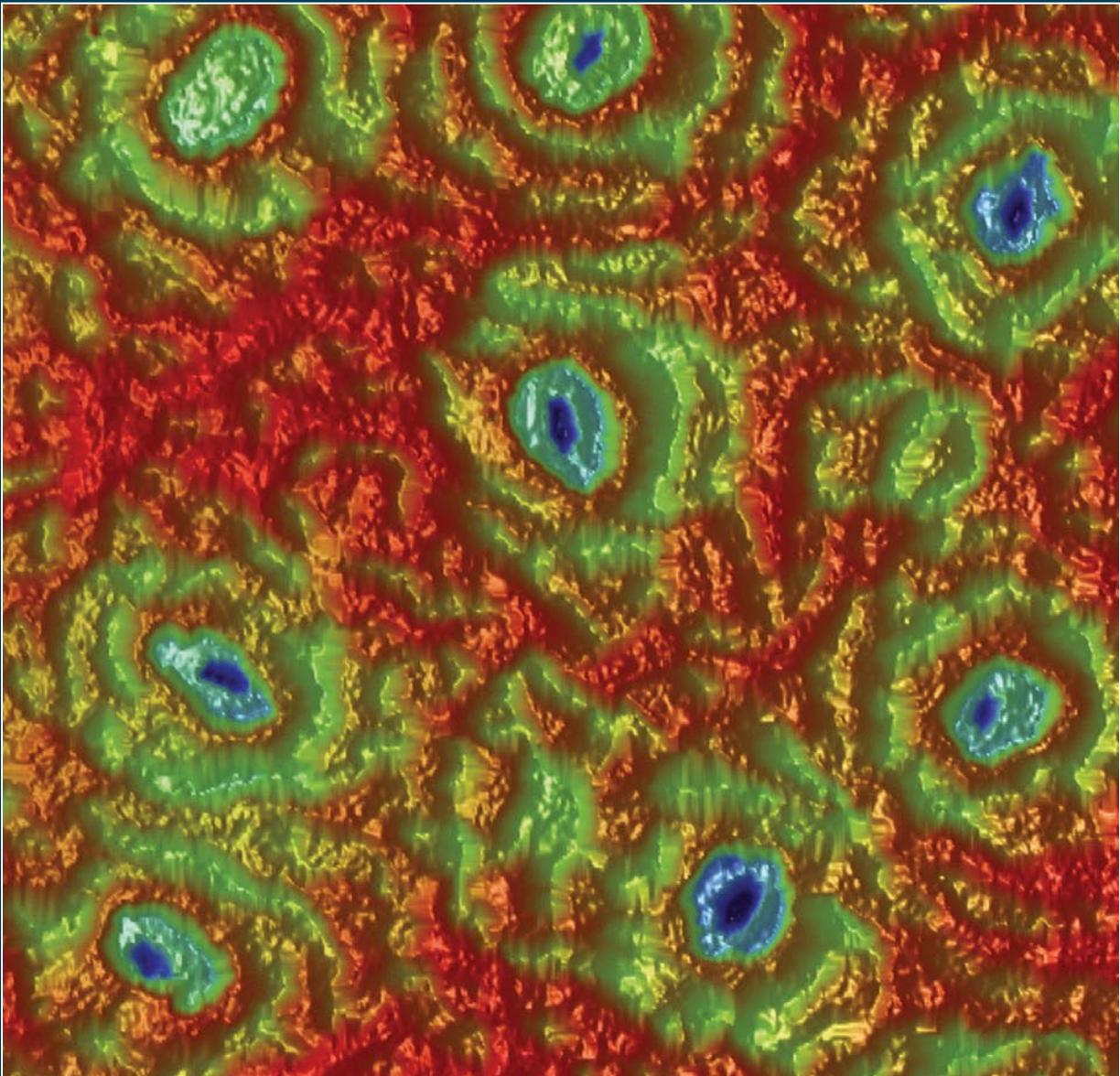


# Southwest HYDROLOGY

The Resource for Semi-Arid Hydrology

Volume 7/Number 1

January/February 2008



## Evapotranspiration

Southwest Hydrology  
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The Resource for Semi-Arid Hydrology

A bimonthly trade magazine for hydrologists, water managers, and other professionals working with water issues.



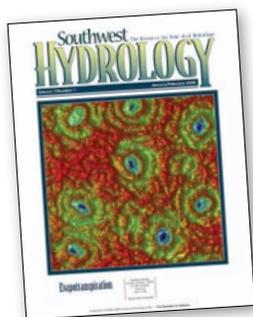
From the  
Publisher

*Evapotranspiration—the sum of water evaporated from bare ground and open water plus water transpired by vegetation—is a significant component of the water balance in the Southwest, and one of the hardest to measure. It varies enormously across an area, depending on such factors as how much sun reaches the surface, how much is reflected, the temperature and moisture content of the air, the wind speed, how much moisture and heat are in the ground, the type and density of plants growing, and many more hard-to-measure and highly variable factors.*

*It's often simpler to measure precipitation, then subtract runoff and groundwater infiltration and assume ET is what's left. For a rough estimate, that approach works. But more precise ET rates are important to some. Irrigators need to know how much water to order. Groundwater modelers want to calibrate their models accurately. Water managers need to know how much water they can properly transfer from an irrigation right to a municipal one. In this issue, our feature authors describe various ways ET can be measured, and where the errors in measurement come in.*

*We are pleased to be starting our seventh year of Southwest Hydrology. Our mailing list has grown to more than 6,000, with a readership that's even greater. Many of our 37 advertisers have been with us from the very first issue. We thank all of you—readers, authors, and advertisers—for being part of Southwest Hydrology.*

Betsy Woodhouse, Publisher



*Atomic force microscope image of the lower surface of a plant leaf showing stomata, which regulate transpiration, the transfer of water vapor and other gases to the atmosphere. Photo: nanoAnalytics GmbH. See [www.nano2life.org](http://www.nano2life.org).*

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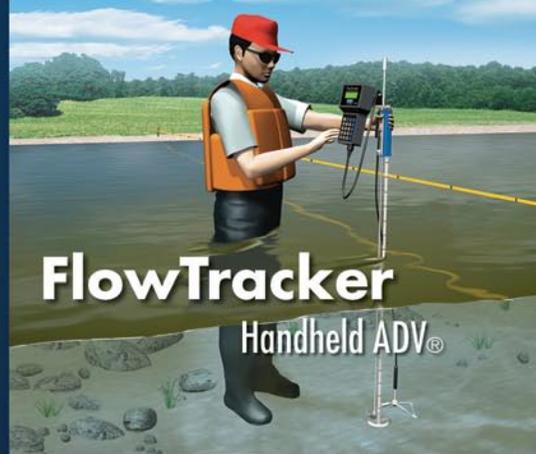
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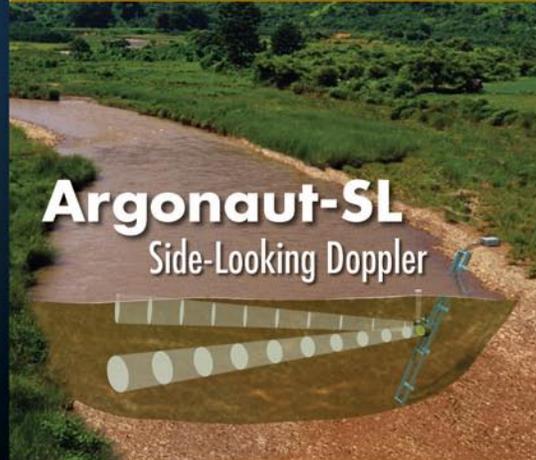
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## Evapotranspiration

With all the sunshine and warm temperatures we have in the Southwest, we have the potential for very high rates of evapotranspiration—if water is available. The question is how much ET *actually* occurs? ET is a difficult parameter to measure, but various methods have been developed to try to get at that upward flux of moisture. These range from direct measurement at a single point to direct measurement from space, or indirect measurement over an equally large range of scales. Who is using these methods? For what uses? What sorts of values are being measured? Our contributors address these questions and more.

### 18 Why Do We Care About ET?

*Richard G. Allen*

What is ET and why do we need to measure it? Find out why hydrologists, engineers, groundwater modelers, agronomists, ecologists, and water managers care about ET and how its measurement figures into their decision-making.

### 20 Approaches to ET Measurement

*Betsy Woodhouse*

Relatively precise means to measure ET over crops have been developed, but what if you need to know ET for an entire watershed and don't have an NSF grant handy?

### 22 Evapotranspiration Measurement Methods

*W. James Shuttleworth*

Methods for direct measurement of ET generally involve water budget and vapor flow measurements. This handy table compares the assumptions, strengths, weaknesses, measurement scale, and error rates of the more commonly used approaches ... and a few of the up-and-coming ones.

### 24 Challenges and Cautions in Measuring Evapotranspiration

*John M. Baker*

Micrometeorological methods of measuring ET, such as eddy covariance and the Bowen ratio/energy balance, have improved the currency and accuracy of ET data, or have they? Potential users need to be aware of pitfalls, limitations, and costs of these methods.

### 26 Quantifying Riparian Evapotranspiration

*Russell L. Scott, David G. Williams, Travis E. Huxman, Kevin R. Hultine, and David C. Goodrich*

Efforts to improve measurement of riparian ET using micrometeorological and plant physiological techniques are resulting in greater appreciation of the importance of riparian vegetation in the water balance of Southwest basins and of the impacts of vegetation change from grassland to shrubland.

### 28 ET—The Key to Balancing the Water Budget in the Southwest

*Michael T. Moreo, Nancy A. Damar and Randell J. Laczniak*

The accuracy of basin water budgets is an essential factor for models to effectively predict the potential effects of groundwater pumping. But obtaining basin-wide ET to include in the water budget is no small task. Read about one such approach in eastern Nevada.

### 30 From High Overhead: ET Measurement via Remote Sensing

*Richard G. Allen, Jan M.H. Hendrickx, David Toll, Martha Anderson, Jan Kleissl, and William Kustas*

Combining spatial ET data from satellites with point measurements of ET and soil moisture and modeling data is proving to be a cost-effective way to improve accuracy of ET mapping. The approach is being used in a wide range of water management and monitoring applications.

Publishing **Southwest Hydrology** furthers SAHRA's mission of promoting sustainable management of water resources in semi-arid regions.



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