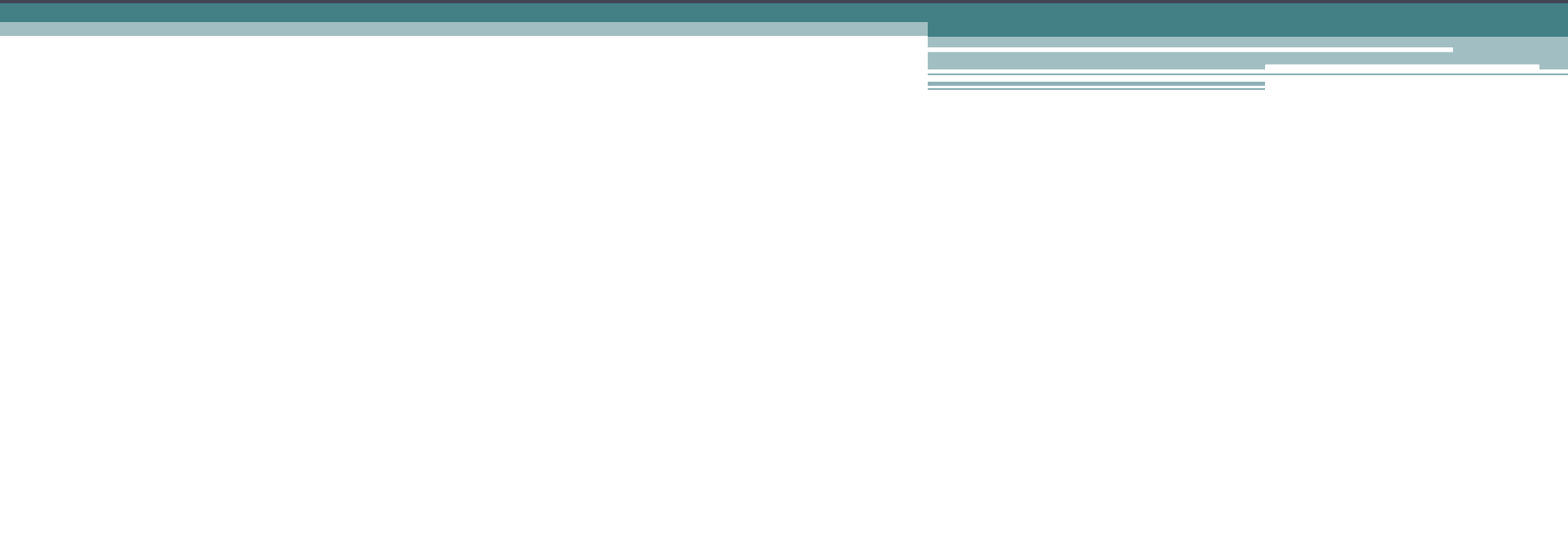


# **Silver Jubilee Celebration of SWAT**



# Jeff's Dissertation: The Original SWAT

SPATIAL SCALE VARIABILITY IN MODEL  
DEVELOPMENT AND PARAMETERIZATION

A Thesis

Submitted to the Faculty

of

Purdue University

by

Jeffrey G. Arnold

In Partial Fulfillment of the

Requirements for the Degree

of

Doctor of Philosophy

December 1992

# Purdue Mafia



## Graduate Students Advised by Dr. Engel

Dr. Engel has served as major professor for 42 graduate students and currently serves as major professor for 8 graduate students. Some of them are listed below:

- Chris Rewerts (PhD, 1992)
- Raghavan Srinivasan (PhD, 1992)
- Ranjan Muttiah (PhD, 1992)
- Jeff Arnold (PhD, 1992)
- Xin Zhuang (MS and PhD, 1993)
- Karla Embleton (PhD, 1993)
- Lois Ann Deer-Ascough (PhD, 1995)
- Norman Seth Levine (PhD, 1995)
- Nissim Ozer (PhD, 1995)
- Darrell McCauley (PhD, 1995)
- Kumar Navulur (PhD, 1996)
- Hubert Montas (PhD, 1996)
- Mike Sears (MS, 1996)
- Karen Kosky (MS, 1997)
- Neeraj Singh (MS, 1997)
- Sudhakar Mamillapalli (MS and PhD, 1998)
- Renee Gunn

- Kyoung Jae Lim (MS and PhD, 2001)
- Paul Miller (PhD, 2003)
- **Kelsi Simone Bracmort** (PhD, 2004)
- Gabriel Vazquez (MS and PhD, 2005)
- Anoop Iyer (MS, 2004)
- Zhenxu Tang (PhD, 2005)
- George Saxton
- Rajesh Singh (PhD, 2005)
- **Pablo Alberto Mercuri** (PhD, 2005)

- Shen Wang
- Jeroen Leroy (MS, 2004)
- Joseph Quansah (PhD, 2007)
- Salvador Guzman (PhD, 2009)
- Mi Hoon Jeong (PhD, 2009)
- Mi Hoon Jeong (PhD, 2011)
- Mark Thomas (MS and PhD, 2011)
- Laurent Ahiablame (PhD, 2012)
- Youn Shik Park

# 2015 International SWAT Conference

## *Soil and Water Assessment Tool*

R. Srinivasan

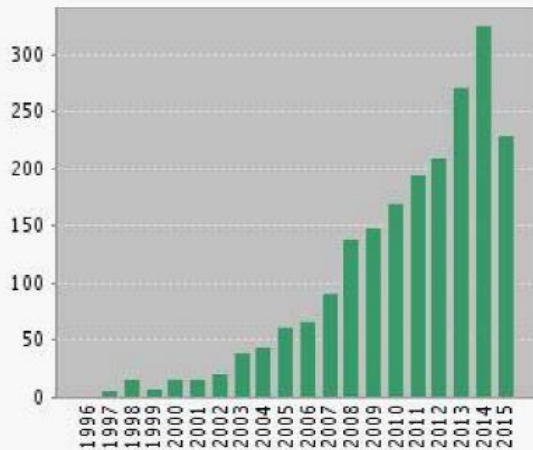
[r-srinivasan@tamu.edu](mailto:r-srinivasan@tamu.edu)

*Blackland Research and Extension Center & Ecosystem  
Science and Management*  
**Texas A&M University**

**\* Several slides were contributed by Phil Gassman**

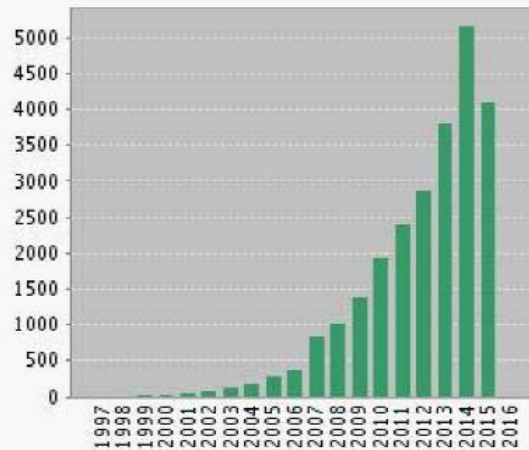
# Historical Trends of Published SWAT-Related Peer-Reviewed Articles (2,200 in Total)

Published Items in Each Year



The latest 20 years are displayed.  
[View a graph with all years.](#)

Citations in Each Year



The latest 20 years are displayed.  
[View a graph with all years.](#)

Results found: 5397

Sum of the Times Cited [?]: 24841

Sum of Times Cited without self-citations [?]: 12531

Citing Articles [?]: 8949

Citing Articles without self-citations [?]: 7469

Average Citations per Item [?]: 11.99

h-index [?]: 66

Sort by: **Times Cited -- highest to lowest**

Page 1 of 540

2012	2013	2014	2015	2016	Total	Average Citations per Year
2880	3807	5161	4113	0	24841	1182.90

Use the checkboxes to remove individual items from this Citation Report

or restrict to items published between 1864 and 2016 Go

**Source: SWAT Literature Database as of July 20, 2014 (including articles not yet released to the database); [https://www.card.iastate.edu/swat\\_articles/index.aspx](https://www.card.iastate.edu/swat_articles/index.aspx)**



☐ 1. **Large area hydrologic modeling and assessment - Part 1: Model development**

By: Arnold, JG; Srinivasan, R; Muttiah, RS; et al.  
JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION Volume: 34 Issue: 1 Pages: 73-89 Published: FEB 1998

[View Abstract](#)

**Times Cited: 1,820**  
*(from All Databases)*

**Usage Count**

☐ 2. **Model evaluation guidelines for systematic quantification of accuracy in watershed simulations**

By: Moriasi, D. N.; Arnold, J. G.; Van Liew, M. W.; et al.  
TRANSACTIONS OF THE ASABE Volume: 50 Issue: 3 Pages: 885-900 Published: MAY-JUN 2007

[View Abstract](#)

**Times Cited: 1,214**  
*(from All Databases)*

**Usage Count**

☐ 3. **The soil and water assessment tool: Historical development, applications, and future research directions**

By: Gassman, P. W.; Reyes, M. R.; Green, C. H.; et al.  
TRANSACTIONS OF THE ASABE Volume: 50 Issue: 4 Pages: 1211-1250 Published: JUL-AUG 2007

[View Abstract](#)

**Times Cited: 686**  
*(from All Databases)*

**Usage Count**

☐ 4. **SWAT2000: current capabilities and research opportunities in applied watershed modelling**

By: Arnold, JG; Fohrer, N  
HYDROLOGICAL PROCESSES Volume: 19 Issue: 3 Special Issue: SI Pages: 563-572 Published: FEB 28 2005

[View Abstract](#)

**Times Cited: 454**  
*(from All Databases)*

**Usage Count**



Hydrological Processes 132	Science of the Total Environment 23
Transactions of the ASABE 108	Water Science and Technology 23
Journal of Hydrology 93	Physics and Chemistry of the Earth, Parts A/B/C 22
Journal of the American Water Resources Association 88	Advances in Geosciences 19
Journal of Environmental Quality 47	Journal of Environmental Management 19
Water Resources Management 43	International Agricultural Engineering Journal 13
Hydrology and Earth System Sciences 40	Journal of Water Resources Planning and Management 13
Journal of Soil and Water Conservation 39	Water International 13
Ecological Modelling 38	Climatic Change 12
Journal of Hydrologic Engineering 37	Environmental Management 12
Environmental Modelling & Software 36	Environmental Modeling and Assessment 11
Water Resources Research 36	Journal of Environmental Monitoring 11
Agricultural Water Management 34	Advances in Water Resources 10
Hydrological Sciences Journal 33	Environmental Earth Sciences 10
Transactions of the ASAE 32	Journal of Water Resource and Protection 10

# Distribution of Journals

- A total of 510 journals included in current database
- Most published in English; some in other languages
- **Assumed that articles are published via a true peer-reviewed process**
- Some of the journals are published by suspected “Predatory Publishers”
  - see <http://scholarlyoa.com/publishers/>

# Broad Categories in Database

Category	Total papers	Category	Total papers
hydrologic only	1,051	computational approaches	12
hydrologic & pollutant	787	pre-SWAT or SWAT-related	10
pollutant only	170	overview of special issue, etc.	8
review/history	64	literature citation analysis	7
interface tool and/or other software	24	BMP review or conceptual approach	6
conceptual approach	19	carbon cycling	3
data or component development	17	watershed descriptions	3
crop/plant growth	14		



# Summary of Top 50 Cited Web of Science Trans. ASABE Papers (July 10, 2014)\*

- Top-cited SWAT application or review papers
  - #s 1, 2, 7, 8, 9, 12, 13, 21, 27, 29, 32, 37
- Other papers with significant SWAT examples or discussions from 2006 TMDL special issue
  - #s 5, 6, 11
- APEX review paper – #38



\*"B" was added for "Biological" in 2006 resulting in Trans. ASABE

# JSWC Article Describing Bibliometric Review of Nonpoint Source Modeling Research

- Citation: Li, S., Y. Zhuang, L. Zhang, Y. Du, and H. Liu. Worldwide performance and trends in nonpoint source pollution modeling research from 1994 to 2013: A review based on bibliometrics. Journal of Soil and Water Conservation 69(4): 121A-126A.
- Both authors of studies and terms in studies are ranked in JSWC article based on review of articles in Web of Science Core Collection
  - searched on terms in article titles, abstracts or keywords
  - SWAT: #4 key term and most widely used model
  - EPIC: Also a key term; declining influence in last decade
- Five indices used to rank authors
  - **total articles**, first or correspondence author, **total citations**, citations per publication, & author h-index based articles included in the analysis

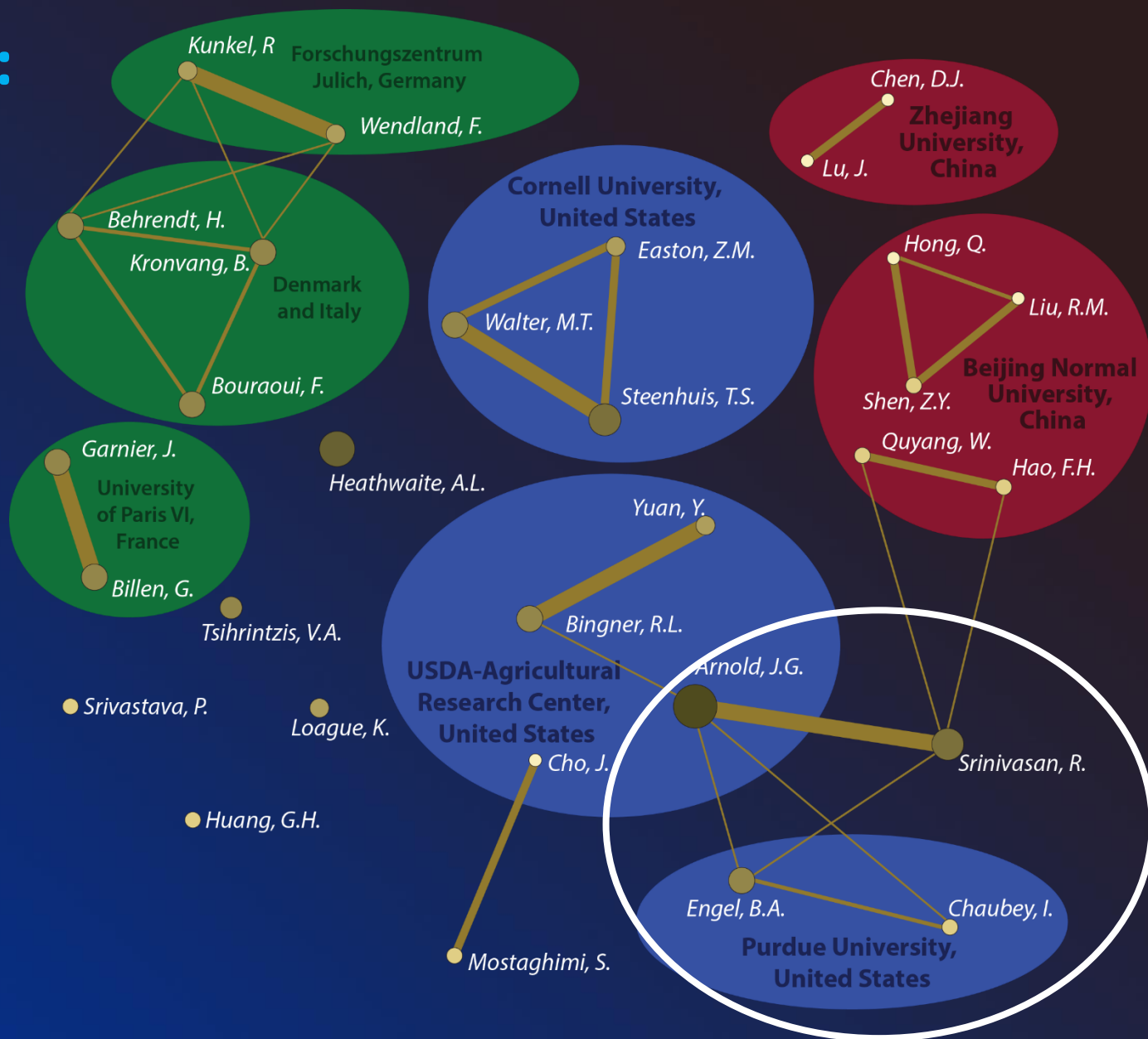


# Influential “SWAT Authors” Among 30 Top Water Quality Modeling Authors in JSWC Article

Rank	Author	Institution	Total Articles	Total Citations
1	J.G. Arnold	USDA-ARS	30	2415
2	R. Srinivasan	Texas A&M Univ.	27	2097
3	T.S. Steenhuis	Cornell Univ.	22	486
5	M.T. Walter	Cornell Univ.	20	399
14	F. Bouraoui	Comm. of European Communities	15	379
19	F.H. Hao	Beijing Normal Univ.	13	194
20	I. Chaubey	Purdue Univ.	12	238
21	Z.M. Easton	Virginia Tech Univ. (Cornell Univ.)	12	169
22	W. Ouyang	Beijing Normal Univ.	11	90

Source: Li et al. Worldwide performance and trends in nonpoint source pollution modeling research from 1994 to 2013: A review based on bibliometrics. Journal of Soil and Water Conservation 69(4): 121A-126A.

# JSWC Article: Cooperation Among Authors



Source: Li et al. Worldwide performance and trends in nonpoint source pollution modeling research from 1994 to 2013: A review based on bibliometrics. *Journal of Soil and Water Conservation* 69(4): 121A-126A.

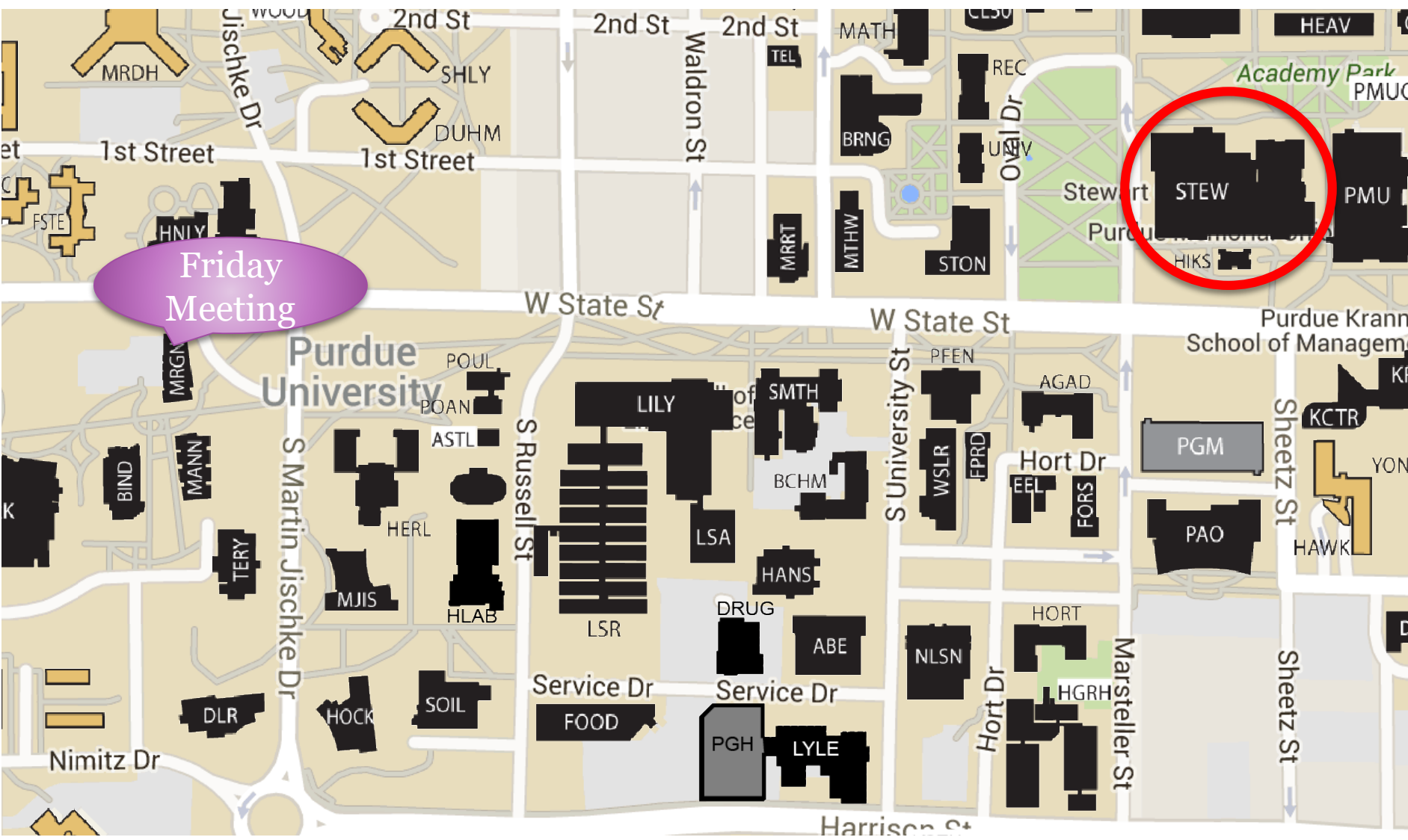


# Major SWAT Conferences and Workshops: 2001 to 2017



# 2015 International SWAT Conference

- **19<sup>th</sup>** International SWAT conference since 2001
- **75** participants in total of five workshops ( SWAT Workshops introductory and advanced, an APEX introductory workshop, Climate change and SWAT/MODFLOW) were held concurrently October 12-13, 2015
- More than **140** Conference Participants:
  - Representing **10** countries
  - **4** continents
  - **22** poster presentations
  - **96** oral presentations



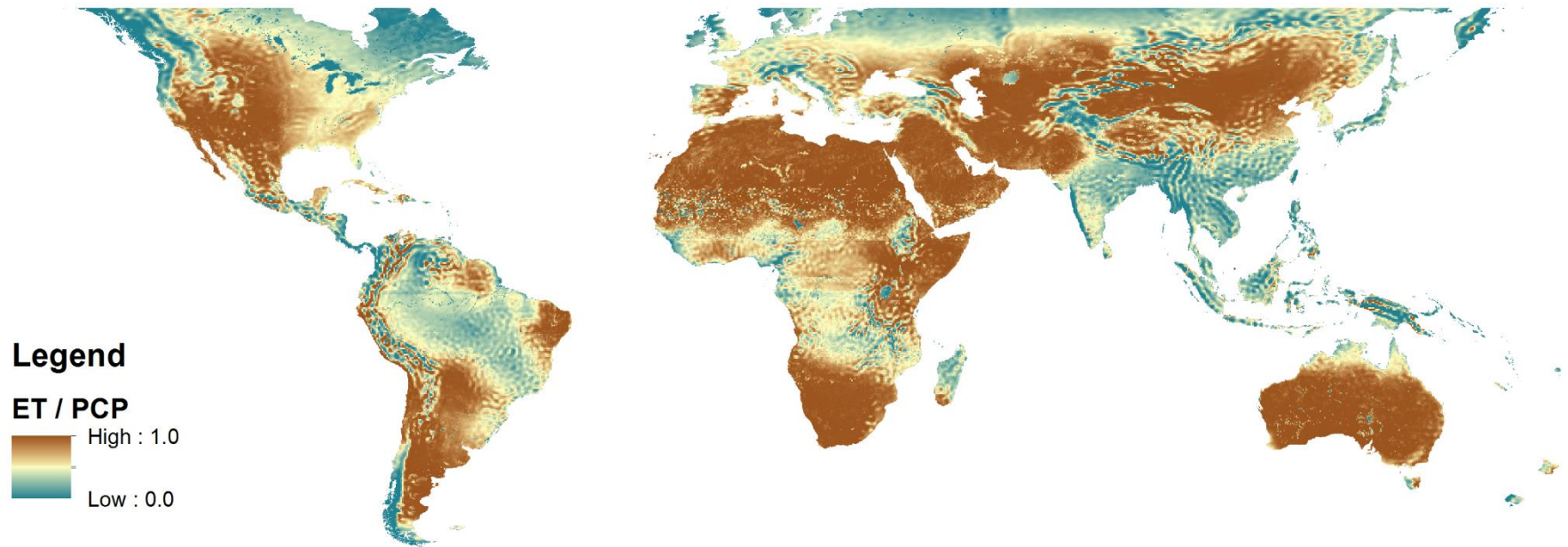
Friday Meeting



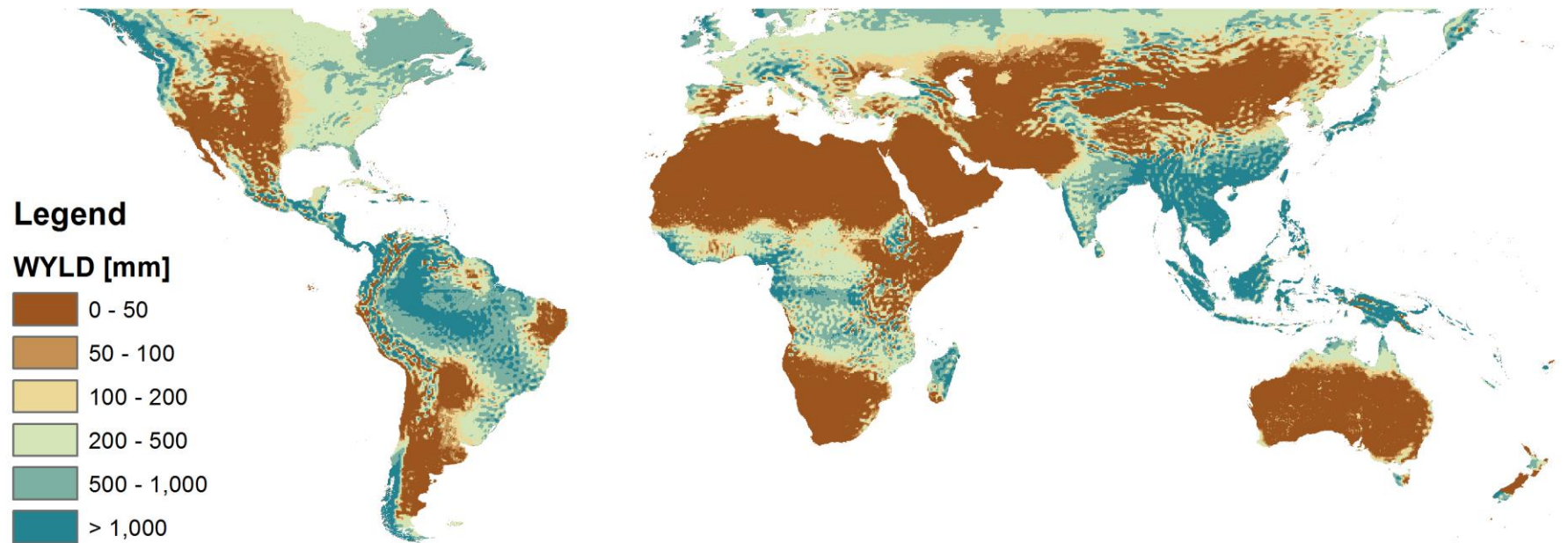
# Global Model Subbasins (10km vs 1km)

Continent	Number of grid cells (10 km resolution) [*1,000]	Number of grid cells (1 km resolution) [*1,000,000]
Africa	367	37
Asia	463	46
Australia	103	10
Central America	33	3
Europe	233	23
North America	238	24
South America	223	22
<b>Total</b>	<b>1,661</b>	<b>166</b>

# Ratio of ET/Precipitation



# Water Yield (Blue Water)





# SWAT - Sustainable land management Tool

Project 1 - SWAT Sustainable Land Management Tool (Release 0.0.1 Beta)

HomeConservation Practices

Current Scenario: A

New

Open

Save

Delete

Add Scenario

Duplicate

Save

Delete

ProjectScenarios

Load / Create Models

Define Baseline Model

Conservation Practices

Manage Scenarios

Assessment

Decision Support

Visualize

Model Outputs

Cost

Select Conservation Practices to add for the current scenario

☐ Burn Operation

☐ CheckDam

☐ Contour Operation

☐ Cover Crop

☐ Fertilizer Management

☐ Field Border

☒ Filter Strip

☐ Fire Operation

☐ Generic Conservation Practice

☐ Grade Stabilization

☐ Grassed Waterways

☐ Grazing

☐ Irrigation Management

☐ Pesticide Management

☐ Pond

☐ Residue Tillage Management

☐ Stream Bank Stabilization

☐ Street Sweeping Operation


☐ Strip Cropping

☐ Terracing Operation

☐ TileDrainage Operation

☐ Wetland

Filter Strips



Filter strips are land areas of either planted or indigenous vegetation situated between a potential, pollutant-source area and a water body that receives runoff

[Documentation](#)

Conservation practice parameters

File Type	Parameter Name	Value	Change Method	ArgumentType	Description
ops	MGT_OP	4	Absolute	Required	Management operation number
ops	IYEAR	1	Absolute	Required	Year operation takes place
ops	MONTH	1	Absolute	Required	Month operation takes place
ops	DAY	1	Absolute	Required	Day operation takes place
ops	FILTER_I	1	Absolute	Required	Flag for the simulation of filter strips
ops	FILTER_RATIO	40	Absolute	Required	Ratio of field area to filter strip area



# Save the Date!

- **2015 – Tokyo, Japan (October 19-23)**
- **2016 – Beijing, China**
- **2017 – Warsaw, Poland**
- **2018 – Madras, India**
- **2019 – Brussels, Belgium**

# THANK YOU

## *International Scientific Committee*

- Karim Abbaspour
- Ann Van Griensven
- Jeff Arnold
- José María Bodoque del Pozo
- Indrajeet Chaubey
- Nicola Fohrer
- Philip Gassman
- A.K. Gosain
- Jaehak Jeong
- Allan Jones
- Valentina Krysanova
- Pedro Chambel Leitão
- Antonio Lo Porto
- José M. Sánchez-Pérez
- Mike White
- Fred F. Hattermann
- Xuesong Zhang
- Sabine Savage
- Balaji Narashimhan
- Tom Cochrane
- Pierluigi Cau
- Claire Baffaut
- Venkatesh Merwade
- Mikolaj Piniewski
- Suzana Gico Montenegro
- Eduardo Mario Mendiondo
- Jaroslaw Chormanski

**Sincere THANKS to**

**Bernie Engel  
Indrajeet Chaubey  
Jane Frankenberger  
Venketesh Merwade**

**And all the volunteers, conference  
organizers and students.**

**Jaclyn Tech, Texas A&M AgriLIFE Research**

# Volunteers

- Adnan Rajib
- Ahmed Abdelkaree
- Hashem Abdelnaby
- Amanda Montgomery
- Andi Hodaj
- Cibir Raj
- Colleen Moloney
- Femeena P V.
- Garrett Pignotti
- Hendrik Rathjens
- Jingqiu Chen
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- Sisi Li
- Won Seok Jang

# Thanks to our Sponsors

