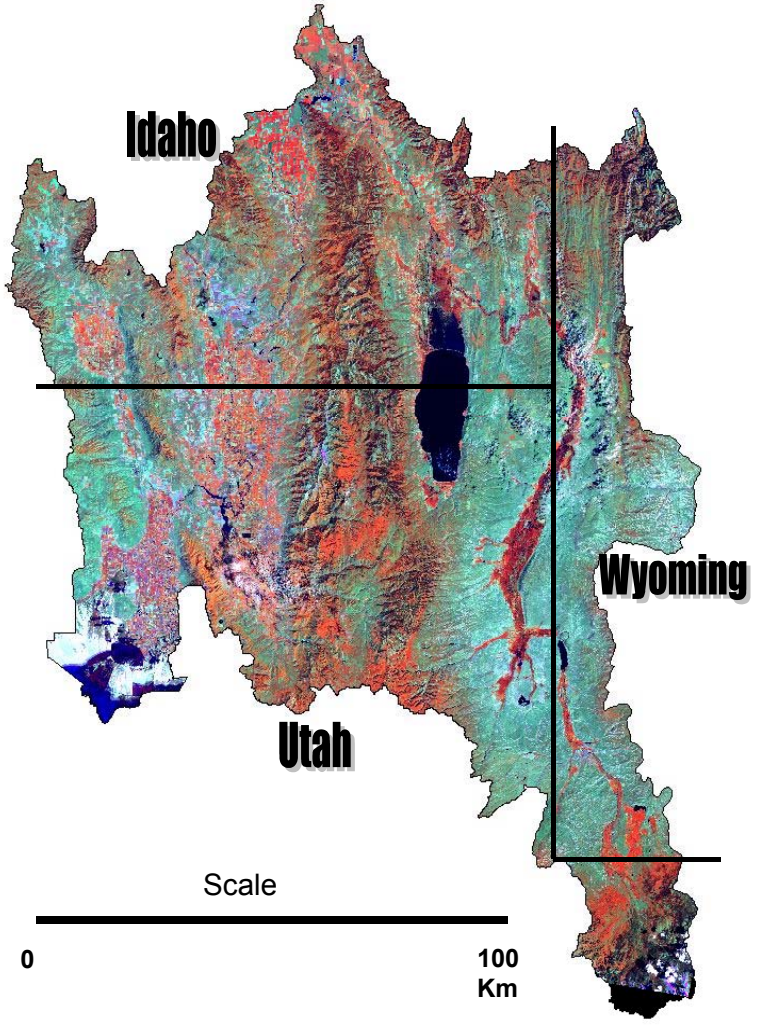
Location	Bear River Basin, Idaho, USA
Contractor	Idaho Department of Water Resources
Period	2000 – 2001

Scope of the project

Managing water rights and irrigation on the Snake River Plain and tributary basins presents a challenge to Idaho Department of Water Resources (IDWR). Water for irrigation comes from surface and ground sources. For various historical reasons, the use of surface water has been directly measured and regulated by IDWR while the use of ground water has not. This situation began to change in 1995 when the Water Measurement Information System Program was established within IDWR to measure ground-water use. IDWR has dedicated considerable resources to water measurement, including three full-time positions to monitor about 5,000 points of diversion, mostly wells. As useful as these data are, they do not provide all the information necessary for effective management of the resource. Information regarding the actual evapotranspiration (ET_a) or consumed fraction of diversions is needed.

Study approach

The SEBAL model of WaterWatch is used to determine actual evapotranspiration. The analysis is based on two Landsat TM images dated July 12 and July 28, 2002. ET for periods between satellite overpasses was computed using ratios of ET from SEBAL to reference ET computed for ground-based weather stations. ET maps via SEBAL provide the means to quantify time accumulated water use from individual fields. The individual fields are indicated on the picture right. ET for each field was determined in a GIS analysis using an overlay of the ET map with the water right polygons.



The volume of water consumed per field is compared with the volume of water authorized to be diverted based on valid water rights. Authorized diversion volume is calculated based on the allocated rate of flow continuously diverted over the 17-day period.

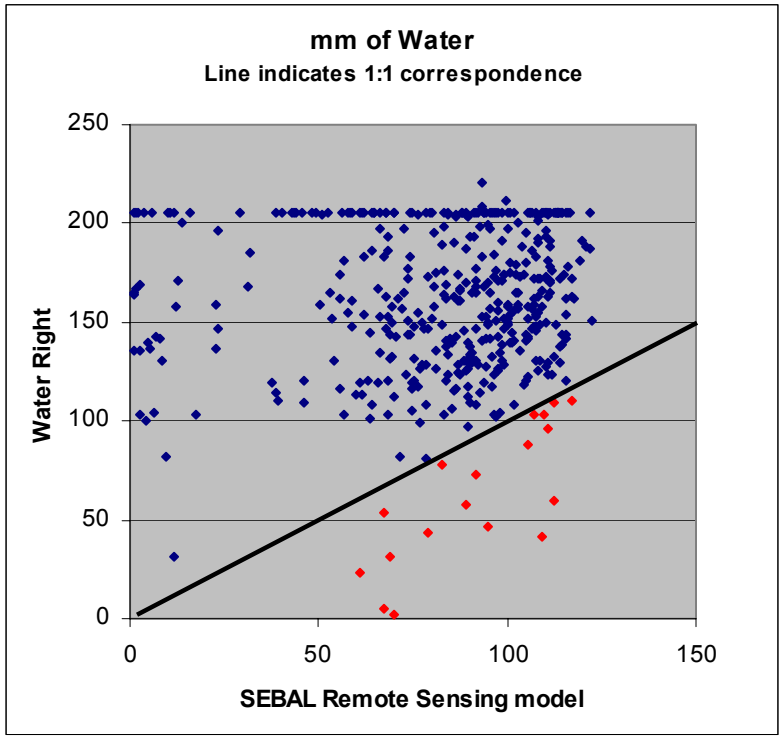
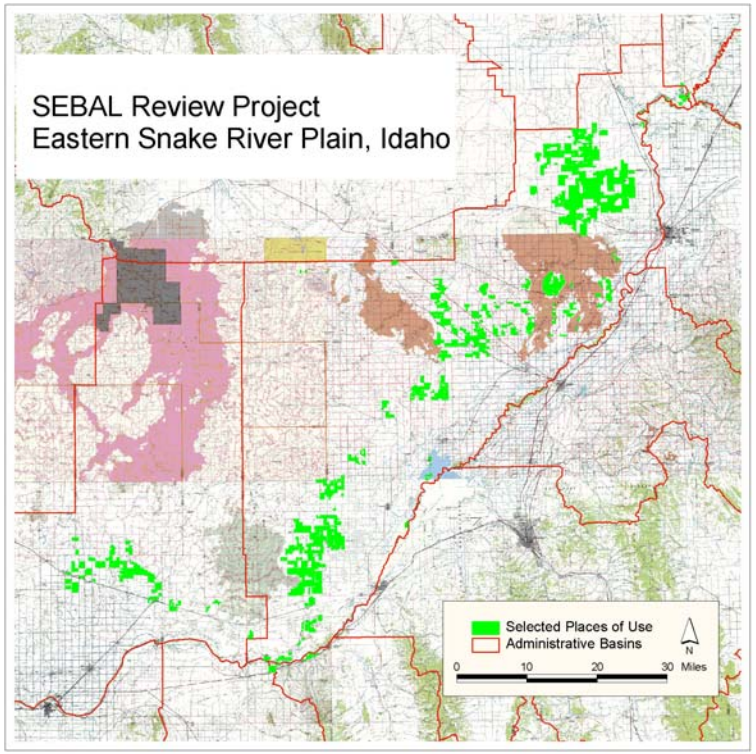


Figure 2: Graph showing the amount of water consumed by ET per field (as calculated by SEBAL), and the amount of water they are allowed to use according to the water rights.

Results

The water rights of 426 fields were compared with SEBAL generated actual ET for the period between July 12 and 28. The results are depicted in the figure left; out of 426 fields, 18 were found to have an actual ET greater than the water right could provide (points below the diagonal line). Those 18 positives were handed-off to water-rights personnel of IDWR for further research.



After research in the field, three of the eighteen comparisons appeared to be valid and the amount of water consumption exceeded the authorized amount. The other 15 fields were incorrectly selected due to errors in the difital file with field-borders.

Conclusions

Initial application and testing of SEBAL indicates substantial promise as an efficient, accurate, and relatively inexpensive procedure to predict the actual evaporation fluxes from irrigated lands throughout a growing season. ET from satellite images may replace current procedures used by Idaho Department of Water Resources and other management entities that rely on ground-based ET equations and generalized crop coefficients that have substantial uncertainty.

This combined methodology offers advantages over present methods:

1) it offers the ability to monitor whether water has actually stopped being used for irrigation after a water shut-off order has been issued;
2) it can discover if more water has been used than authorized;
3) it can quantify and be used as proof of beneficial use of a right;
4) it can be used as an unbiased, quantitative record of historical use;
5) the consumed fraction and return of non-evapotranspired water to the resource can be quantified;
6) estimates of yield and productivity can be made to assess benefits of water development and tradeoffs in water management.

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