Dynamic Statewide Water Budget

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NEW MEXICO DYNAMIC STATEWIDE WATER BUDGET (DSWB)

The DSWB is an attempt to account for the origin and fate of New Mexico's water resources through time. In order to account for water resources, we must specify both the areas over which the accounting will occur (SPATIAL RESOLUTION), and the smallest amount of time over which accounting terms will be averaged (TEMPORAL RESOLUTION). As is common in formalized accounting methods, we use STOCKS to define how much water of a given type is stored in a given area over a given amount of time, and FLUXES to determine how much water moves from one stock to another, or into or out of the area of interest.

SPATIAL & TEMPORAL RESOLUTION & EXTENT

The spatial resolution of mass balance accounting units (MBAU) is either by County, or by Water Planning Region. WPRs were defined by the New Mexico Office of the State Engineer (NMOSE) and the Interstate Stream Commission (ISC), and are shown on the map below. The total spatial extent will be the State of New Mexico, meaning summing terms across all counties considered, or all WPRs considered will give values at the state level. The temporal resolution of the mass balance is monthly meaning no flux or change in storage information will be available averaged across less than a month of time. The temporal extent will be approximately 1980 through 2010 for data driven historic runs. Future work may include the option to extend this analysis into the future to create scenarios based dynamic modeling of system behavior calibrated to historic data and trends.

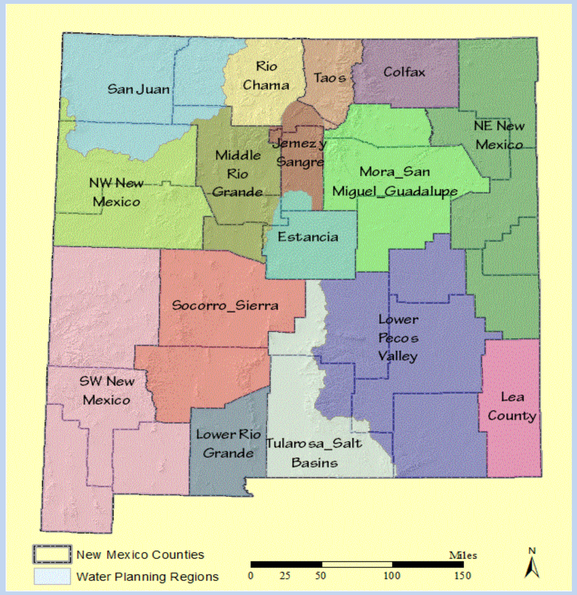

Figure 1. Spatial resolutions of the DSWB model. Colored areas represent the 16 WPR, grey lines show the 33 counties.

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Stocks

Available Surface Water

is water flowing in rivers and other natural water ways that can be diverted or impounded for human use. Available Water comes from stream flows across the boundaries of the mass balance accounting unit (MBAU) in question (State, County, or Water Planning Region), or runoff to streams and rivers from rainfall within the MBAU. Similar to the Land Surface stock, the actual storage of water in this stock will not be calculated, and will not change through time. At each timestep, the fluxes into and out of this stock will be balanced.

Land Surface

The Land Surface system conceptually represents moisture stored in soils and vegetation, and any other surface water source that cannot be practicably diverted for human use. The water stored in this stock is unknown, and will not be calculated in this effort. Change in storage of this stock will be set to zero for all timesteps. Thus, the land surface stock for purposes of this conceptual mass balance is a construct which allows precipitation to be partitioned into recharge, evaporation, and available surface water at each timestep.

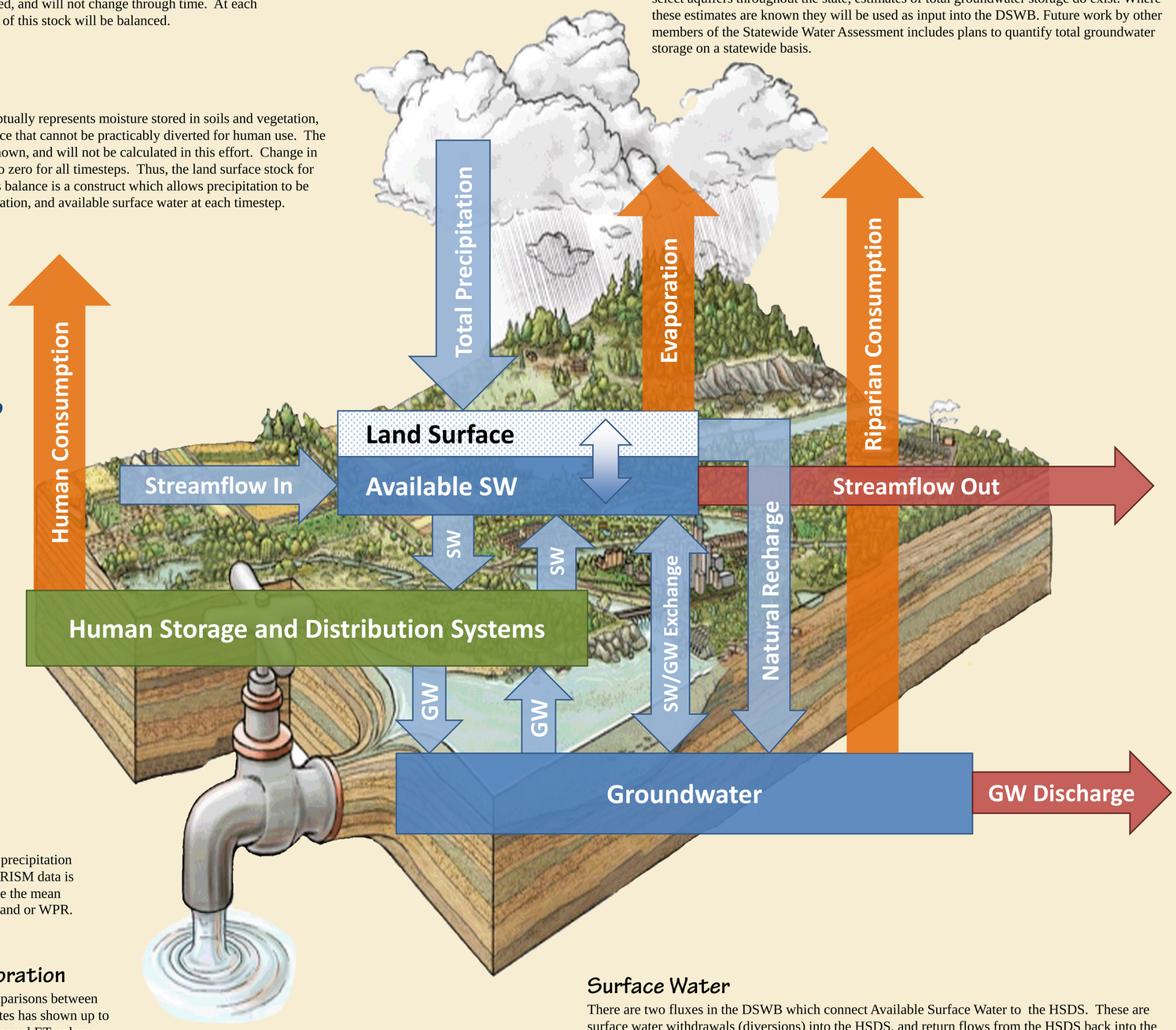
Human Storage and Distribution System (HSDS)

represents water at any given time residing in manmade storage impoundments or distribution systems, such as public water supplies, irrigation canals, and reservoirs. (For purposes of this mass balance, when water is added to storage in a reservoir, it is considered a diversion of available surface water to the HSDS, and when it is released from storage, it is considered a return to the available surface water system.) The fluxes out of the HSDS, including reservoir evaporation are a mix of modeled values and data from the OSE water use by categories reports.

Groundwater

Total groundwater storage for the state of New Mexico is largely unknown. However, for select aquifers throughout the state, estimates of total groundwater storage do exist. Where these estimates are known they will be used as input into the DSWB. Future work by other members of the Statewide Water Assessment includes plans to quantify total groundwater storage on a statewide basis.

Fluxes



Human Consumption

tracks water use in the DSWB model as reported by the OSE water use reports in the following categories:

- **Public Water Supply**
- **Domestic***
- **Irrigated Agriculture**
- **Livestock***
- **Commercial***
- **Industrial***
- **Mining***
- **Power***
- **Reservoir Evaporation**

* **Self-supplied**

Total Precipitation

PRISM data is used for monthly precipitation estimates starting in 1970. The PRISM data is aggregated in ArcGIS to calculate the mean monthly precipitation by county and or WPR.

Land Surface Evaporation

Ongoing work of statewide comparisons between three remotely sensed ET estimates has shown up to a 200% difference in statewide annual ET volume. Validation efforts are in progress (Schmugge et al.) to determine the accuracy of these estimates. If any of these remotely sensed ET estimates are deemed accurate they will be used to model land surface evaporation.

Streamflow In/out

Streamflow data from the United States Geologic Survey's (USGS) streamflow gaging network will be used to approximate to the best extent possible, streamflow in and out of a given county and or WPR.

Recharge

Current work to determine areas of groundwater recharge is under way and scheduled to be completed this year (Newton and Phillips). Future work by this group includes plans to quantify recharge in those identified areas. However, in the first year the DSWB recharge estimated will be provided from the Interstate Stream Commission's published regional water plan reports.

Groundwater

Two fluxes of groundwater are included in the DSWB between HSDS and Groundwater. These are groundwater diversions, either from wells or irrigation drains, and returns to the groundwater from the HSDS, either from active recharge, recharge from agricultural activities including leakage from reservoirs and irrigation ditches and canals, or domestic septic tank returns. Data and reports which can help quantify these terms are available to varying degrees from the NMOSE, USGS, U.S. Army Corps of Engineers (USACE), and U.S. Bureau of Reclamation (USBR).

Surface Water

There are two fluxes in the DSWB which connect Available Surface Water to the HSDS. These are surface water withdrawals (diversions) into the HSDS, and return flows from the HSDS back into the Available Surface Water stock. As described above, for accounting purposes, adding water to storage in a reservoir is considered a withdrawal, and releasing it to the river system is considered a return. Estimates of diversions and returns to/from all sectors except reservoir storage are provided from the NMOSE's Water Use by Categories reports. Changes in reservoir storage are available from historic storage records.

Riparian Consumption

is calculated in the model but multiplying reference ET (Hargreaves-Samani) by a corresponding crop coefficient and then by riparian area. Riparian area for each county/WPR is estimated to be equivalent to wetland area from USGS National Land Use Land Cover data.

Groundwater Discharge

Analogous to streamflows across a County line or WPR boundary, groundwater can also move from one accounting unit to another across the boundaries that separate them.

Surface Water Groundwater Exchange

In many river systems in New Mexico leakage to the groundwater system (losing reaches), or gains from the groundwater system (gaining surface water reaches) are important fluxes for both the surface water and groundwater systems. These fluxes are modeled in the DSWB.