

CFAES

College of Food, Agricultural, and Environmental Sciences



THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES

CFAES WATER QUALITY TASK FORCE

2018 FACULTY SURVEY RESULTS

November 2018

BACKGROUND AND METHODS:

In the fall of 2017, Dean and Vice President Dr. Cathann Kress appointed a group of 8 faculty from the College of Food, Agriculture, and Environmental Sciences to a Water Quality Task Force (WQTF). The WQTF was charged with developing a proposal for a CFAES Water Quality Initiative (WQI) that could be used to coordinate and increase the impact of water quality-related research, teaching and outreach/extension activities of the college's faculty and staff.

As part of its work, the WQTF distributed an online, Qualtrics-based survey to CFAES faculty and staff in late February and early March 2018. The goals of the survey were to: (i) inventory the depth and breadth of ongoing work on water quality within the college; (ii) document faculty and staff assessments of priority water quality issues; and, (iii) to get suggestions from the faculty and staff about what the future WQI should include.

We emailed the survey to 615 individuals who held permanent research and teaching positions within the college. These included all tenure-track and tenured faculty, research scientists, clinical faculty, lecturers, and extension educators. We received 174 useable responses, representing a 28% response rate. Many of those who responded provided both answers to fixed item questions, but also lengthy responses to open ended questions.

The survey instrument asked questions about a wide range of topics, including:

- The extent of each respondent's engagement in water quality-related research, teaching, and outreach/extension efforts.
- Details about water quality-related research projects, courses and other teaching activities, and outreach/extension programs.
- Details about partnerships and collaborations within and outside CFAES on water quality projects.
- Specific water quality topics that should be prioritized in the CFAES WQI.
- Specific kinds of activities or programs that should be included in the CFAES WQI.

This report is designed to present highlights of the survey findings. These results are being used by the WQTF to inform the development of a WQI proposal (to be submitted to Dean Kress later in 2018).

Key Take-Aways

Faculty & staff are **highly engaged in water quality related work** and the WQTF effort. Since not all CFAES faculty and staff work directly on water quality-related projects, the 28% response rate (174 useable responses) and the quality of written comments/feedback suggest a high degree of engagement and interest in the work of the WQTF. A majority of the CFAES faculty and staff respondents are addressing water quality in their research, outreach & Extension, and teaching activities - approximately 50%, 60%; and 70%, respectively - see Figure 2 and Table 1.

Our faculty and staff conduct research on a wide range of water quality issues – ranging from Harmful Algal Blooms (HABs) in Lake Erie and other waterways, to rural water supplies and septic systems, to urban water quality challenges associated with stormwater runoff and industrial wastewater, to efforts to protect the integrity of aquatic ecosystems. Most of the research done by our faculty is focused on improving our understanding of the mechanisms behind water quality problems and development of applied technologies or other solutions to prevent water quality impairment and remove contaminants to protect consumers and wildlife.

In terms of which water bodies which should be prioritized in a WQI, nearly **90%** of respondents ranked **Lake Erie as a high priority**; ~60% Ohio River tributaries; and 54% Ohio groundwaters. Combining high and medium rankings, **all types of water bodies are considered a priority** by an overwhelming majority (nearly or above 90% of respondents) – see Figure 3.

When asked what sources of water quality impairment should be a focus, faculty listed **Nutrient Losses / Runoff** as the highest priority source of impairment. Remaining sources were split between high-medium (Sediment / Erosion; Agrichemicals; Stormwater / CSOs; Urban & Industrial Pollution; Pathogens; and, Changes in Agricultural Drainage) and medium-low priority clusters (Hydraulic Fracturing; Invasive Species; Pharmaceuticals; Dams & Hydrogeomorphic Alterations) – see Figure 4.

Of five types of water quality impacts listed in the survey, respondents ranked **Human Health** as the highest priority. *Aquatic Ecosystem Health & Ecosystem Services* also ranked highly and may have been viewed as overlapping topics. *Economic Development* ranked medium-high, split 50/50; and, *Aesthetics & Recreation* ranked lowest – see Figure 5.

An important goal of the survey was to solicit input on what activities are important to a future College Water Quality Initiative. The options presented, as ranked by respondents, formed three clusters.

The two highest ranked were *Expanding Support for Outreach/Extension* and *Facilitating Research Collaboration*. The medium-high group included four activities: *Support for a Water Quality Monitoring System*, *Research Proposal Support*, *Direct Research Funding*, and *Science Working Groups*. And, finally, the collective response showed the least support for the following three activities: *Public Information Portal*, *Data Archive*, *Incentives for Developing Coursework Incentives*. See Figure 6 and

Figure 7.

FINDINGS

Who Responded?

About two-thirds of respondents to the survey were tenured or tenure-track faculty members (see Figure 1). Another quarter of respondents were OSU Extension Educators. Other respondents were research scientists, lecturers, or served in other roles.

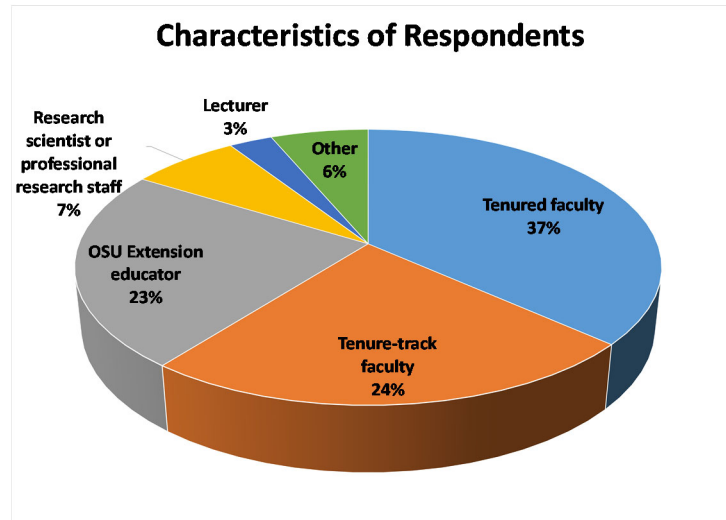


Figure 1. Proportion of Respondents in Different Roles within CFAES

Engagement in Water Quality-Related Efforts

The survey asked respondents to indicate the extent that water quality is included in their research, coursework & teaching, and outreach & Extension activities – see Figure 2 and Table 1.

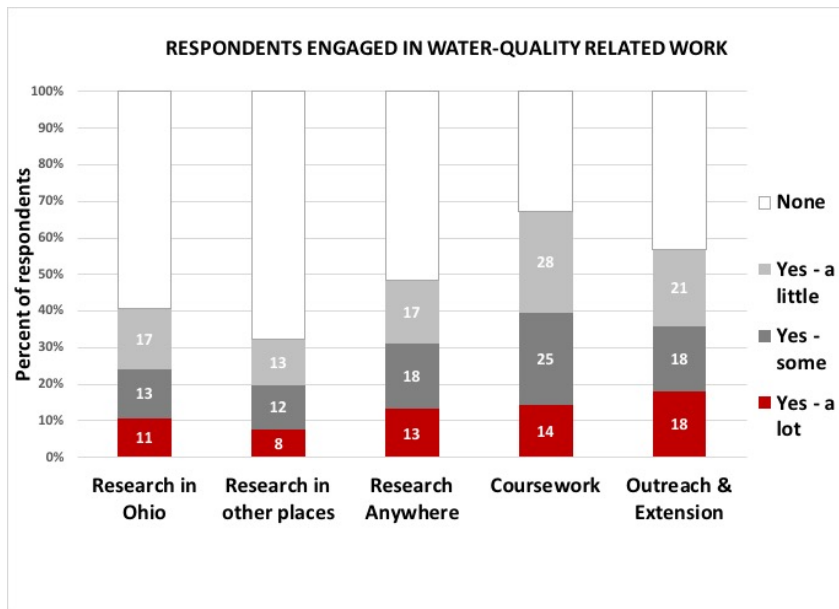


Figure 2. Percentages of Respondents Engaged in Water Quality Related Work

	RESEARCH				TEACHING				OUTREACH/EXTENSION			
	None	A little	Some	A lot	None	A little	Some	A lot	None	A little	Some	A lot
Tenured or Tenure Track Faculty (n=86)	49%	19%	19%	14%	33%	30%	27%	10%	48%	22%	17%	13%
OSU Educators (n=33)	64%	21%	15%	0%	21%	27%	27%	24%	15%	27%	30%	27%
Non-Tenure Track Other (n=23)	30%	9%	26%	35%	35%	22%	17%	26%	35%	22%	9%	35%

Table 1. Percent of respondents engaged in research, teaching and outreach/extension efforts related to water quality, by type of role played in CFAES.

Research, Extension and Teaching Details

If respondents indicated that water quality is included in their work, the survey presented open-ended text boxes to provide details in each of three categories – Research, Extension, and Teaching. Responses varied from short bullet lists to multiple-paragraph descriptions with great detail. Here, research and Extension activities are very generally described by topic areas and grouped into clusters.

Clusters of Research Activity

Agricultural Systems

- Fertilizer Application – Tri-State Recommendations
- Edge-of-Field Studies – P Risk Index (On-Field Ohio)
- Livestock Diet Manipulation for Nutrient Reduction
- Farmer Behaviors
- Economics & Cost-Benefit Studies
- Use of Biosolids on Ag Lands
- Precision Agriculture
- Manure Management
- Irrigation Technologies

Urban & Industrial Systems

- Urban Hydrology
- Stormwater Management
- Urban Soil Remediation
- Manufacturing Wastewater
- Wastewater Treatment
- Food Processing Source & Waste Waters
- Biodigester Effluent Treatment
- Septic Systems
- Well Construction
- Shale Development Implications
- Highway Bridge Design

Ecosystems

- Aquatic Ecosystem Health & Restoration
- Riparian Birds & Ecosystems
- Peatland Restoration
- Invasive Species

Human Systems

- Human / Public Health
- Social Impacts: Anglers, Recreation
- Public Awareness, Behaviors, & Wellness
- Environmental Economics & Policy
- Deglobalization Impacts

Research related to Lake Erie – Harmful Algal Blooms (HABs)

- On-Farm Research & Demonstrations
- Multi-Model Analyses of BMPs
- Lake Dynamics
- HAB Forecasting
- Cyanotoxin Impacts on Human Health and Aquatic Species
- Economic Analyses
- Policy Implications & Solutions

Clusters of Extension Activity

- Agricultural nutrient stewardship programs
 - FertCert and ReCert programs
 - E-fields and other BMP testing projects
 - Edge-of-field studies
 - Presentations at field days and conferences
- Environmental education
 - Programs to engage young girls in STEM
 - School programs related to riparian corridor health, wetlands, aquatic ecology
 - Presentations/demonstrations to public, teachers, students at Olentangy Wetlands
 - Citizen/student Water Quality monitoring efforts
 - Presentations and workshops on restoration of peatlands and wetlands
 - Presentations to faith-based communities
- Wastewater & septic management
 - Private water well construction and management programs; workshops for private landowners, installers & regulators
 - Soil Environment Technology Learning Lab – extension program for onsite wastewater treatment systems
 - Work with cities to remove contaminants from anaerobic digester wastewater
- Stormwater
 - Collaborations with cities and developers to assess stormwater practices
 - Facilitate community forums on stormwater issues
 - Taught national webinar on permeable pavements;
 - State inspection and maintenance certification workshop for Ohio
- Policy
 - Workshops and training on collaborative approaches to watershed management
 - Presentation of research on stormwater systems to shape state/local policy
 - Formulation of water quality trading programs
 - Host/lead Policy forum
 - Public health / promotion of water consumption
 - Environmental Professionals Network

Examples of Resident Instruction Teaching

- Over 60 courses listed, a third of which are primarily about water-related topics
- Draws from nearly every unit in college
- See Appendix for details

Priority Water Quality Issues

Participants were asked to identify priority water quality issues facing Ohio that a college initiative should address. Water quality issues were defined in three ways:

- Water body
“Based on your understanding and experience, how high a priority should the WQI place on addressing water quality challenges in each of the following types of waterbodies?”
- Source of impairment
“There are many forms of water quality impairment. Based on your experience, how high a priority should each of the following types of water quality stressors receive from the future college initiative?”
- Type of impact
“Water quality impairment can cause a wide range of impacts. If you were to pick, which types of water quality impacts should receive highest priority in a new college initiative?”

Water Body Priorities

In terms of water bodies in Ohio, all of the examples given were considered to be medium or high priorities by the overwhelming majority of respondents. Results suggest that the water quality problems in Lake Erie (particularly harmful algal blooms that have received considerable attention in the media and legislature) are a top priority for faculty in the college (Figure 3). Nearly 90% of respondents ranked Lake Erie as a high priority. A majority of respondents also ranked Ohio tributary rivers and streams and groundwater in the state as high priority targets for a future initiative. While there was somewhat less attention to inland lakes/reservoirs and the Ohio River and Mississippi River Basin, these water bodies were still prioritized by significant numbers of respondents.

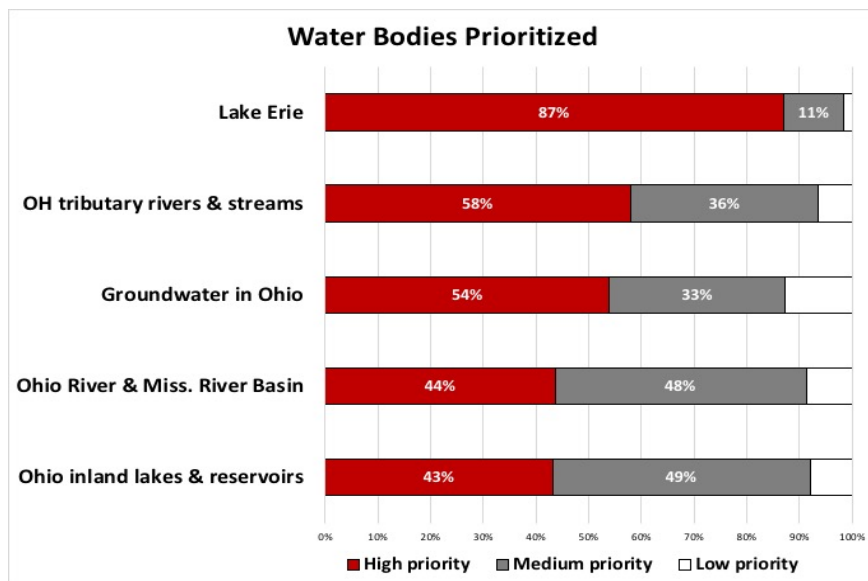


Figure 3. Percent of Respondents Prioritizing Different Ohio Water Bodies

SOURCES OF WATER QUALITY IMPAIRMENT

In terms of sources of water quality impairment, it was evident that respondents view nutrient losses / runoff as the highest priority, 81% high and 19% medium priority. The remaining ten categories of impairment sources can be lumped into one of two groups of relative priority levels.

Highest Priority

Nutrient Losses / Runoff

Medium-high Priority

Sediment / Erosion

Agrichemicals

Stormwater / CSOs

Urban & Industrial

Pollution

Pathogens

Changes in Agricultural

Drainage

Medium Priority

Hydraulic Fracturing

Invasive Species

Pharmaceuticals

Dams & Hydrogeomorphic

Alterations

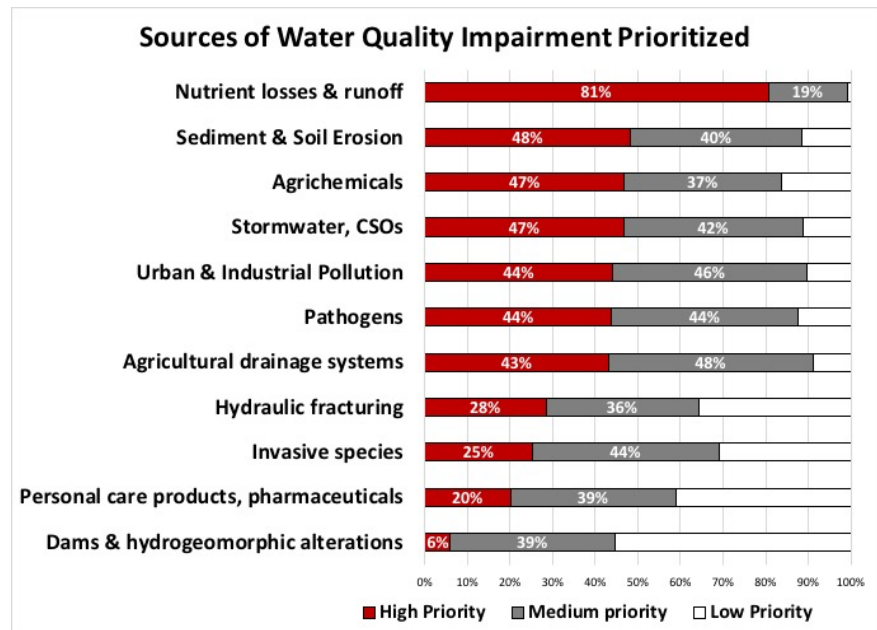


Figure 4. Percentages of Respondents Prioritizing Different Sources of Water Quality Impairment

Difference by Respondent's Role

We examined how responses may differ by the type of job each respondent has within the college. A few noteworthy observations include:

- All 3 main categories (tenure/tenure-track faculty; Extension educators; and research scientists/other) ranked nutrient losses/runoff as #1.
- Faculty ranked sediment/soil erosion much lower, #7; and pathogens slightly higher, #3
- Extension educators ranked agrichemicals much lower (#8); and stormwater & CSOs slightly higher #3
- Non-TT faculty & staff ranked Stormwater/CSOs #3 (and sediment/erosion #5)

WATER QUALITY IMPACTS

The survey asked participants to prioritize different types of impacts that can result from water quality impairment. We included the following five options, all of which were ranked as high or medium priority by a majority of respondents:

- Human health (municipal drinking water, private wells, recreation and fish consumption advisories)
- Health of aquatic ecosystems (including fisheries and wildlife biodiversity)
- Ecosystem services (e.g., nutrient cycling, biogeochemical processes, metabolism, etc.)
- Recreation/Aesthetics (impacts of water quality on the ability of Ohio residents to enjoy the state’s water resources)
- Economic Development (impacts of water quality on agriculture, fishing and recreation/tourism industry, real estate values, economic development, etc.)

Human health impacts are clearly the highest priority; and, it was similarly so when we looked at priority ranks by different roles. *Aquatic ecosystem health* and *Ecosystem services* in high-medium priority were very similar, suggesting overlapping topics between the category titles (see respondent comments below). Less than half (on the whole) considered *Economic Development* a high priority, though Extension educators ranked it 3rd. And; *recreation / aesthetics* ranked medium-low. There were few differences in the rankings by role, e.g. Extension educators ranked Economic Development #3.

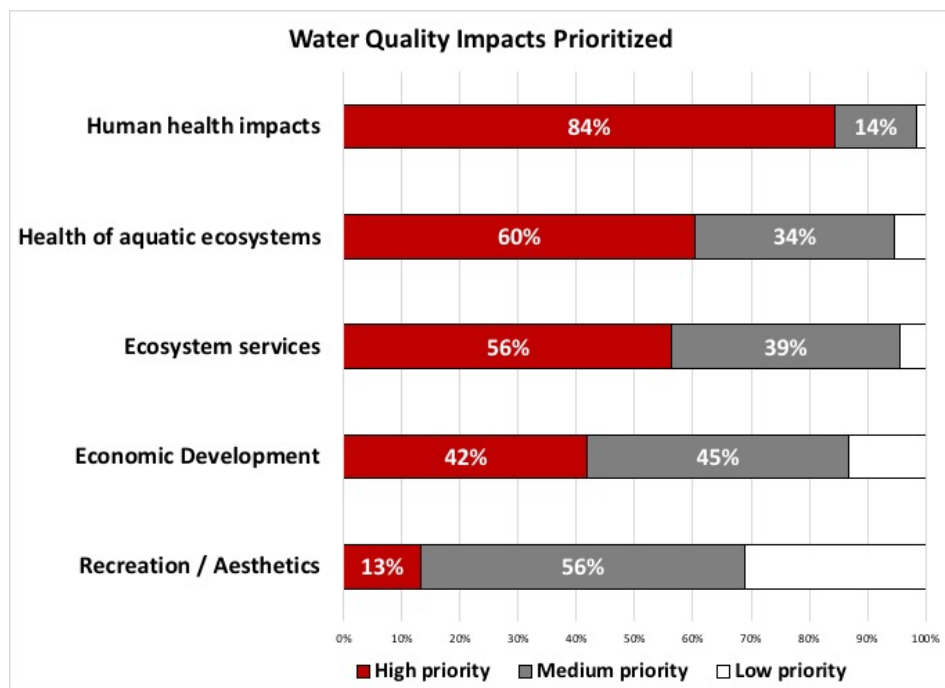


Figure 5. Percentages of Respondents Prioritizing Different Types of Water Quality Impacts

Comments

We received four comments in the write-in boxes for this section.

- A systems approach that considers each of these and tradeoffs.
- Ecosystem services is so broad an impact it encapsulates all the others. Integrated assessment is needed to inform trade-offs and policy/practice
- Ecosystem services encompass the others (e.g. economics and human health) so that's why I put it first.
- I only put them in this order because research on economic impacts and recreational limitations is more likely to move people to change habits (the real end-goal, in my opinion) than knowing the impacts on fish and wildlife, although I find this to be equally as important to understand.

Possible Programs or Activities to Include in Water Quality Initiative

After examining programs in other universities and brainstorming possible options, the WQTF members identified a set of nine types of programs or activities that could be included in the WQI. This list was not meant to be exhaustive of all possibilities, but to provide a stimulus to respondents to gauge their relative level of support for each option. Respondents were asked to sort each option into one of three boxes: high priority, medium priority, and low priority.

List of example Water Quality Initiative activities as presented in the survey (in descending rank order).

1. *Outreach/Extension Support* - Expand CFAES outreach, extension and public education efforts focused on water quality.
2. *Facilitate Research Collaboration* - Facilitate increased research collaboration across OSU colleges, and between OSU and other Ohio universities on water quality research topics.
3. *Monitoring System* - Lead or support efforts to expand a water quality monitoring system to track trends in water-quality conditions in Ohio.
4. *Research Proposal Support* - Facilitate efforts by CFAES faculty to submit proposals on water quality to external research funding sources.
5. *Direct Research Funding* - Allocate college funds to directly support water quality related research by CFAES faculty and staff.
6. *Policy/Management Working Groups* - Convene scientific working groups to review scientific literature to help inform policy makers, management agencies and practitioners
7. *Public Information Portal* - Create a public portal with information about water quality conditions across Ohio (historical trends, in real time)
8. *Data Archive* - Build and host a public water quality data archive for researchers to coordinate their work.
9. *Coursework Incentives* - Provide incentives to expand graduate and undergraduate coursework on water quality within the College.

All of the options presented were rated as medium or high priority by a majority of respondents (Figure 6). Results for the combined sample suggest that the top three preferences for activities include college support for:

- a) Expanding outreach, extension and public education on water quality
- b) Facilitating increased collaboration across OSU colleges and between scientists at OSU and other universities
- c) Leading or supporting efforts to expand a water quality monitoring system to track trends

There was also significant support for college help for faculty to submit research proposals to external funding sources and for the convening of scientific working groups to review scientific literature to inform policy makers and decision-makers.

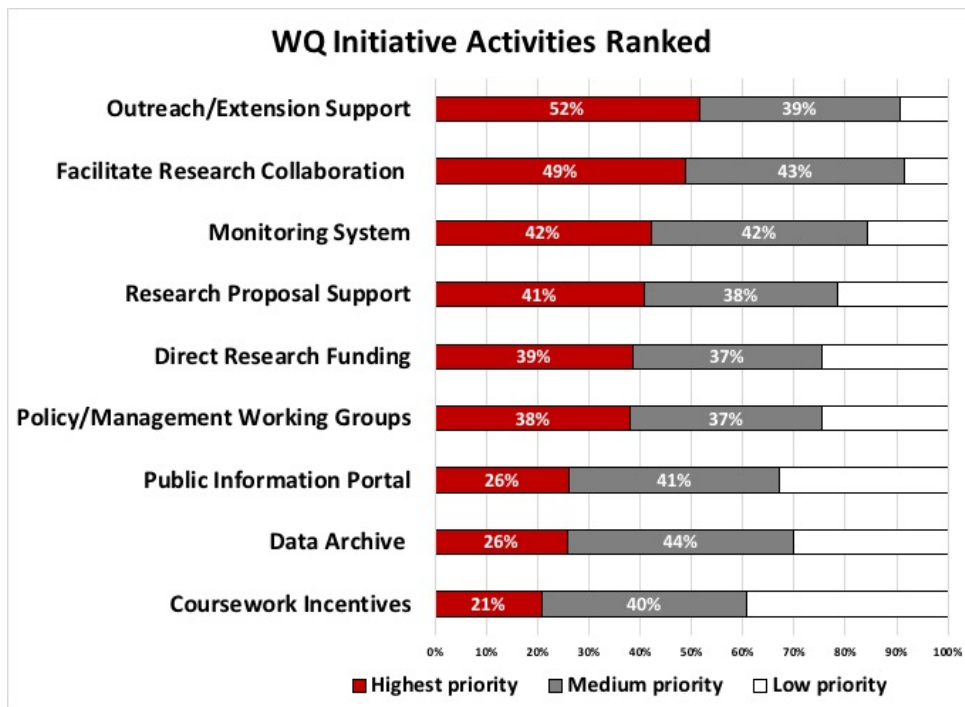


Figure 6. Percentage of Respondents Rating WQ Initiative Activities by Priority Category.

Priorities by Role of Respondent

When broken out by type of respondent, we found some important differences in priorities based on whether a respondent was a tenured/tenure-track faculty, extension educator, or in another non-tenure track research, teaching, or outreach staff position (Figure 7).

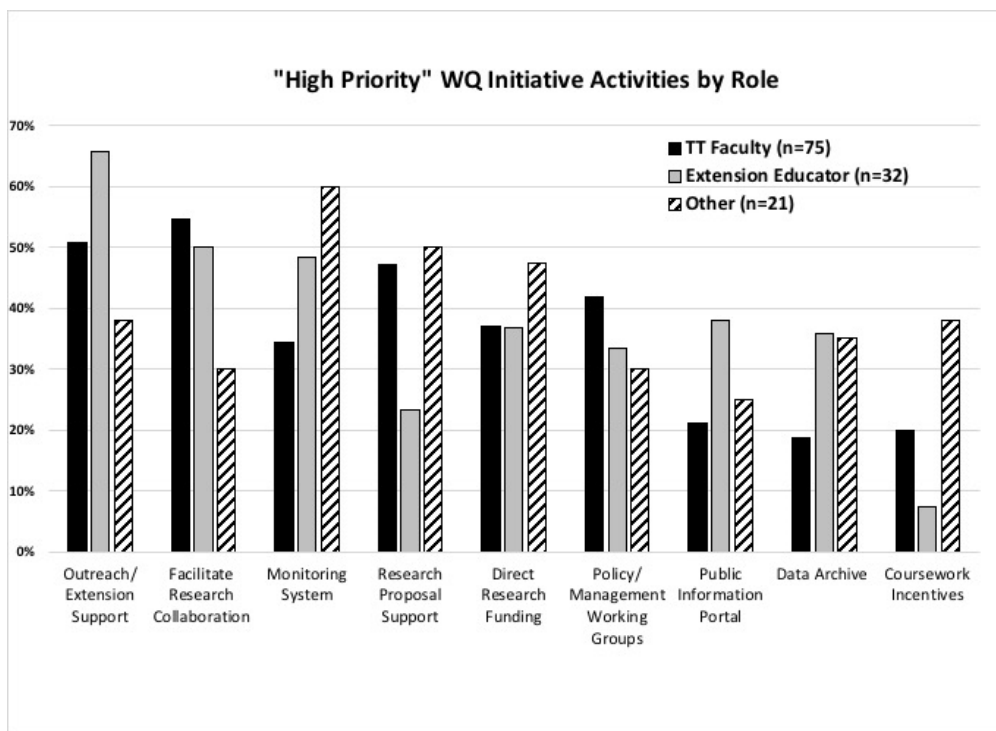


Figure 7. Percent of Respondents Ranking Activity as "High Priority" by Role

Another way to look at differences in the relative priority for each type of activity by faculty role is to see how each group ranked the options. Table 2 shows how five of the nine activities were in at least one group's top 3 high-priority rankings:

	Tenure/ Tenure-track Faculty	Extension Educator	Research Scientist, Lecturer, & Other Positions
<i>Outreach/Extension Support</i>	2	1	4
<i>Facilitate Research Collaboration</i>	1	2	7
<i>Monitoring System</i>	6	3	1
<i>Research Proposal Support</i>	3	8	2
<i>Direct Research Funding</i>	5	5	3
<i>Policy/Management Working Groups</i>	4	7	7
<i>Public Information Portal</i>	7	4	9
<i>Data Archive</i>	9	6	6
<i>Coursework Incentives</i>	8	9	4

Table 2. Rankings of Water Quality Initiative Activities (based on High-Priority ranking) by role of respondent.

Written Comments

Survey respondents had the opportunity to write-in activities not on the list that they would like to see included in an initiative. We received 20 written comments:

Activities not listed in the survey

- Identify and fill gaps in the College's water quality expertise pool, example given – irrigation
- Coordinate College/University messaging with regard to water quality - convey all research findings with context and include all perspectives.
- Take a Comprehensive Approach to Water Quality
 - WQ efforts should include all aspects, e.g. food supply chain, food prep in homes; also, wastewater, domestic and industrial (not just agricultural and storm water runoff);
 - Global / International - Include global impacts in Outreach & Education; facilitate graduate research on global issues; and explore cross-cultural and cross-disciplinary international programs.

Specific suggestions for the activities listed in the survey

- Outreach & Extension Support
 - Assist with implementation of On-Field Ohio
 - Efforts to sustainably mitigate the effects of flooding injury as well as the negative impacts on water quality.
 - Education and training tools for farmers and fertilizer applicators, including integration of research findings.
 - Summaries of Ohio water quality information to share with faith community audiences and guides to practical action steps.

- Facilitate Research Collaborations- Ensure a broad approach.
 - Connect researchers with Extension educators, to ensure they are included in planning and research;
 - Include OSU Departments outside CFAES; and,
 - Avoid duplication by collaborating where possible, even if outside CFAES/OSU, (e.g. LEARN, GL HAB Collaboratory; Heidelberg University)

- Direct Research Funding
 - Long-term experiments on effect of soil management on water quality (e.g. former North Appalachian Experimental Watershed)
 - Collect data on water users and their values
 - Conduct statewide Ohio P and N assessments
 - Benefits and impacts of aquaponics & hydroponics on WQ in urban areas (also outreach)
 - Assessing efficacy of agro-ecological practices for protecting water quality

Ways to be Involved

Finally, the survey asked, “In what ways would you like to be involved in a future CFAES Water Quality Initiative?”. Respondents were able to select none up to all of the example activities listed and also had the option to write-in ideas. There was general interest with approximately 1:3 to 1:5 respondents overall expressing interest in all of the activities presented. There is also some variability among roles – see Figure 8. 115 respondents indicated they would like to be involved in one or more of the activities presented; and, 80 indicated 2 or more activities.

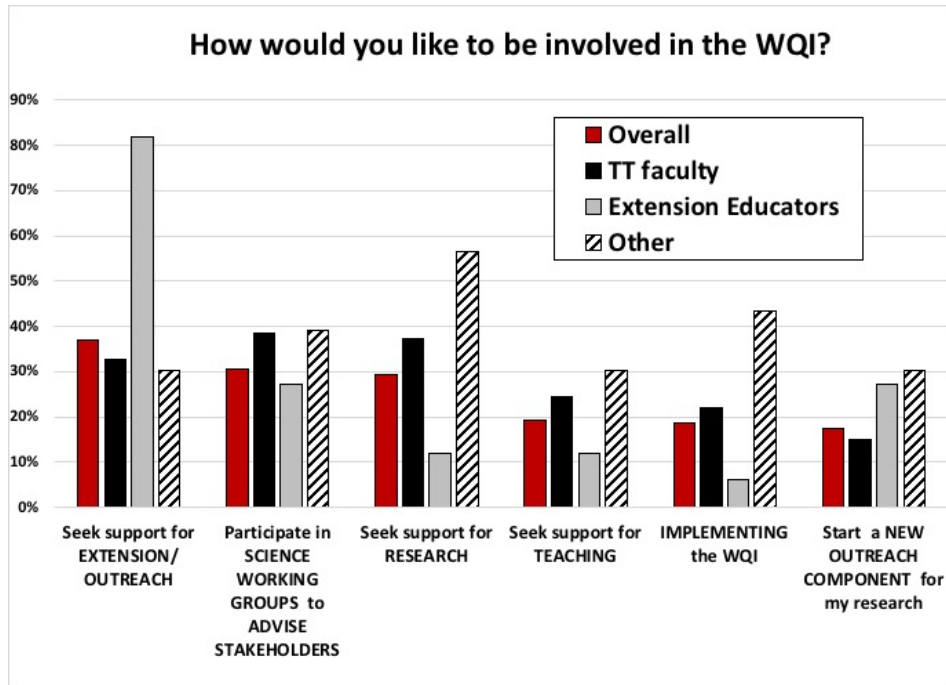


Figure 8. Faculty & Staff Involvement Interest in a Future Water Quality Initiative.

Comments

Five respondents wrote additional comments in the open ended question at the end of the survey. Some expressed specific support for activities in which they would be interested in being involved with a Water Quality Initiative. A number of people also took the opportunity to express and/or reiterate their research or work emphasis, which are also listed below, if not mentioned elsewhere above.

Support Activities

- Administrative support
- Faculty with policy experience can contribute to framing issues to maximize public awareness and impact.
- SWEL Lab can provide data for soil and water analysis.
- Support via AMP and InFACT
- Community & youth education; evaluation activities

Research Activities

- Regional-scale water quality projects
- Methane research in wetlands, with ultimate goal to use methanotrophs to reduce methane emissions from natural and constructed wetlands
- Water, energy and food nexus; food security
- Agronomic approaches that mitigate water quality while enhancing farm profitability
- Soil saturation-flooding injury and impact on yields
- Aquaponics/hydroponics
- Urban issues and resources
- Global water issues

Appendix A. List of Reported Courses with Water Quality Related Content

Section	Title / Description	Section	Title / Description
AEDE 2001	Principles of Food and Resource Economics	ENR 4900.02	Capstone Course Field. OSU Mansfield
AEDE 4310	Environmental and Resource Economics	ENR 5194	Climate, Agriculture, and Sustainability in the Corn Belt: Focus on Lake Erie Watershed - Stone Lab
AEDE 5330	Benefit Cost-Analysis	ENR 5263	Aspects of Aquatic Microbiology
AEDE 6330	Semester long project on HABs in Erie	ENR 5270	Soil Fertility
AEDE/ENR 2500	Intro to EEDS	ENR 5273	Environmental Fate & Impact of Pollutants in Soil & Water
AEDE/IS 4597.01	Food, Population, and the Environment	ENR 5280	Stream Ecology
ACEL 2367	Agricultural Issues in Contemporary Society	ENR 5345	Methods in Aquatic Ecology
ANIMSCI 3130	Principles of animal nutrition	ENR 5348	Aquatic Population Ecology and Management
ANMLTEC 2200	Intro to Animal Sciences	ENR 5350.01	Taxonomy of Aquatic Invertebrates - Ohio focus
ANMLTEC 2300	Intro to Animal Sciences Lab	ENR 5350.02	Taxonomy and Behavior of Fishes:
ANMLTEC 2510.04	Food Animal Resource Management	ENR 5358	Advanced Physiological Ecology
ANMLTEC 3404	Small Ruminant Production and Management	ENR 5364.02	Avian Biology & Management
ANMLTEC 3407T	Dairy Facilities, Environment, and Equipment	ENR 5451	The Politics and Governance of Water
ASM 5786	Environmental Issues in East Asia	ENR 5480	International Conservation
BIOWMGT 2020T	Bioenergy and Wastewater Technologies	ENR 5560	The Dynamics of Ecosystem Restoration
CRPSOIL 2324T	Soil Management	ENR 5600	Sustainable Agriculture and Food Systems
CRPSOIL 2580T	Soil Fertility and Fertilizers	ENR 5790.11	Sustainable and Resilient Tanzanian Community.
EEOB 1930	Intro to Aquatic Biology (Stone Lab)	ENR 7380	Climate and Society
ENG 1110	Food Security	ENR 7400	Communicating Environmental Risk
ENR 3000	Introduction to Soil Science	ENR 8890	Special Topics-History & Ecology of Large Rivers
ENR 3280	Water Quality Management	ENR/WGSST 3530	Women, Environment and Development
ENR 3285	Watershed Hydrology	ENTMLGY 5800	Pesticide Science
ENR 3300	Introduction to Forestry, Fisheries and Wildlife	FABE 2720	Basic Hydrology
ENR 3400	Psychology of Envl Problems	FABE 5310	Ecological Engineering
ENR 3470	Religion and Environmental Values in America	FABE 5730	Design of Agricultural Water Management Systems
ENR 3500	Community, Environment, Development	FABE 5750	Stream Geomorphology and Watershed Hydrology
ENR 3800	Intro wetland restoration, soil erosion management.	FABE 5750	Stream survey and hands-on GIS
ENR 4000	Environmental Policy	FDSCTE 5400	Unit Operations in Food Processing
ENR 4260	Soil Resource Management	FST/FABE 7430	Advanced Food Process Design
ENR 4900.01	restoration- Ohio focus	HCS 5670	Golf and The Environment
		RURLSOC 3580	Social Groups in Developing Societies