Overview of the SWAT Literature Database: Current Developments and Updated Literature Trends (https://www.card.iastate.edu/swat_articles/)

Philip W. Gassman, Curtis Balmer, & Mark Siemers
Center for Agricultural and Rural Development, Iowa State Univ., Ames, IA, USA

Raghavan Srinivasan
Spatial Sciences Laboratory, Texas A&M University, College Station, TX, USA

Presentation Outline

- Provide background on origin/structure of database

- Clarify the basis for as to which papers/models are included in the database

- Discuss trends in SWAT literature

- Some thoughts on the future of the database

Quirky

- **Definition: Having or characterized by peculiar or unexpected traits or aspects**

- Synonyms: eccentric, idiosyncratic, unconventional, unorthodox, unusual, off-centre, strange, bizarre, weird, peculiar, odd, freakish, outlandish, offbeat, out of the ordinary

SWAT Review Articles

- Original literature list started by Dr. Manuel Reyes, North Carolina A&T Univ., Greensboro, NC

- Gassman, P.W., M. Reyes, C.H. Green, J.G. Arnold. 2005. SWAT Peer-Reviewed Literature: A Review. In: 2005 SWAT Conference Proceedings.

- Gassman, P.W., M.R. Reyes, C.H. Green, and J.G. Arnold. 2007. The Soil and Water Assessment Tool: Historical development, applications, and future research directions. Trans. ASABE. 50(4): 1211-1250.

CARD

Trans. ASABE 2007 Review Article SWAT Literature Summary

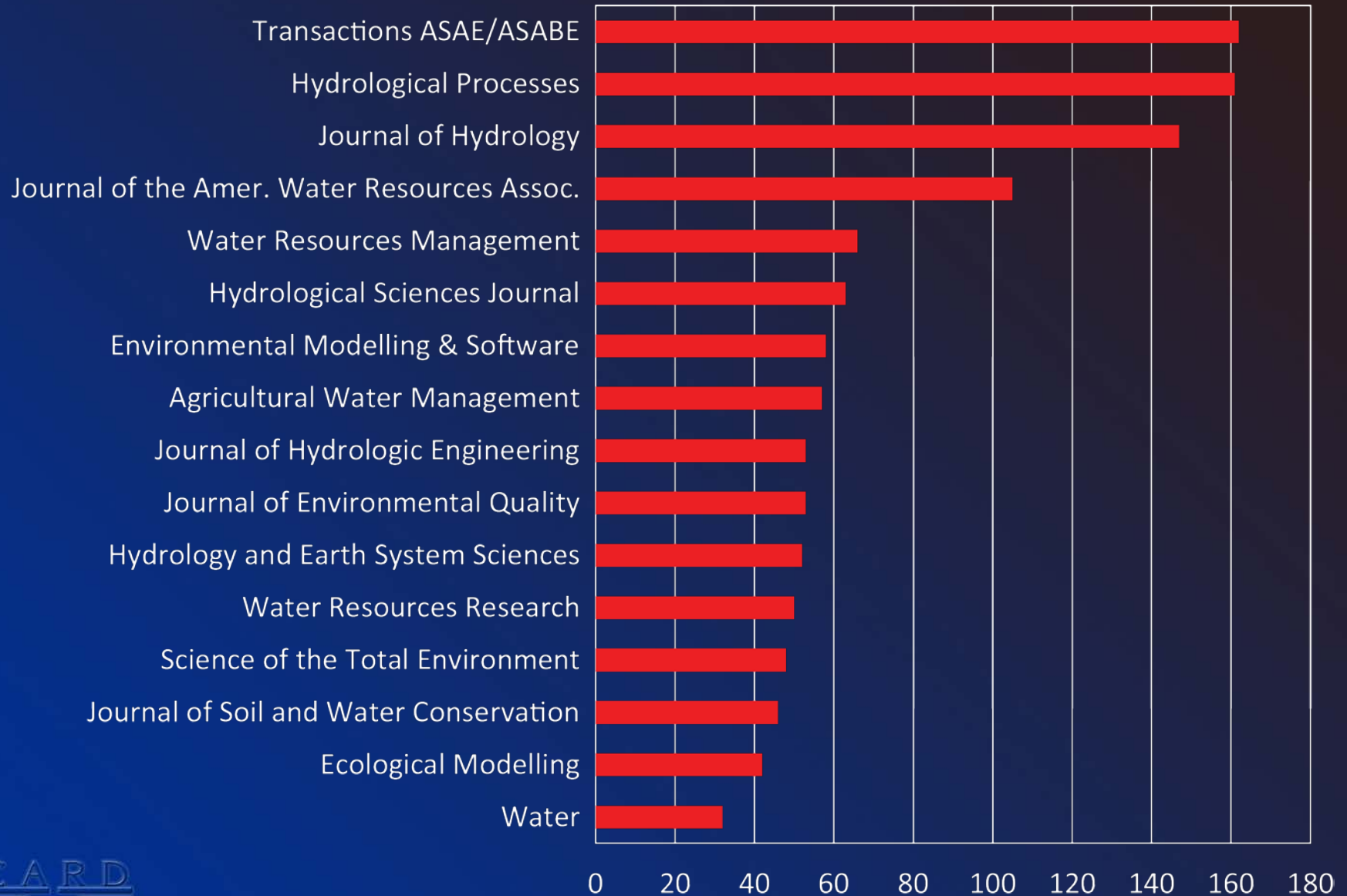| Primary Application Category	Hydrologic Only	Hydrologic & Pollutant	Pollutant Only
Calibration and/or sensitivity analysis	15	20	2
Climate change impacts	22	8	--
GIS interface descriptions	3	3	2
Hydrologic assessments	42	--	--
Delineation or input data effects	21	15	--
Comparisons with other models/methods	5	7	1
Interfaces with other models	13	15	6
Pollutant assessments	--	57	6

Current Structure of Database

- 2,700 total papers currently included
  - -593 different journals represented; most are English
  - -Assumed to come from "peer-reviewed journals" ….

- Dr. Jeff Beall, University of Denver, U.S.
  - -Has identified so-called "Predatory Publishers" (PP)
  - -Journals of questionable scientific soundness
  - -His PP list: https://scholarlyoa.com/publishers/
  - -Some SWAT articles in database in PP journals (~10%?)

- Currently adding indexing and PP data to database
  - -Web of Science All Databases, Web of Science Core Collection (& JIF), Scopus and/or PP identification

Journals with 30+ Papers in Current Database

Journal	Papers
Transactions ASAE/ASABE	~162
Hydrological Processes	~160
Journal of Hydrology	~147
Journal of the Amer. Water Resources Assoc.	~105
Water Resources Management	~66
Hydrological Sciences Journal	~63
Environmental Modelling & Software	~58
Agricultural Water Management	~57
Journal of Hydrologic Engineering	~53
Journal of Environmental Quality	~53
Hydrology and Earth System Sciences	~52
Water Resources Research	~50
Science of the Total Environment	~48
Journal of Soil and Water Conservation	~46
Ecological Modelling	~42
Water	~32

CARD

Current Structure of Database

- Functions/information included:
  - option to upload citation data for papers
  - Readme (brief description of database)
  - send message to database operators
  - citation lists by author or model
  - DOI or URL weblink to most article webpages
  - can download citation data for subsets of papers
  - Most abstracts not currently visible but DOI/URL links available for most papers
    - abstracts are included in searches

- Subdivided into broad, primary & secondary categories
Use caution when using general search option: e.g., a search on "India" also returns "Indiana" articles
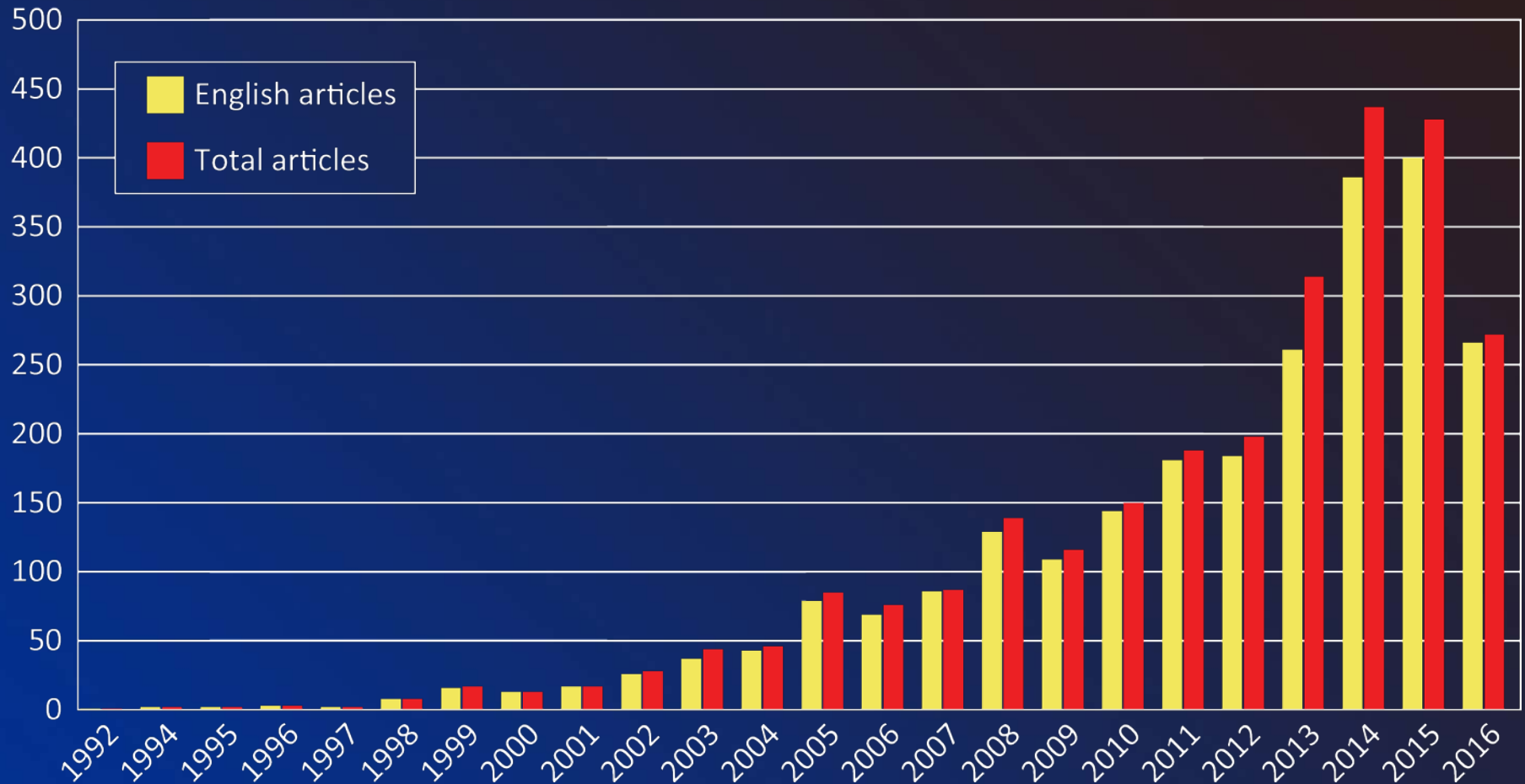
What Qualifies as a SWAT Paper?

- Most studies are obvious applications of SWAT or a modified version of SWAT

    -SWAT is a minor component of some studies

- A few studies represent "pre-SWAT" models, "SWAT-related" models or "no model"

- Reviews: (1) only discuss SWAT, (2) comparisons of SWAT & other models, or (3) other relevant reviews

Broad Categories in Database

Category	Total papers	Category	Total papers
hydrologic only	1314	literature citation analysis	10
hydrologic & pollutant	928	special issue overview	10
pollutant only	216	pre-SWAT or SWAT-related	10
review/history	91	BMP review, etc.	6
interface tool / other software	26	carbon cycling	4
conceptual approach	21	watershed descriptions	3
data or component development	21	Documentation and/or terminology	2
crop/plant growth	18	Editorial	2
computational approaches	17		

Trends in SWAT-related articles in SWAT Literature Database (July_2016)

Models Represented in Database

- Model names listed in database confined mainly to SWAT or modified SWAT model names

- A few entries include other models developed at the co-located labs in Temple, TX or key models related to the development of SWAT

- Other models included in studies are not listed (unless included as part of a modified model name); e.g., HSPF, AGNPS, MODFLOW, SWMM, TOPMODEL

CARD

Models Represented in Database

- Vast majority of papers describe some sort of standard SWAT application
    - don't differentiate by specific version/release #

- Over 140 modified SWAT models in literature
    - identified in database by specific name or simply as "SWAT (Modified)"

- A few "Pre-SWAT or SWAT-Related" papers
    - Models that contributed key components or are closely related to SWAT (i.e., models from the Temple Labs)

CARD

Example Modified SWAT Models

Name	Country	Description
SWATMOD	U.S. (Kansas)	SWAT and MODFLOW groundwater model interface
SWIM	Germany	Comprehensive water quality model developed from SWAT and MATSALU models
SWAT-G	Germany	Improved flow predictions for typical conditions in low mountain ranges in Germany
ESWAT	Belgium	"Extended" with sub-hourly time step, enhanced hydrology and in-stream components, and autocalibration options
SWAT$_{BF}$	Canada	Better simulate processes within forested watersheds in the Canadian Boreal Plain
SWAT-K	South Korea	Multiple modified modules for Korean conditions; includes interfaces with the MODFLOW and SWWM models
SWAT-VSA	U.S. (Cornell Univ.)	Re-conceptualized model that simulates overland flow in ways consistent with variable source area hydrology
SWAT-CS	Canada	Improved flow predictions for Canadian Shield region
PCPF-1 @SWAT	Japan	Improved approach for simulating pesticide transport in rice paddies

Pre-SWAT or SWAT-Related Models Cited in Database

- ALMANAC: Agricultural Land Management Alternative with Numerical Assessment Criteria

- APEX: Agricultural Policy/Environmental eXtender

- EPIC: Environmental Policy Integrated Climate

- GLEAMS: Groundwater Loading Effects of Agricultural Management Systems

- ROTO: Routing Outputs to the Outlet

- SWRRB: Simulator for Water Resources in Rural Basins

Williams J.R., J.G. Arnold, J.R. Kiniry, P.W. Gassman and C.H. Green. 2008. History of model development at Temple, Texas. Hydrol. Sciences Journal. 53(5): 948-960. Doi: 10.1623/hysj.53.5.948.

Distribution of Models in Database

Specific model or category	Total papers
SWAT	2387
ESWAT	10
SWAT-G	14
SWIM	41
SWAT (modified)	143
SWAT (modified) & SWAT	38
PRE-SWAT or SWAT-related[***]	14
PRE-SWAT or SWAT-related[***] & SWAT	26
None	27

[***]**Includes ALMANAC, ALMANACBF, APEX, EPIC, GLEAMS, SWRRB, & ROTO**
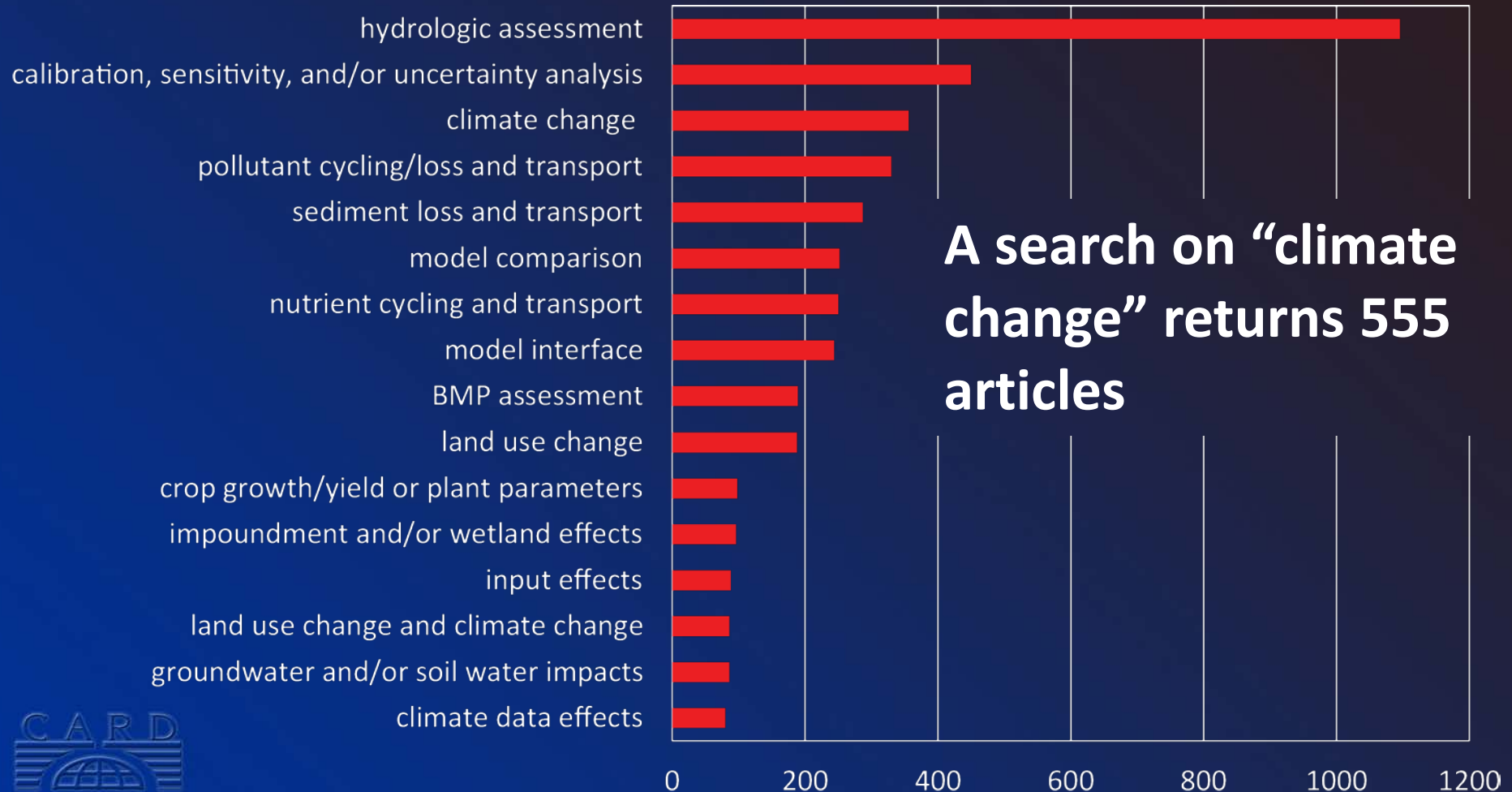
Languages Represented in Database

Category	Total papers	Category	Total papers
English	2492	Spanish & English	5
Chinese	67	Vietnamese	4
Korean	50	German	3
Portuguese	32	Japanese	2
Indonesian	13	Polish	2
Spanish	11	Basque	1
Farsi	10	Romanian	1
French	7		

Primary & Secondary Categories

- Currently 68 primary/secondary categories

- Over 300 papers set as "none" for secondary category

- Some of the categories reflect emerging trends
  - e.g., crop growth/yield results, modified curve number approaches, Green-Ampt method, glacier melt, stream temperature

- Subjective decisions used in categorizing papers
  - some papers could be categorized in 3 or more categories

CARD

Recategorization of Some Categories is Gradually Occurring

- Nutrient cycling/loss & transport: specific "nitrogen cycling/loss & transport or "phosphorus cycling/loss & transport" categories have been added

- Input Effects: several specific categories have been added; e.g., climate data effects, DEM effects, soil data resolution effects, land use change

- Calibration, sensitivity analysis and/or uncertainty analysis: some recategorization has been initiated

CARD

EPIC/APEX Literature Database

- https://www.card.iastate.edu/epic_apex_articles/

- Maintained on CARD website but managed by Robin Taylor and others at BREC in Temple, TX

- Structure of database very similar to SWAT Literature Database

- Citation data available for 100 articles so far

CARD

Some Concluding Thoughts

- SWAT literature continues to expand rapidly
    - disciplines represented also continues to expand
    - ability to keep adding lots of future papers not guaranteed

- Plan to add citation database data soon

- Hope to also add Continent, country & other location data

- Users are encouraged to upload citation data and also identify typos/errors

- Any other feedback from users is welcome