A Review of Select Water Education Initiatives of the Last 40 Years

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Why Water?

- High quality and relatively inexpensive water supplies provided the foundation for cities, industrial growth, agricultural production, and recreational activities, but few areas have reported the long-term ability to support current water use trends (Hundley, 2009; Loucks, van Beek, Stedinger, Dijkman & Villars, 2005).

Agricultural Water Use Statistics Nationwide

Total Water Withdrawn In the United States (USGS, 2005)

Specifically…

- In Idaho Arizona, Idaho, Kansas, New Mexico, Oregon, Utah and Wyoming , 75% of all water withdrawals were designated for irrigation in 2005
- In Colorado that figure was around 90%; in Montana it was nearly 96% (USGS, 2005)

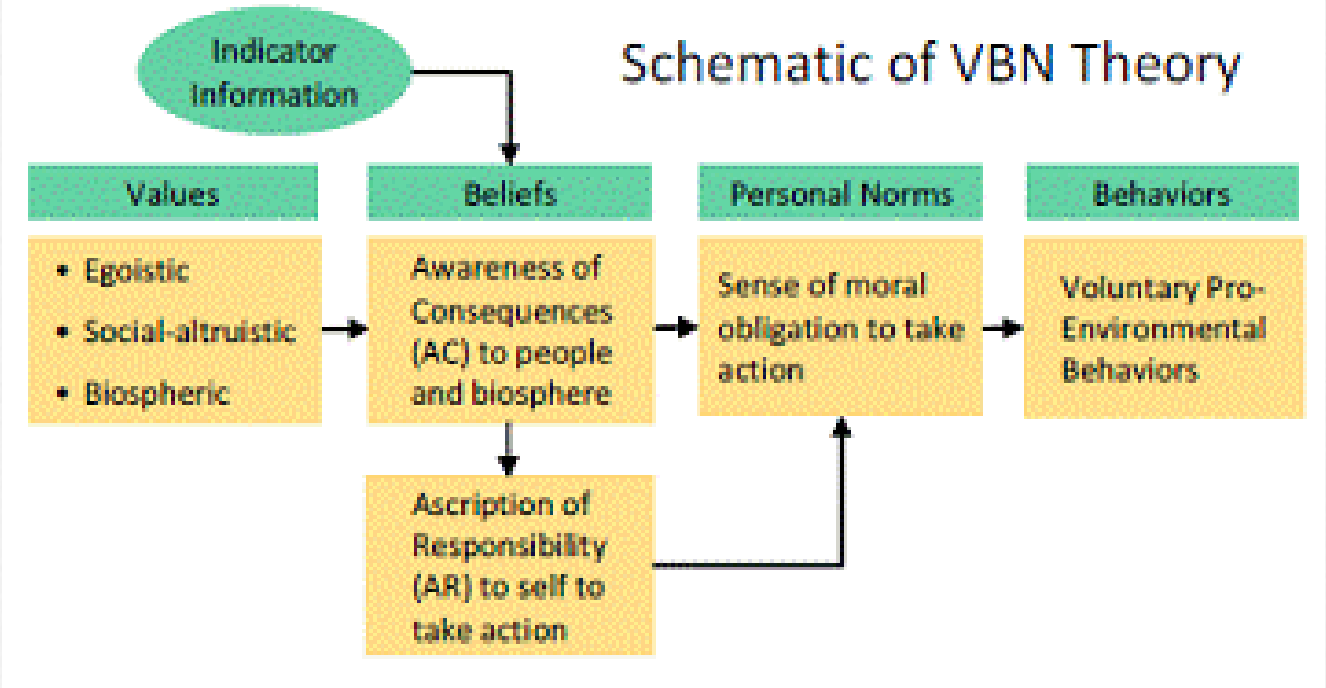
- Clearly, water resource education has an important place in high school and college level agricultural education curriculums.

The Working Connection Between Agricultural Education and Environmental Education

- Behavior change models within environmental education suggest that knowledge alone does not necessarily impact environmental behavior.

- Despite such limited utility, the linear behavior change model has consistently been applied by non-government organizations (NGOs), in government-funded initiatives, and in various adult education settings (Kollmus & Agyeman, 2002)

Value-Belief-Norm Model (Stern, 2000)



Goals of the Study

- This paper aimed to examine select water-related events of the last 40 years, the educational initiatives in response to those events, and ultimately to assess the impact those initiatives had on overall water use patterns. The timeline referenced the passage of the Clean Water Act in 1972.

- The historical review also sought to establish a working connection between formal environmental education and agricultural education.

The Generations

- Water users were divided into 3 “Generations” of users:
  - The First generation (aka the “Silent Spring Generation”) – a period characterized by little to no formal environmental education. The review of this generation examined two hallmark projects of the Clean Water Act: Lake Erie and Chesapeake Bay. These projects were selected because of their large diverse-use watersheds and publicity.
  - The Second Generation – defined by the adoption of nonpoint source pollution mitigation and by the population booms in the southwest that resulted in major irrigation reform during the 1980s and early 1990s.
  - The Third Generation – Starting in the late 1990s and early 2000s - this group was defined by the technical advancements that affected water use patterns and the way educational material was disseminated.

The First Generation - Findings

- The literature review of the first generation showcased two major restoration projects from the era: Lake Erie and Chesapeake Bay. The juxtaposition of these two projects and their respective educational initiatives was intriguing because the ecological damage was similar, but the corresponding public education efforts could not have been more different.

The First Generation

Chesapeake Bay

- Targeted with one of the most comprehensive and proactive water education programs of the 20th century complimented those mandates.
- Forty years after the passage of the CWA, residents in Chesapeake states still reported moderate to high knowledge of the bay's ecological condition and remained intellectually interested and fiscally supportive of restoration and education efforts (Chesapeake Bay Trust, 2008; Chesapeake Bay Foundation, 2012b).

Lake Erie

- Similar technical variables between the Chesapeake Bay and Lake Erie projects: both involved large populations; approximately 17 million people lived in the Lake Erie watershed in 1985 (Ohio Sea Grant College Program, 1989), and 13.5 million people lived in the Chesapeake Watershed (Chesapeake Bay Program, 2012a). Both of these complex watersheds contain massive arterial tributaries tapped by diverse industrial and agricultural users.
- In 2012 Lake Erie experienced eutrophication rates second only to those measured during the 1970s (Wines, 2013), while Chesapeake Bay continued to demonstrate steady, albeit slow, progress (Chesapeake Bay Foundation, 2012a).

The Second Generation - Findings

- The second generation was an interesting paradox in the history of water-resource education and the Clean Water Act.
- In 1987, the CWA was amended to establish the Section 319 Nonpoint Source Management Program. The term nonpoint source (NPS) pollution was often viewed as a catchall for various types of pollution sources not defined in the CWA.
- While the majority of point-source pollution had been identified, if not explicitly addressed, ongoing NPS pollution cast a dark shadow on existing restoration projects because it was so extensive and multifarious.

The Second Generation - Findings

- Many BMP programs demonstrated the general inadequacy of the linear environmental education model
- The program's focus was slow to shift because of the hands-off approach of voluntary implementation efforts (Zaring, 1996). This might have been a product of Section 319's tenuous beginnings; the section was passed by Congress but ultimately vetoed on the premise that it was too expensive and would harm industry and agricultural operations (Kovacic, 1991).

Environmental Protection vs. Economic Growth

- Voluntary management programs like BMPs were only effective if a strong social norm existed to implement the change.
  - The idea of creating an "information incentive" (Feather & Amacher, 1994, p. 159) was not useful when BMPs required out of pocket costs and were not well supported within a community. Thus, environmental education only achieved the goal of helping reduce financial incentives and cost-share programs when the programs were supported on a community level.
  - Prokopy, Floress, Klotthor-Weinkauf & Baumgart-Getz (2008) recommended educators consider the "knowledge of social factors" (p. 309) in BMP educational programming. This was supported by the early vision of Karr & Dudley (1981), who suggested that peer pressure between farmers would increase the adoption of BMPs; it was also in-line with the large body of research pointing to social norms and other social factors as a driving force behind environmental action, particularly in communities that felt threatened by environmental regulations.

The Third Generation

- The third generation may have been the most telling of all three generations. The literature of the third generation pointed to the idea that individuals did not believe their actions mattered if large-scale water users and policies did not complement the efforts of individuals (Barnett, 2011; Hundley, 2009; NEETF, 2005). This was consistent with Stern's value-belief-norm model and the types of environmental action it predicted (2000).

The Third Generation - Findings

- The third generation had not let go of the economic-growth-versus-environmental-protection debate from the second generation; this was evident in policies that increased extraction industry development without much regard to water use or degradation (Scientific American, 2011).
- Technology innovations of the third generation shaped water management faster than policy and management practices could be updated.
- This trend is only accelerating; in the coming decades it will be important to insure that those charged with water resource education, particularly educators of adults and diverse users, are able to respond quickly and with research-based information.

Implications for Agricultural Educators

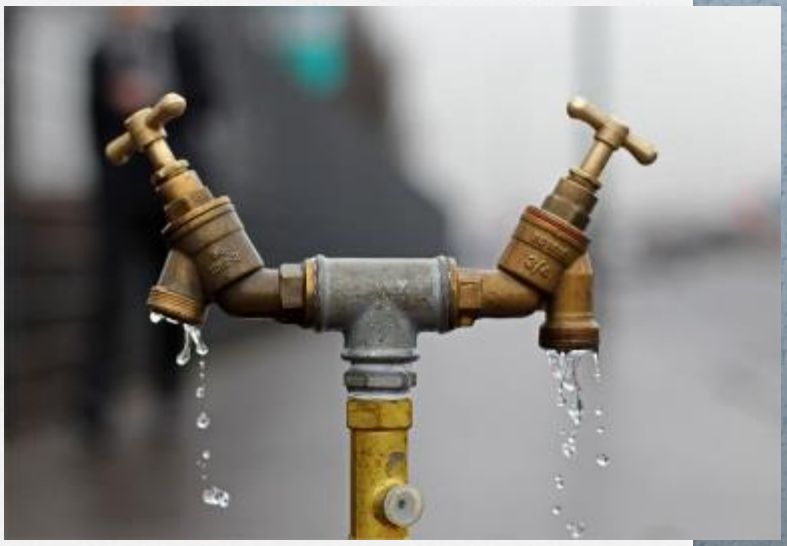
- **Social norms:** Voluntary programs regarding water stewardship have not been demonstrated to be effective unless they are supported by social norms. Agricultural educators must internalize the past and current relationships between regulatory agencies and water users and design programming that speaks to community perceptions about water resources and availability.
- **Self-efficacy:** Agricultural educators must emphasize the ability of the water user to impact water quality and future availability.
- All three generations spoke to the complex and often heated interactions between diverse water users. Inefficiencies associated with the polarization of different groups were highlighted throughout the review; agricultural educators should seek to promote more dialogue between users in an effort to promote management strategies that are economically and ecologically viable.

Implications

- There has been much discussion within environmental education arenas about not promoting environmental agendas; this has caused educators to stray away from trying to change social norms in their teaching.
- While agendas and propaganda are valid concerns, promoting more sustainable water use practices is an issue of public wellbeing and the future of agriculture, particularly in the western U.S.
- Educators not only can promote a more sustainable water use ethic in the U.S., they need to promote sustainable use in order enact meaningful change. Otherwise, they are simply providing students and the public with environmental *information.* Education without an environmental sensitivity component does not ultimately lead to behavior change.

Implications for Agricultural Educators

- There are larger implications for agricultural users and educators, mainly because agriculture uses so much water in the western U.S. and its viability is constantly threatened by municipal and industrial growth.
- The idea of a water use ethic has started to permeate classrooms, but it has not consistently reached large scale and agricultural water users in a way that does not villanize them.



In the Classroom

- Agricultural educators must take it upon themselves to promote sustainable water use principles and understand that they are equal parts environmental and agricultural educators.
- Changing traditional social norms within agricultural users must happen internally; norms cannot be imposed by external agencies or by activists who do not understand the relationship between withdrawals for irrigation and agricultural viability.

To Conclude…

- Agricultural water users can lead the way in meaningful water use reform that is written with goals of future economic and ecological security, not retroactive regulations imposed by federal agencies.
- The definitions of beneficial water use have shifted in many states, but many traditional agricultural users do not understand the complex web of future rights to use water, economic incentives to reduce consumptive use, or whether their current systems are managing water in the most efficient way possible.
- The literature review of the third generation partially explained why water law has undermined beneficial use goals; large-scale users need to understand these issues and what they can do to enhance future water security. If use patterns are not changed, the viability of western agriculture altogether may be threatened as water distribution changes and water sources are consumed or contaminated.

Any Questions?

Bamberg, S., & Moser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behavior. *Journal of Environmental Psychology, 27,* 14-25. doi: 10.1016/j.jenvp.2006.12.002

Barnett, C. (2011). *Blue revolution: Unmaking America's water crisis.* Boston, MA: Beacon Press.

Chawla, L., & Cushing, D. F. (2007). Education for strategic environmental behavior. *Environmental Education Research, 13*(4), 437-452. doi: 10.1080/13504620701581539

Chesapeake Bay Foundation. (2012a). *2012 state of the bay*. Retrieved from http://www.cbf.org/about-the-bay/state-of-the-bay/2012-report

Chesapeake Bay Foundation. (2012b). Our history. *Chesapeake Bay Foundation: Saving a National Treasure.* Retrieved from http://www.cbf.org/about-cbf/history

Chesapeake Bay Program. (2012a). Education and interpretation. *Chesapeake Bay Program: Science, Restoration, Partnership.* Retrieved from http://www.chesapeakebay.net/indicators/indicator/education_and_interpretation

Chesapeake Bay Program. (2012b). Population growth. *Chesapeake Bay Program: Science, Restoration, Partnership.* Retrieved from http://www.chesapeakebay.net/issues/issue/population_growth#inline

Chesapeake Bay Trust. (2008). *Marylanders and the environment*. Retrieved from http://www.dnr.state.md.us/irc/conservationcoursedocs/lesson1/Marylander&Environment.pdf

Cox, D., Lawver, D. E., & Doerfert, D. (2004). Critical water related curriculum needs as perceived by agricultural science teachers in programs located within the boundaries of the Ogallala Aquifer. *Journal of Agricultural Education, 45*(4), 22-33. doi: 10.5032/jae.2004.04022

Dunlap, R. E., & Van Liere, K. D. (1978). The new environmental paradigm: A proposed measuring instrument and preliminary results. *The Journal of Environmental Education, 9*(4), 10-19.

Educating Young People About Water. (2004). History. Retrieved from http://www.uwex.edu/erc/eypaw/history.html

Environmental Protection Agency. (1992). *The quality of our nation's water.* Retrieved from: http://water.epa.gov/lawsregs/guidance/cwa/305b/upload/2002_04_08_ 305b_92report_92summ.pdf

Environmental Protection Agency. (1994). *What is nonpoint source (NPS) pollution? Questions and Answers* (taken from EPA's Polluted brochure EPA-841-F-94-005, 1994). Retrieved from http://www2.epa.gov/sites/production/files/documents/ whatisnonpointsourcepollution.pdf

Environmental Protection Agency. (2012a). *Climate change: Society impacts and adaptations*. Retrieved from http://www.epa.gov/climatechange/impacts-adaptation/society.html

Environmental Protection Agency. (2012b). The Clean Water Act: Protecting and restoring our nation's waters. *Water: Clean Water Act 40th Anniversary*. Retrieved from http://water.epa.gov/action/cleanwater40/cwa101.cfm

Feather, P. M., & Amacher, G. S. (1994). Role of information in the adoption of best management practices for water quality improvement. *Agricultural Economics, 11,* 159-170.

Fortner, R.W., Mayer, V. J, Brothers, C. C., & Lichtkoppler, F. R. (1991). Knowledge about the great lakes environment: A comparison of publics. *Journal of Great Lakes Research, 17*(3), 394-402. doi: 10.1016/S0380-1330(91)71375-0

Graham. F., Jr. (1978). Rachel Carson. *EPA Journal.* Retrieved from http://epa.gov/history/topics/perspect/carson.html

Greenberg, P. (2012, May 12). The Clean Water Act at 40: There's still much left to do. *Environment 360: Opinion, Analysis, Reporting & Debate.* Retrieved from http://e360.yale.edu/feature/the_clean_water_act_at_40_theres_still_much_left_to_do/2532/

Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behaviour: A meta- analysis. *Journal of Environmental Education, 18*(2), 1-8. doi: 10.1080/00958964.1987.9943482

Hundley, N. (2009). *Water and the west: The Colorado River Compact and the politics of water in the American West* (2nd edition). Berkeley and Los Angeles, CA: University of California Press.

Hungerford, H.R. & Volk, T. (1990). Changing learner behavior through environmental education. *Journal of Environmental Education, 21*(3), 8-21.

Karr, J. R., & Dudley, D. R. (1981). Ecological perspective on water quality goals. *Environmental Management, 5*(1), 55-68. doi: 10.1007/BF01866609

Kellstedt, P. M., Zahran, S., & Vedlitz, A. (2008). Personal efficacy, the information environment, and attitudes toward global warming and climate change in the United States. *Risk Analysis, 28*(1), 113-126. doi: 10.1111/j.1539-6924.2008.01010.x

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research, 8*(3), 239-260. doi: 10.1080/13504620220145401

Konisky, D. M., & Beierle. T. C. (2001). Innovations in public participation and environmental decision making: Examples from the Great Lakes Region. *Society and Natural Resources, 14*(9), 815-826. doi: 10.1080/089419201753210620

Kovacic, W. E. (1991). The Reagan judiciary and environmental policy: The impact of appointments to the federal courts of appeals. *Boston College Environmental Affairs Law Review, 18*(4), 699-713. Retrieved from http://lawdigitalcommons.bc.edu/ealr/vol18/iss4/4

Loucks, D.P., van Beek, E., Stedinger, J.R., Dijkman, J. P.M., & Villars, M. T. (2005). *Water Resources Systems Planning and Management: An Introduction to Methods, Models, and Applications*. The Netherlands: UNESCO.

Malka, A., Krosnick, J. A., & Langer, G. (2009). The association of knowledge with concern about global warming: Trusted information sources shape public thinking. *Risk Analysis*, 29(5), 633-647. doi: 10.1111/j.1539-6924.2009.01220.x

Molden, D., Oweis, T., Steduto, P., Bindraban, P., Hanjra, M. A., & Kijne, J. (2010). Improving agricultural water productivity: Between optimism and caution. *Agricultural Water Management,* 97(4), 528-535. doi: 10.1016/j.agwat.2009.03.023

National Environmental Education and Training Foundation. (2005). *Environmental literacy in America: What ten year of NEETF/Roper research and related studies say about environmental literacy in the U.S.* Washington, DC: Coyle.

Ohio Sea Grant College Program. (1989). *Lake Erie water quality: Past, present and future* (Fact Sheet 045). Columbus, OH: Jeanneret.

Palmer, J. A. (1998). *Environmental Education in the 21st century: Theory, practice, progress, and promise.* Routledge: New York, NY.

Poortinga, W., Steg, L., & Vlek, C. (2004). Values, environmental concern, and environmental behavior: A study into household energy use. *Environment and Behavior, 36*(1), 70-93. doi: 10.1177/0013916503251466

Prokopy, L. S., Floress, K., Klotthor-Weinkauf, D., & Baumgart-Getz, A. (2008). Determinants of agricultural best management practice adoption: Evidence from the literature. *Journal of Social and Water Conservation, 63*(5), 300-311. doi: 10.2489/jswc.63.5.300

Scientific American. (2011, October 19). Safety first, fracking second. *Scientific American.* Retrieved from http://www.scientificamerican.com/article.cfm?id=safety-first-fracking-second

Slimak, M. W., & Dietz, T. (2006). Personal values, beliefs, and ecological risk perception. *Risk Analysis, 26*(6), 1689-1705. doi: 10.1111/j.1539-6924.2006.00832.x

Steel, B. S., Soden, D. L., & Warner, R. L. (1990). The impact of knowledge and values on perceptions of environmental risk to the great lakes. *Society & Natural Resources: An International Journal, 3*(4), 331-348. doi: 10.1080/08941929009380730

Steg, L., Dreijerink, L., & Abrahamse, W. (2005). Factors influencing the acceptability of energy policies: A test of VBN theory. *Journal of Environmental Psychology, 25*(4), 415-425. doi: /10.1016/j.jenvp.2005.08.003

Stern, P. C. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Sciences, 56*(3), 407-424. doi: 10.1111/0022-4537.00175

Stern, P. C., Dietz, T., Abel, T., Guagnano, G., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Research in Human Ecology,* 6(2), 81-97. Retrieved from http://humanecologyreview.org/pastissues/her62/62sternetal.pdf

Tarlock, A. D. (2001). Ideas without institutions: The paradox of sustainable development. *Indiana Journal of Global Legal Studies,* 9(1). Retrieved from http://www.repository.law.indiana.edu/ijgls/vol9/iss1/3

United States Geological Survey. (2009). *Estimated use of water in the United States in 2005* (USGS Circular 1344). Retrieved from http://pubs.usgs.gov/circ/1344/pdf/c1344.pdf

Welch, T., & Braunworth, W. S. (2010). Education in the face of controversy: When water and politics mix. *Journal of Extension,* 48(3). Retrieved from http://www.joe.org/joe/2010june/a1.php

Wines, M. (2013, March 14). Spring rain, then foul algae in ailing Lake Erie. *The New York Times*. Retrieved from http://www.nytimes.com/2013/03/15/science/earth/algae-blooms-threaten-lake-erie.html?pagewanted=all&_r=0

Zaring, D. (1996). Agriculture, nonpoint source pollution, and regulatory control: The Clean Water Act's bleak present and future. *Harvard Environmental Law Review, 20,* 515-545.