Conjunctive Use of Water Resources for Integrated Water Resources Management (IWRM) – Integrating Spatial Analysis and Innovative Geomatics Techniques

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INTRODUCTION

Conjunctive use of water resources may be defined as the sustainable management of different water resources, which vary in availability, quantity and quality over time and space to optimize productivity and minimize the risk of failure.

A balanced management decision system demand the following prerequisites:

1. Sufficient information must be available to the manager about the quality, quantity and availability of the water resources in question.The probability of availability of these resources must be known with a certain level of significance to ensure the reliability of the concept.
3. Quantity and quality of the water resources must be predictable and the dynamic process generating their variability of both must be understood.
4. The processes controlling the regeneration of the respective water resource must be appreciated to avoid overexploitation.
5. The water resource must be part of an integrated systems balancing approach.

The main objective of the integrated approach is to promote the management of conjunctive use of water resources as a vital component of a holistic systems approach towards *integrated water resources management (IWRM)* within a *dynamic human framework*.

REQUIRED METHODOLOGY AND TOOLSET:

In order to achieve the integrated objectives, the required methodology and toolsets are:

- A user-friendly integrated geo-relational database management system (DBMS) comprising data from different sources to support the information requirement of the holistic systems approach.A distributed regional hydrological model using the DBMS as an information base to simulate the "real world" water resources balance dynamics integrating "state-of-the-art" Geomatic techniques.A distribution model simulating "what-if?" scenarios to use the different water resources most efficiently.

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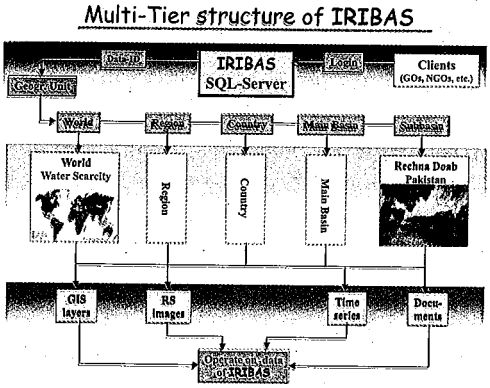
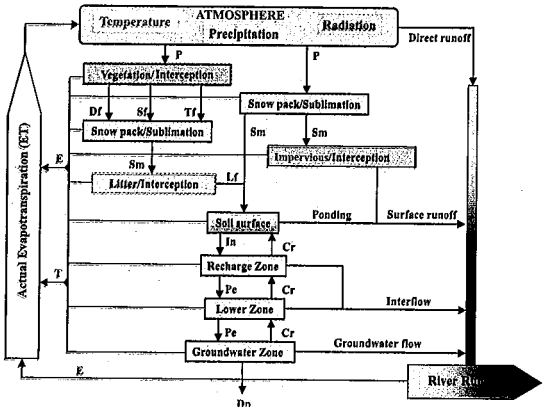
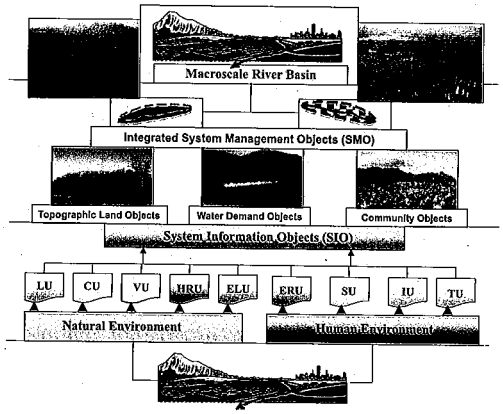
- A user-friendly decision support system (DSS) integrating the various components mentioned above and evaluating various "real world" management scenarios.The following figures explain how integrated and innovative geomatics techniques can be used in conjunctive use



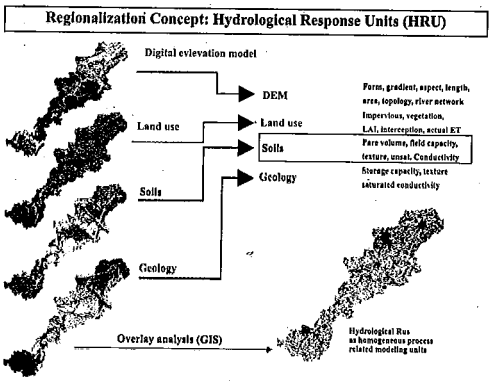
The Figure indicating a multi-tier structure of integrated river basin management showing the data bases, geographical integrity and utility of integrated river basin management.



The Figure explains the conceptual design and storage oriented cascading structure of the regional catchment models.
These models could be used to study the hydrological dynamics of river basins.



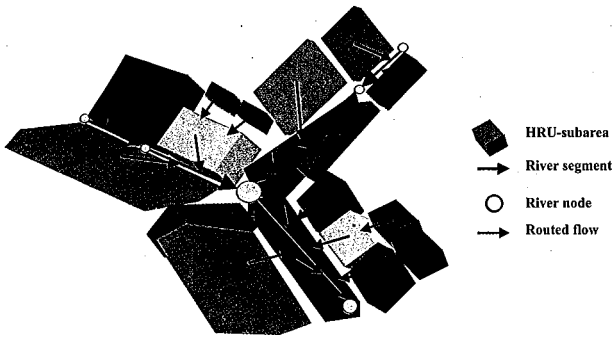
The Figure depicts the distribution of river basin using generic response units (RU) concept, which represents the basin heterogeneity in terms of its natural and human environment.

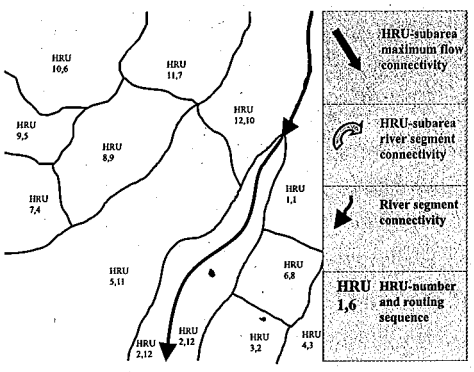


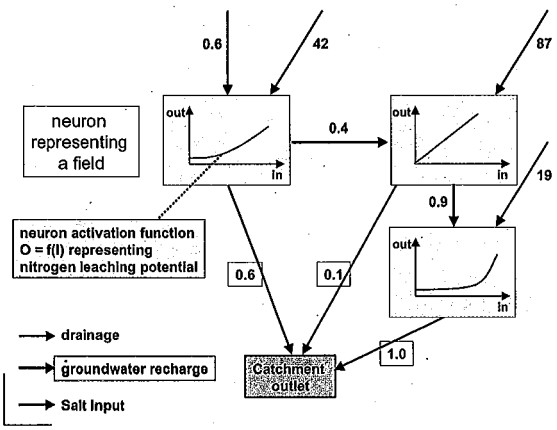
The Figure shows the regionalization concept of hydrological response units using remote sensing (RS) and GIS integration

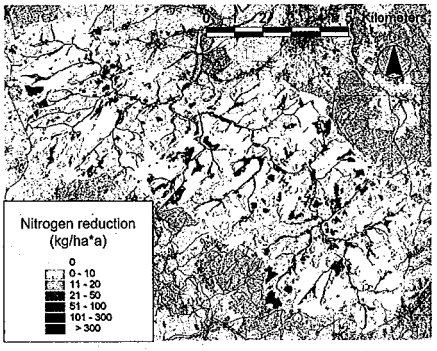
of water resources for integrated water resources management

The following Figures represents the schematics of the topological connectivity of HRU-subareas for routing water, solute and erosion material to the corre sponding adjacent river segment

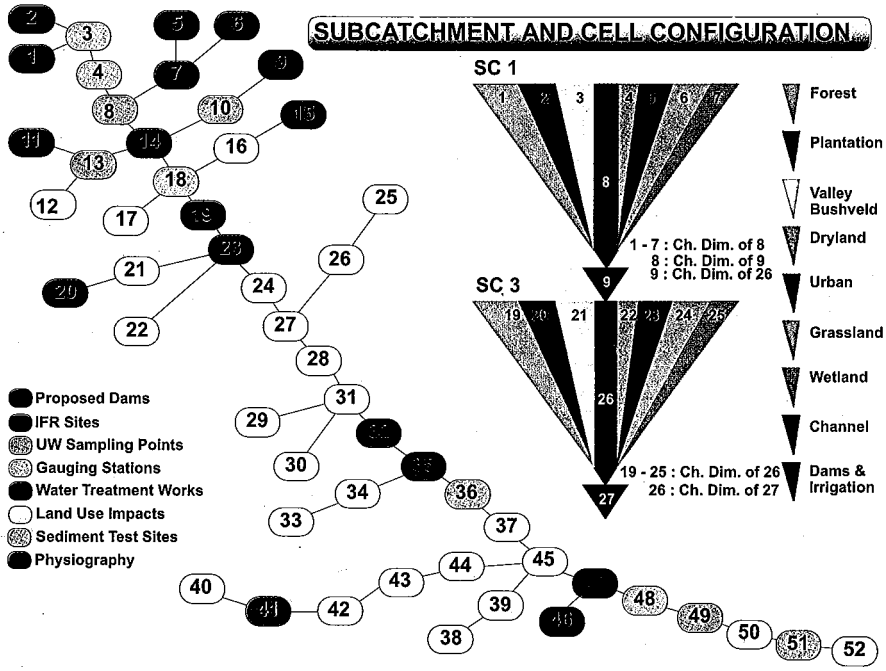




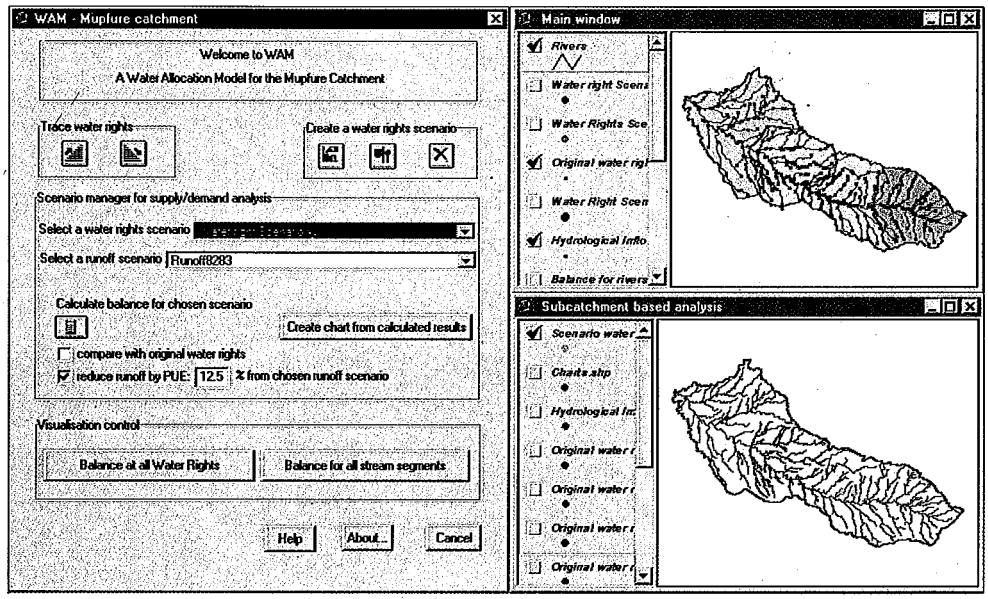




The Figure given below indicates the conceptual model of water resources response units (WRRUs) representing the resource routing and distribution within a command area.



Water allocation model (WAM) using GIS network analysis: Elevating various "what if" scenarios of water allocation in a command area.



CONCLUSION AND FUTURE RESEARCH

A primary task for conjunctive water use must be the establishment of a user friendly DBMS which provides the required information to users of the concept.

Regional hydrological modeling must be carried out to analyse the recharge and balance of the respective water resource as a base of a sustainable IWRM on a basin level.

A DSS must be available to support managers and decision makers integrating the DBMS and the systems modeling for the design of "real world" management scenarios for decision support.

The concept of conjunctive use of water resources must be disseminated and implemented as a common management approach and a strategy to sustain the use and availability of the respective water resource.

Conjunctive use of water resources requires a sophisticated and collaborative approach and this cannot work in an isolated and overburdened environment.