOW?

- ▶ Decide on the temporal resolution of the analyses (recent years, dry/wet years, historic comparison)
- ▶ Get more familiar with SEBAL and start the analyses

SUGGESTIONS AND IDEAS

