

# Vadose-Zone Monitoring to Quantify Forest Water Use/Yield under Different Land Management

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# Overview: Managing Forests for Water Yield

**Basic concept:** Small reduction in ET could mean significant water yield to surface and groundwater bodies



Forest Understory Management = Manipulating leaf area index (LAI) and basal area (BA), and groundcover



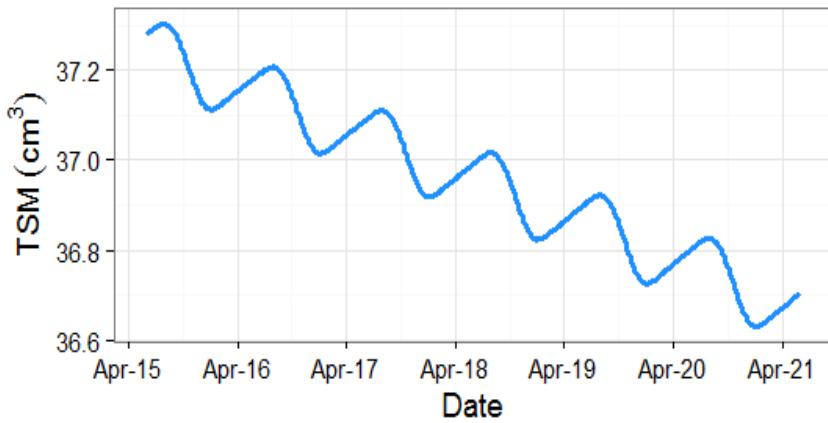
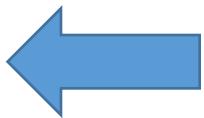
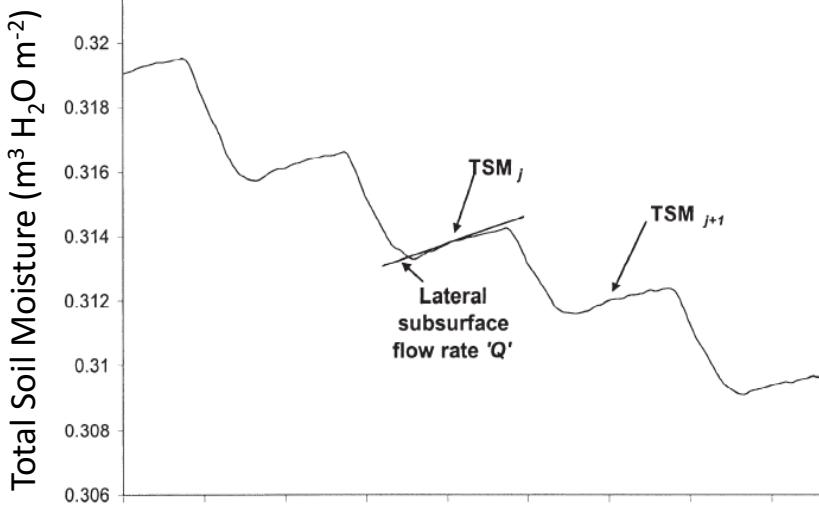
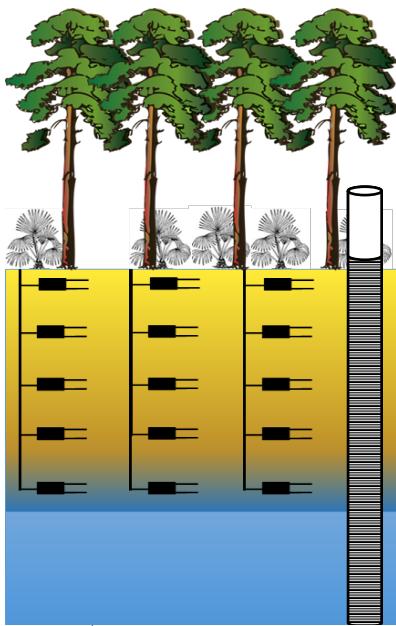
Thick understory

Prescribed burning and/or thinning)



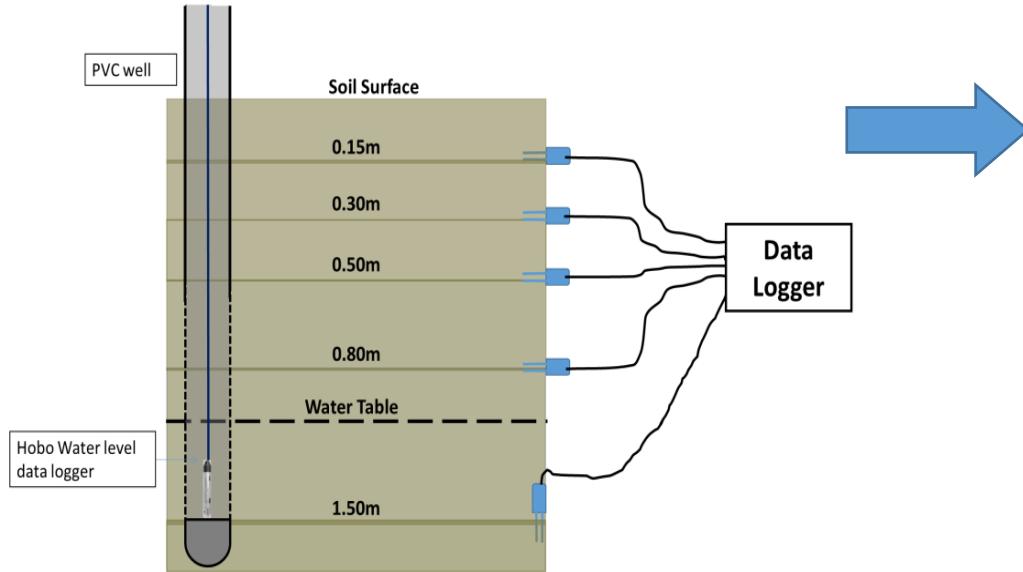
Increased water availability in aquifers, lakes and streams

# Vadose-zone monitoring & ET estimation

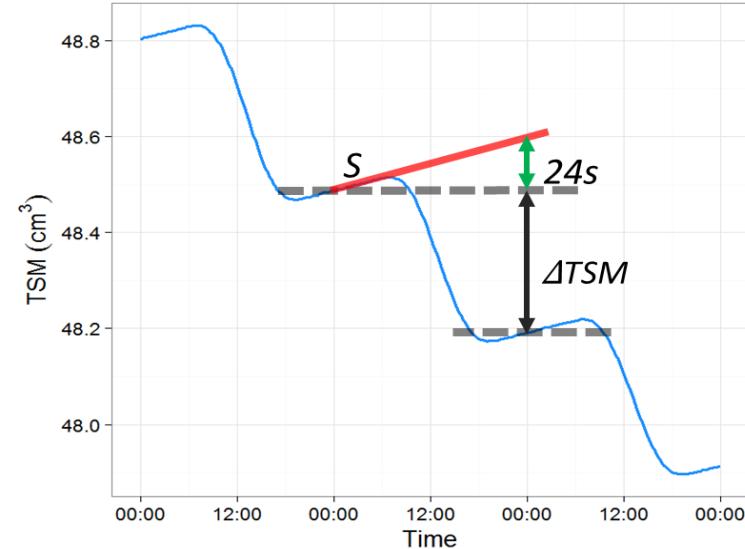


$$\text{ET} = \text{TSM}_j - \text{TSM}_{j+1} + 24 \times Q$$

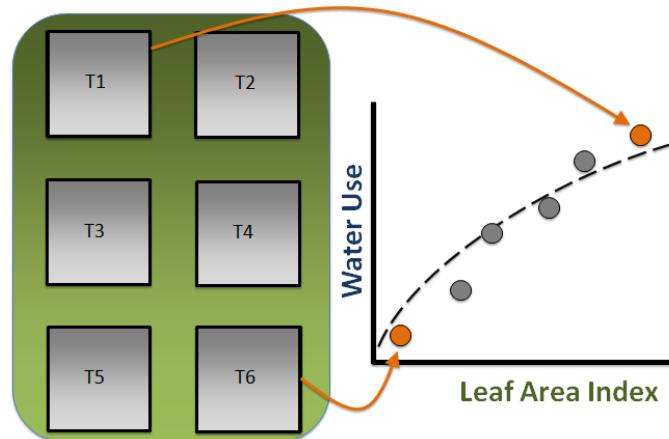
# Water Yield: From Point to Stand Scale



Nachabe (2005) Method



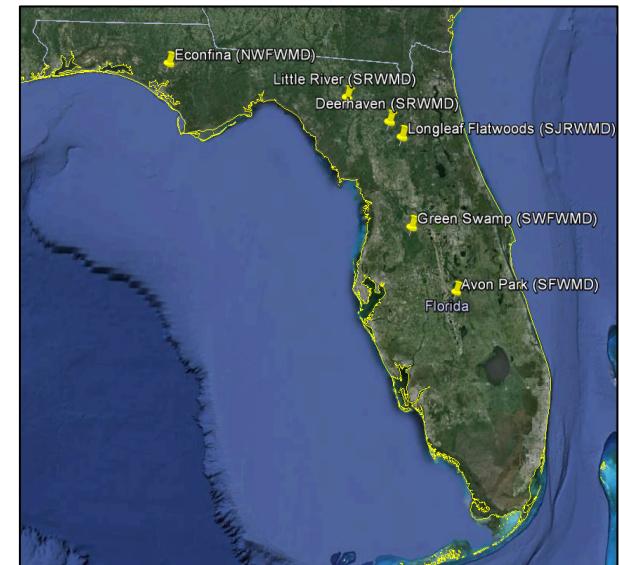
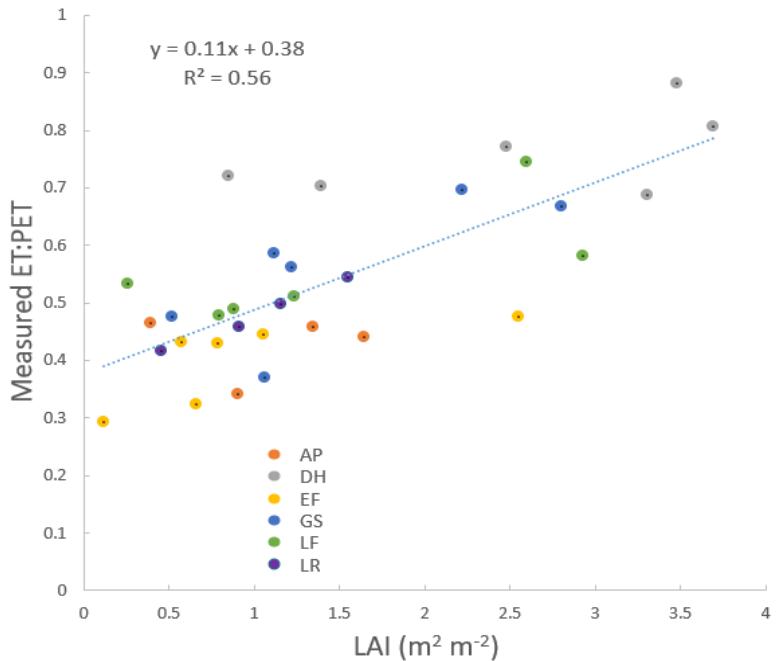
$$ET = \Delta TSM + 24s$$



Water Yield  
(Stand scale)

ET  
(Point scale)

# LAI and Forest Water Use (ET:PET) Across Sites



## GLM with Site, TSM and LAI Effects on ET:PET

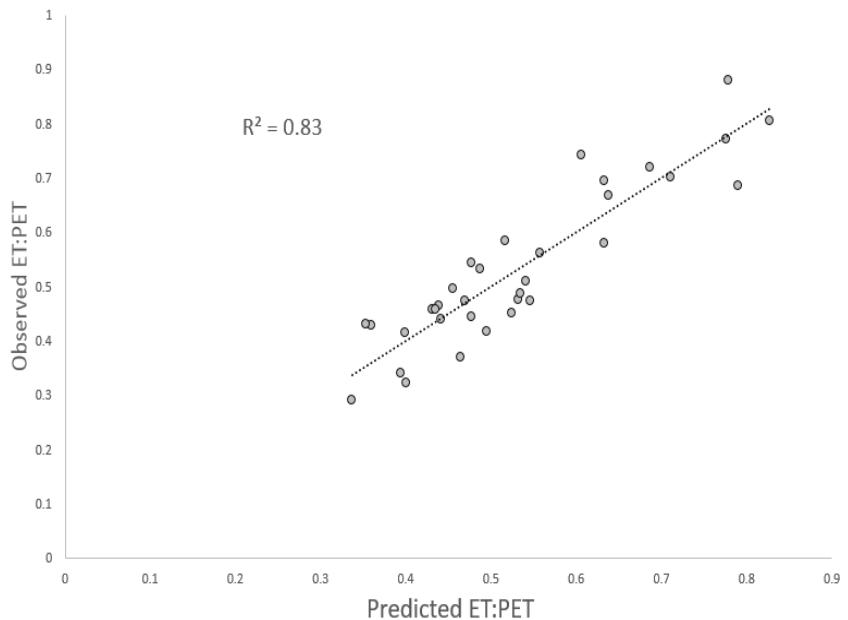
Coefficients:

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	0.29	0.05	5.73	6.68e-06 ***
siteDH	0.23	0.05	4.81	6.80e-05 ***
siteEF	-0.004	0.04	-0.09	0.93
siteGS	0.07	0.05	1.44	0.16
siteLF	0.09	0.04	2.10	0.04 *
siteLR	0.08	0.05	1.66	0.11
LAI	0.06	0.014	4.35	0.0002 ***
TSM	0.003	0.0017	2.05	0.05 *

Signif. codes: '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05

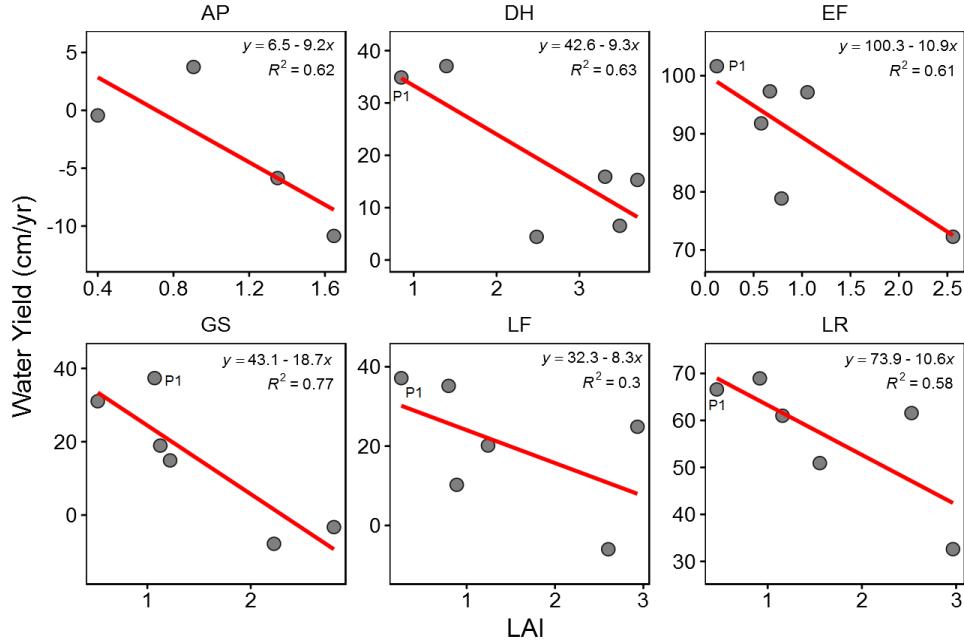
Null deviance: 0.678821 on 31 degrees of freedom  
Residual deviance: 0.097952 on 24 degrees of freedom

AIC: -76.436

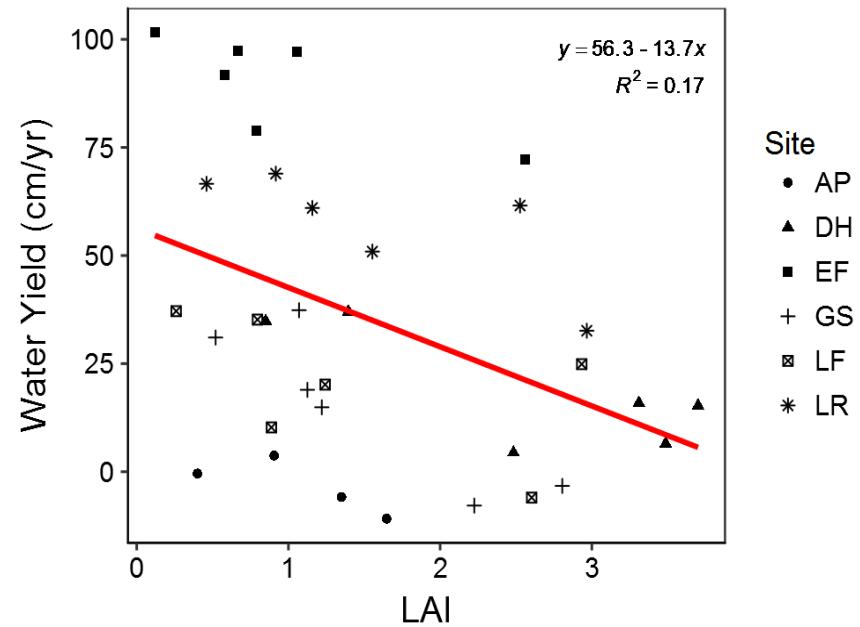


# Forest Water Yield

Site Wise LAI Vs. WY



Global LAI Vs. WY



## A GLM of WY with Site, LAI and Groundcover Effects

Coefficients:

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	1.20	8.11	0.14	0.88
siteDH	38.89	6.95	5.59	7.09e-06
siteEF	94.40	6.67	14.15	1.00e-13
siteGS	22.96	6.37	3.60	0.0013
siteLF	29.92	6.64	4.50	0.0001
siteLR	67.54	6.55	10.31	1.11e-10
Mean LAI	-9.63	2.20	-4.37	0.00018
Ground Cover	0.10	0.09	1.16	0.25

Null deviance: 37626.8 on 33 degrees of freedom  
 Residual deviance: 2494.8 on 26 degrees of freedom  
 AIC: 260.54

