

## Expanding and Developing New Approaches to Water Security

*Further discussion on the National Land Grant Initiative to Improve of U.S. Water Security by the nation's Land Grant Institutions*

### **A compelling reason to act:**

Agriculture sits at center of a host of 21<sup>st</sup> century water challenges ranging from the impact of farm practices on our waters, to not having enough water to grow crops and livestock. Agriculture is coming under increased scrutiny about its role in water security and human health. Recent attention to drought and wild fires in the Western U.S. are one example. Meanwhile in the other sections of the county, especially the Midwest and South, nutrient loading combined with heat waves and extreme runoff events generate blue green algae blooms that result in beach closures and loss of drinking water sources. Local ponds and reservoirs are increasingly unusable and urban residents in the Great Lakes have witnessed large scale hardships, including physical illnesses, due to loss of quality drinking water. Algae blooms are also implicated in the increasing widespread generation of harmful drinking water contaminants, like chloroform, that result from byproducts of disinfectants combining with organic matter.

Now more than ever, the US farm community is demanding a response from USDA. Bill Myers, president of Ohio's Lucas County Farm Bureau was recently quoted in the Detroit Free Press, July 29, 2015:

*"I am tired of hearing hypotheticals on where things are coming from. We need to know for sure what areas are contributing, and target the highest levels with the quickest response. I don't care which ones we identify, [but] being able to treat this water so people can drink it is the No. 1 task."*

Land Grant Institutions have a systematic network of expertise, on-going research, campus-based instruction, and strong community/county-based responses through agents and educators that are all well positioned to work on challenges associated with water security. Land Grant Institutions are able to go beyond site-by-site fragmented projects and link local needs to our capacity on campuses and in communities.

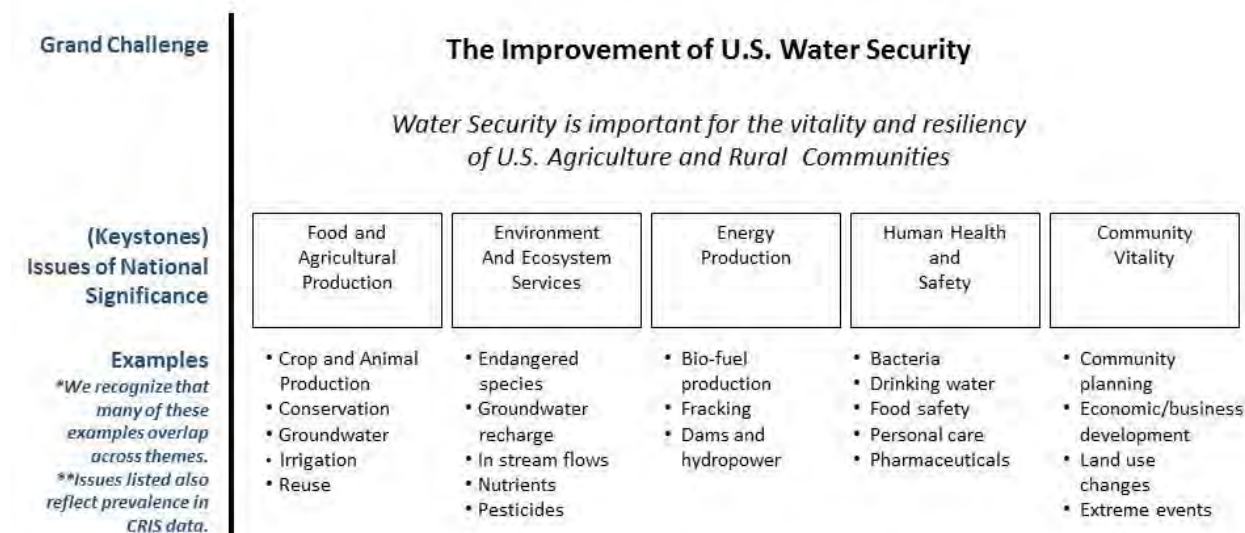
This water security initiative will increase collaboration within and among our Land Grant Institutions as part of a collective national response. As outlined it maximizes our existing institutional resources, leverages where appropriate with others, and expands what we do to meet emerge issues. This initiative addresses current and emerging needs by expanding the current expertise and infrastructure of our national Land Grant network – a network that is well positioned to respond -- but currently overstretched.

### **An invigorated Land Grant/NIFA partnership can address these challenges:**

The National Water Working Group produced recommendations for expanding and enhancing new approaches to protecting water security in the U.S. [*please see full report from August 2014*]. To further document the need for such bold steps by the nation's Land Grant Universities and Colleges the following is a more detailed explanation of what steps would be taken if funded.

The National Water Working Group identified National Issues of Significance (Figure 1) which represent current and and emerging threats to U.S. water security. These issues are primary drivers for future research, teaching programs and extension-outreach to communities. Addressing U.S. water security interests will require substantial investment in new/additional funding.

**Figure 1. National Issues of Significance.**



The Issues of National Significance greatly influence how Land Grant Universities need to organize their expertise and the way they should offer community assistance through research, teaching and Extension. This national water security initiative increases support so our Land Grant University can meet both current and emerging needs described in the Issues of National Significance by enhancing their capacity. **The Working Group report calls for \$100M (annually) in new/additional funding [Table 1] to be allocated across the five Essential Elements.** [PLEASE SEE FULL REPORT FOR A COMPLETE EXPLANATION OF HOW ESSENTIAL ELEMENTS FOSTER IMPROVED RESPONSES, EFFICIENCY AND COLLABORATION AMONG LAND GRANT INSTITUTIONS.]

**Table 1. \$100M/year National Water Security Initiative**

Essential Element		
#1. State/Institution-based Coordination	\$4M	Fixed costs
#2. Regional Water Centers	\$6M	Fixed costs
#3. Integrated Regional Water Grants	\$45M	50% of competitive funds
#4. AFRI National Grants	\$36M	40% of competitive funds
#5. Instructional Grants	\$9M	10% of competitive funds
<b>TOTAL</b>	<b>\$100M</b>	Annually - for a <u>minimum</u> of five years.

**About Table 1. Fixed Costs versus Competitive Funding.**

**Fixed costs** are essential investments required to support the expertise and services of Land Grant Institutions as they expand their efforts to address water security. These are basic costs that occur, regardless of funds associated with short-term projects (commonly supported by grants). These costs are presented as static/fixed because they are necessary for on-going activities (ranging from program/project/curriculum development to administrative coordination). This support ensures integration among and between Agricultural Experiment Stations (AES) and Cooperative Extension Services (CES). **The Working Group recommends the first \$10M in any new/additional funds be dedicated to meet these needs. The Working Group also recommends that the \$10M amount in fixed costs should not decrease even if the funding for competitive programs is less than described (\$90M).**

The following describes each of the National Issues of Significance in terms of the primary problems, and links those priorities to where Land Grant Universities are best positioned to make a difference by expanding current efforts and developing new approaches across research, teaching and extension.



## **Food and Agricultural Production**



Water insecurity is threatening our ability to maintain agricultural production at a time when increased world population pressures suggest we must increase production. While gains have been made in irrigation efficiency that have resulted in increased yields, adoption of these technologies and the information needed to manage them has been lagging. Agriculture is on the cusp of a new era of increased production using environmentally responsible technologies. There is an urgent need to assist in this transition to information based management systems that uses big data, earth mapping, earth monitoring systems and other internet based technologies to increase water use efficiency, manage water systems and reduce water quality concerns. These technologies are currently spawning new methods of addressing water quality and conservation issues through “precision conservation” techniques that target programs to those areas with the greatest production, environmental stewardship and economic impacts. These new technologies will be even more important as irrigated and rain fed agriculture adapts to more variable climate conditions in our future. In addition, poor groundwater management across the nation is threatening future water supplies. Our Land Grant Institutions need to promote irrigation efficiencies, increase yields and help our communities better manage all of their water supplies.

### Specific actions provided by this initiative will include:

- Adoption of advanced irrigation technologies and the information and management tools to effectively use them. This includes: increasing the development and adoption of precision conservation technologies and techniques; adaptive planning to account for interactions between surface waters and groundwater recharge; and the use of big data, earth mapping, earth monitoring systems and other internet based technologies. *GOAL: In five years, increase acreage under precision irrigation (target - over 1 million acres).*
- Work with growers to adopt sustainable management systems for surface and groundwater that recognize their interconnection. This would support: the creation and implementation of sustainable groundwater and surface water management plans; increased use of aquifer recharge strategies to increase groundwater storage and build drought resilience; and increased reuse of agricultural and urban waters, including agricultural runoff, urban stormwater runoff, treated urban waste water and others. *GOAL: In five years, increase aquifer recharge in targeted river basins (target - at least 10 major basins will increase recharge by 10 percent).*
- Increasing soil health through techniques such as no-till and addition of soil amendments such as compost to increase water holding capacity and soil tilth in ways that will sustain our agricultural systems and increase yields. *GOAL: In five years, increase acreage under no-till systems (target – over 5 percent increase in acreage).*
- Creation and adoption of drought resilient plant varieties in irrigated and rain fed agricultural systems.
- Decrease animal product water footprints through more water efficient feed production, feed formulation, and selective breeding.

## **Environment and Ecosystem Services**

America’s agricultural and rural lands serve as the water source for downstream lakes, rivers and estuaries – but more intensive production from existing agricultural lands is sought if we are to meet the demands of a growing world population while retaining natural ecosystems. Melding these two visions of agriculture and rural lands represents one of the major challenges of the 21<sup>st</sup> century. Improved nutrient use can accelerate production, but runoff from poor management of cropland and animal agriculture fosters harmful algae

blooms that cause beach closures and fish kills from ponds in the Midwest to the Great Lakes and the coasts. Irrigation is a key component that will enable stable and high levels of agricultural productivity but poor management threatens fish migration, spawning and nursery habitats. We are poised to make major advances that will provide safe and plentiful water from agricultural and rural lands.

Specific actions provided by this initiative will include:

- Innovative, rapid crop and soil tests combined with advances in cropping systems and nutrient management can reduce offsite losses and enhance production.
- Locally-based watershed assessment that rely on new, high resolution geospatial data can target “hotspots” of nutrient losses and identify and enhance ecosystem niches, such as riparian zones and beaver ponds that purify runoff waters. *GOAL: In five years, improve the efficiency of conservation and restoration investments in targeted watersheds (at 12 digit HUC level).*
- New water sensors are now available that provide real-time data on river, lake and estuary water quality and advance our capacity to pinpoint the effects of timing of agricultural practices on nutrient losses. These data are poised to be translated into risk reduction practices.
- New management practices such as edge of field bioreactors are now being optimized for nitrogen control on drained cropland and innovations are ongoing to promote phosphorus reductions. *GOAL: In five years, increase the use of edge of field bioreactors (target – installation of field bioreactor on 500,000 acres of drained cropland).*
- Advances in geospatial data, high resolution modeling and new agro-forestry practices can now promote strategic restoration of headwater habitats through riparian buffers and elimination of instream barriers.
- Advances in irrigation water management through the use of improved technologies, computer mapping, and state-of-the-art sensors can be combined with improved understanding of critical flow periods to sustain important fisheries.

## Energy Production

Extreme events such as the current Western drought directly affect both agriculture and the energy sector, often putting these two critical sectors in competition for scarce water resources. According to the U.S. Geological Survey’s 2010 report, 45% of US water withdrawals are for thermoelectric power generation and 37% are attributed to agriculture. As such, much of the problem and solution to water availability and water quality lie within these two sectors. However, the economics of energy production are such that agriculture cannot compete in the marketplace with the energy sector for water supplies. The recent movement of irrigation water to hydraulic fracturing demonstrates this tension graphically. Additionally, our food system is a large consumer of energy. About 30% of the global energy demand is used for the full food production and supply chain. In the U.S., use of energy along the food chain has increased more than six times the rate of increase in total domestic energy use between 1997 and 2002. Aside from food transportation and processing, significant energy use occurs in the pumping of irrigation water. According to the USDA-ERS, over 30% of the US corn crop is used for ethanol production. Collectively, these facts make it abundantly clear that energy and water are intertwined in our food system and that research and extension programs are critically needed to address these linkages for a secure food supply – both domestically and internationally.

Specific actions provided by this initiative will include:

- Provide new methods, technologies, water efficiency and water sharing strategies to reduce/optimize agricultural water and nonrenewable energy use. *GOAL: Over the next decade, decrease excessive irrigation application (target - 56 million U.S. irrigated acres by decrease by an average of one acre-inch over the next decade); GOAL: Increase the use of renewable energy in agriculture (target - 10 percent increase in renewable energy by those participating in program activities).*

- Develop algorithms and optimization strategies to use the right water in the right place and time. In many cases energy production can utilize marginal waters and effluents from Ag systems, in other cases Ag can utilize waste waters from energy. *GOAL: In five years, increase the use of treated effluents and marginal water (target - 1 million acre feet).*
- Develop biofuels production systems that produce more energy with lower water and energy inputs. *GOAL: In five years, maintain current biofuel production levels, decrease water and energy use in producing biofuels (target - 15 percent less water in biofuel production).*
- Provide US crop and livestock producers with timely data and information to improve decisions on energy and water use to balance the tradeoffs that occur with these critical inputs. *GOAL: Develop and manage open source data and modeling platforms that provide needed information on water use, water quality, soil, climate data, crop growth, carbon stocks at a 12 digit HUC level to enhance producer decisions.*

## Human Health and Safety

The safety and security of our nation's food and water supply is of paramount importance to individual and community health. We must understand and communicate the inherent risks and uncertainties in the complex food-water system. Advanced research and extension programs can create and disseminate the knowledge necessary for producers and consumers to take appropriate actions to ensure the long-term safety and continued productivity of our food and water systems.

### Specific actions provided by this initiative will include:

- Nationwide, increase the number of private well owners who test and protect their private wells. New extension programming also will provide critical education resources for private well owners to ensure the safety of their drinking water in the aftermath of extreme events and natural disasters (e.g., flooding, coastal storm surges). *GOAL: In the five years, increase the number of private well owners who test their water and take steps to protect their private wells (target - over 100,000 private well owners will test their drinking water).*
- New research that examines the occurrence, fate, and transmission of waterborne contaminants – specifically pathogenic bacteria and pharmaceuticals that could impact food safety (fruits, vegetables, and shellfish).
- Establishing trans-disciplinary research and extension teams that address both food safety and water quality protection. These teams will help to solve the complex and interrelated issues that impact the safety of the nation's food supply. Gathering and communicating interdisciplinary-based information will help communities make balanced and informed decisions.
- Studying and communicating the impacts of water quality management practices on potential contamination from domestic and wild animals, contaminant persistence in irrigation tailwater, sediments from irrigation, and sediment control structures. For example, vegetable growers report finding themselves in an untenable position—pressured to *minimize* the use of on-farm conservation practices that promote water quality in order to address concerns of food safety professionals. *GOAL: In the five years, nationwide, a growing number of farms will develop food safety plans (in response the Food Safety Modernization Act) that balance soil and water conservation with food safety concerns (target - 50,000 farms will develop food safety plans and implement them to some degree).*
- Analyzing the role of agricultural landscapes in groundwater recharge and conjunctive water management with an emphasis on drinking water supplies. Transparent information about local, regional, and national groundwater use will be made available.

## Community Vitality

Water security is important for long-term economic growth and community vitality in our cities and rural communities. This link between water and community vitality is very strong and transcends merely protecting water security solely through biophysical and remediation means.

For a community to be vibrant – it must be resilient to drought, floods and potential contamination events. Communities need support from Land Grant Institutions that foster wise and appropriate decisions over protection and enhancement of water resources. Likewise, when the water resources are secure it leads to a greater sense of quality of life through improvements in public health, local economies, water-related recreation, tourism, and aesthetic appreciation. When water has greater value as a public asset it helps that community improve its sense of place and identity. Water is part of a community's basic infrastructure, and therefore for a community to be healthy and vital it must be secure.

The vast Land Grant network of academic expertise is ultimately anchored locally by extension professionals with the ability to attack problems by working with local decision makers and cities on programs involving comprehensive community and land use planning, economic/business development, public health, and preparing for decisions faced during unexpected natural events (e.g., flood, wild fire, drought, and climate variability). This is the heart of addressing water security and community vitality.

### Specific actions provided by this initiative will include:

- Improve quality of life indicators (measures) that most closely align with water security. These include: protecting economic prosperity; engaging citizens in decision of public and individual rights over water use and protection; addressing social and leisure interactions with water; ensuring water availability for basic human needs such as human health and food production; and meeting the needs of sustaining natural resources. *GOAL: These quality of life indicators (measures) will become components to national impact reporting on CES and AES water programming (and will be reflected in <https://landgrantimpacts.tamu.edu/>).*
- Increasing community/citizen involvement in local decisions about water quality and quantity by supporting watershed councils and citizen advisory processes. Programming will support citizens with training and leadership programs that foster community-based decisions about water quality and quantity and natural resources (ranging from water quality issues such as non-point source pollution to water quantity and drought management). *GOAL: In five years, our programs will expand the number of citizens who take part in training and leadership programs (target - more than 100,000 citizens will take part in these programs and subsequently assume leadership roles in their communities).*
- Increasing use of science-based information by community-, state- and multistate-based group that made decisions about water quality and quantity. This will include: community-based planning involving the management of water and natural resources; and assisting a community in its “readiness” to address unexpected natural events (this would integrate and expand the current limited reach of programs such as EDEN).
- Assisting communities in their efforts to create and retain jobs directly dependent upon water resources. *GOAL: In five years, increase support jobs creation and/or retention in areas associated with water security protection (target - than three (3) million will be impacted – created and/or retained).*
- Provide training programs for professional water resource managers that will: improve the management of water treatment facilities; develop and implement new technologies for testing and treating public drinking water; encourage collaborative land management among producers/growers in headwater regions and communities/municipalities; and support public education through extension programming on water conservation. *GOAL: In five years, increase the number of water professionals will take part in training and professional development programs [in some states this may involve University-based certification programs] (target - more than 7,000 water professionals will be trained).*

- Mobilizing partnerships, especially those where the community-based expertise of our Land Grant Universities is well positioned to link and facilitate those connections. *GOAL: Program leveraging will multiply the federal funding by three-to-one (3:1). Meaning, for every dollar invested by USDA/NIFA three additional dollars in state/local support will be offered by partners and collaborators.*
- Engaging broad interest in helping our communities understand and respond to issues of water security.
- Engaging young people in efforts to enhance water security. *GOAL: In five years, engage more youth in programs supported by this national water security program (target – more than one (1) million youth will take part in programs and activities associated with this water security initiative).*

### **Why Invest in Water Security – Because National Issues of Significance Merit Expanded Attention:**

There has been a continual decline in the level of competitive grant funding available for water resource projects over the past thirteen years. In 2002, the three flagship grant programs that NIFA used to fund water projects were the National Integrated Water Quality Program (NIWQP), the National Research Initiative (NRI) Water Program, and the Small Business Innovation Research (SBIR) Program (Soil, Air, and Water Section). These three programs combined to fund a total of \$15.1 million in grants in 2002. In 2014, the NIWQP, SBIR, and the Agriculture and Food Research Initiative (AFRI) Water for Agriculture Challenge Area combined to offer \$10.6 million in grants. With the termination of the NIWQP in 2015, the expected total grant awards from SBIR and the AFRI Water for Agriculture Challenge Area will combine for \$9.3 million. The net result is a loss of 40% in total (annual) funding over the past thirteen years (not adjusted for inflation).

The National Water Working Group developed recommendations based on the need to **both** expand current efforts and to foster new systematic approaches to protecting water security in the US. Just as in other major societal advances, agriculture must reinvest in efforts to protect our waters. We must consider the existing investment in the national Land Grant Institutions and how to best focus that expertise. This isn't about recreating and/or duplicating current efforts, it is about expanding and enhancing new approaches, all the while taking advantage of the institutional expertise that is already in place. There is a strong case for a national water security initiative -- water and agricultural security are in an age where population projections continue to grow and food production needs to closely follow. If we do not act it will lead to a water-agriculture crisis that demands critical attention far above and well beyond existing investments which are struggling to address and meet the needs of today's broad array of critical issues.