The No Chico Brush Partnership

A farmer-led initiative for capacity building, demonstration and evaluation and research on efficient irrigation approaches in the Gunnison Basin

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Further information is available at http://gunnisonriverbasin.org/projects/no-chico-brush/

Executive Summary

Gunnison Basin Predicament

Like across most of the arid West, irrigated agriculture in the Gunnison Basin faces a predicament posed by competition for limited water resources. As identified by the Gunnison Basin Roundtable and the Colorado Water Plan, the current gap between demand and supply for water in the Gunnison River Basin for agricultural sector is estimated to be an average of 116,000 acre-feet per year (Colorado Water Plan, 2015).

This predicament affects irrigators and agricultural producers in the Gunnison River Basin, who struggle to meet their crop demands with available water supplies in most years. This issue is exacerbated by the uncertain future that will be marked by increasing demands and diminishing supplies of water due to observed and projected warming, along with market conditions that fluctuate dramatically without warning.

To some producers, the challenging situation has been expressed as "farming for self-defense." Put a little differently, irrigated farming has, in some areas, become a 'defensive strategy' to be used to fend off intra-state and inter-state competitive pressures for limited water supplies and productive land. This defensive attitude represents a dramatic shift from the long heritage and the once-secure ideal that irrigated agriculture is a permanent part of the landscape, essential to the aesthetic, culture and economy of the region.

Now, water availability and water quality challenges drive the search for creative approaches and adaptation strategies to be undertaken by producers to shift away from 'self-defense' and survival mode. To do this, a balance between agricultural water supplies and demands is needed to sustain productivity; at the same time additional pressures from non-consumptive uses, posed by recreationalists and environmental needs, must be met.

Even with creative and flexible thinking, along with modernized irrigation practices, the central question remains: what does a sustainable irrigated agricultural system look like?

Conventionally, agricultural water conservation programs have been used to address water shortages. In recent years, these conservation programs have moved away from the approach of permanent fallowing of productive farmland, known colloquially as "buy and dry," after some disastrous experiences in Crowley County, Colorado, the Owens Valley, California and elsewhere in the west. Now, with permanent fallowing out of favor with farmers and the public alike, agricultural water conservation has generally shifted to partial or rotating fallow programs., The "Super Ditch" in the Arkansas River basin (Nichols *et al*., 2016) and the System Conservation Partnership Program (UCRC, 2018) are examples of this approach. These newer agricultural conservation efforts have moved towards the concept of temporary, voluntary and compensated "lease and cease" processes. However, such temporal programs must address significant concerns about long-term effects on rural economies, labor impacts, cropping patterns and genetics, agronomics, markets, and financial institutions that support the agricultural industry. Such studies are on-going (CRD, 2020)

In pursuit of alternatives, approaches and solutions to the described predicament, the leaders of the No Chico Brush partnership put together this research project that emphasized 1.) the quantification of site-specific crop water needs and on 2.) defining efficient irrigation methods and timing that can garner higher margins and investment returns. The project focused upon quantifying the benefits associated with increased irrigation water management using sophisticated monitoring and efficient irrigation technology.

Overall, the No Chico Brush project served to demonstrate a pathway to a sustainable water balance guided by optimal management and cooperative investment in technology that results in increased productivity and profitability using less water. Proponents are hopeful that the findings and associated flexibility would enable related agricultural water conservation practices and programs. This could include, but not be limited to, demand management through potential temporal leasing-fallowing, deficit irrigation and other techniques. Furthermore, that such programs could also enable the implementation of soil health, water quality improvement and water supply availability in the context of a comprehensively and holistically managed framework.

The No Chico Brush Partnership

The No Chico Brush Partnership, or "No Chico Brush" (NCB), as it has become known locally, was formed in 2011 to support communication, demonstration and research on sustainable agriculture in the Lower Gunnison River Basin. This project originated with local producers in the Delta and Montrose Counties, who were seeking viable alternatives to minimize legal, climatic and economic threats to their water supplies. Building on local interest in soil health, the group saw the need to further evaluate water use as part of the adaptive strategy for the irrigated agriculture community in the Gunnison Basin. The costs and benefits of newer and more efficient irrigation technology, best management practices (BMPs), and alternative water management techniques are NCB priorities to define, develop and to share.

As a farmer-led group, NCB recognized that it could use its strength to play a crucial role in challenging traditional practices, predicated on building trust within the agricultural community regarding newer, different techniques for irrigation. Fundamentally, NCB is a local "capacity building" initiative, aimed at supporting the most effective use, and future sustainability, of investments in irrigation water system within the Gunnison Basin.

Although the NCB vision is made up of many disparate elements, over the years, the group has evolved and is characterized as:

- A producer-led advisory group
- seeking stability, security and protection from water shortages
- driven by site-specific research, analysis and evaluation
- funded by diverse cooperative sources
- focused on understanding water use as it related to niche- and/or cash-crop markets
- interested in improving water efficiency to improve crop quality for use as a market driver

No Chico Brush "Grand Design"

The NCB Partnership was founded upon the premise that increasing the efficiency of agricultural water use is central to achieving sustainability for irrigated agriculture in the Lower Gunnison River Basin. This premise is integral to the "Grand Design" idea envisioned by the NCB Partnership. This "Grand Design" endeavors to comprehensively optimize the water diversion, collection, storage, conveyance, and distribution systems from the source, to the point of application and use, enhanced by irrigation technology that includes innovative infrastructure, measurement, control and communication (e.g., pressurized pipelines, SCADA, telemetry).

The No Chico Brush 'philosophy' is that efficiency improvements are overlooked, important alternatives to traditional approaches that have relied upon the historical "buy and dry" variety of water transfers that results in the removal of water from historically irrigated lands. No Chico Brush places a high priority on increased efficiency in agricultural water use, as a preferred alternative to fallowing programs locally called "lease and cease" or "brown and down" actions.

As part of the development and implementation of a comprehensive, systematic approach to address the issues associated with water availability, demand management, and associated water quality issues, No Chico Brush began applying the "Grand Design" in the Lower Gunnison Basin, focusing on the Uncompahgre and North Fork Valleys, driven by the simple principle of making the 'best use' of water, as possible. In general, the group supports common-sense system improvements that include canal lining, piping, near farm regulated water storage and delivery systems that move away from an 'always on' towards an 'on-demand' system. Such optimization endeavors would include multi-beneficial on- and off-farm innovations and improvements that enable soil-health, reduced deep percolation and runoff that limit contaminant loading, wildlife habitat improvements and even micro-hydroelectric production.

The Grand Design, when implemented, would be a cost-effective method of addressing agricultural water shortages by taking advantage of "system wide conservation" (i.e., optimal timing, diversion on demand, etc.) while also allowing more flexibility under drought conditions. Such flexibility enables: 1) sharing of positive benefits of greater efficiency in the consumptive agricultural sector with the growing non-consumptive (e.g., recreation and environmental) sector; 2) improving water quality by reducing salt and selenium loading from increasing efficient agricultural practices (e.g., sprinklers and drip); 3) conservation of soil by minimizing erosion by reducing less efficient agricultural practices (e.g., flood-furrow); 4) enabling the introduction of soil health improvement practices to increase water holding capacity (e.g., minimum till practices that utilize cover cropping after sweet corn); 5) increasing productivity and profitability to enable growers to reduce the net number of irrigated acres.

The initial focus of NCB was to undertake a series of evaluation projects aimed at building advisory and technical capacity to support greater efficiency in the use of irrigation water. Contrasted with traditional *research*, the purpose of *evaluation* in the agricultural sector is to examine the adequacy of project logic, situational constraints, implementation deficiencies and responses, and overall operational effectiveness. With these goals in mind, NCB wanted to understand the impacts of irrigation water practices and application quantities to crop production and forage yields.

As the research project evolved, the NCB Partnership prioritized the need to evaluate the impacts of improving irrigation practices upon crop quality, in addition to yield, focusing on sweet corn. This reflected

the evolving prioritization, motivation and incentives that farmers consider when investing in irrigation technology.

Conclusions and Findings

The results of the NCB-sponsored research project resulted in important locally-specific information and perspective on the potential for irrigation efficiency to address agricultural water resource issues in the Gunnison Basin.

Observations and direct survey results from project participants indicate that 1.) *motivation, 2.) understanding and 3.) developing confidence* were key drivers in the behavioral dynamics and capacity building and the potential adoption of new agricultural practices.

These behavioral drivers combined with analytical results related to quantity and quality of crop yields in comparison to water usage led to the evolution and progression of the project and primary findings over the 5-year study period.

The primary findings include:

- Significant system net benefits (such as increased yields, higher quality agricultural production, decreased labor, decreased input costs leading to increased profitability) can result from increased efficiency in agricultural water use; *potentially motivating participation;* (see Phase I results)

- Potential per acre increases in consumptive use (CU) associated with higher agricultural production due to better agricultural water use efficiency could be offset if better productivity and yields enable producer to a decrease the number of irrigated acres further reducing input costs, leading to higher net profits and sustainability and *potentially motivating participation*; (see enterprise budgets)

- Quality-based agricultural production improvements are an underappreciated *motivating factor* for water efficiency practices, this project found that crop quality and quantity can be improved through increased water efficiency as evidenced by the sweet corn trials; (see Phase II results)

- Implementation and use of moisture monitoring and telemetry technology is important to *increasing understanding* regarding soil mechanics and associated factors related to 'cause and effect' that can lead to higher adoption rates of water efficiency techniques; (see Phase I)

- Use of meteorological data provided by CoAgMet stations (supported as part of the project) is important to *increasing understanding* regarding climatic drivers that can lead to higher adoption rates of water efficiency techniques; (see Phase I)

- Moisture monitoring technology is essential to water efficiency, however, despite industry-promoted advantages of irrigation efficiency, these approaches are not "plug and play" and require specialized knowledge and a broad network of support (i.e. sensor calibration issues,

tech support, pivot removal example) to *build the confidence* needed to be successful; (see Phase I results)

- Agricultural productivity is not adversely impacted by decreased water diversion and/or delivery reductions when operations are informed by moisture monitoring data and locally-derived crop-water demands, industry incentives for diversion reduction, thus *increasing confidence* in water efficiency; (see Phase II results)

- Optimal management could result in approximately 10% reduction in diversions with an *increase* in crop quality (estimated based upon one less irrigation on sweet corn - Phase 2). thus *increasing confidence* in water efficiency techniques. (see Phase II results)

Recommendations

The success and/or failure of agricultural water efficiency research and implementation efforts is strongly influenced by identifying and engaging with a **motivated** sponsor (group) that has a good **understanding** of the known issues and exhibits the willingness and **confidence** to address challenges and uncertainties associated with unknown issues. In other words, going forward, a clearly defined vision is needed to provide motivation (e.g., avoiding water shortages and increasing profitability) for educated producers to confidently engage in efficient water use practices. Such a guided process should form a unified framework to drive water efficiency activities.

Without clear underlying **motivation** driving participation, research and implementation efforts can be subject to undesirable program changes and associated inefficiencies and even unmet expectations. For example, some producers were motivated by drought conditions and the fear of administrative curtailments, while others had envisioned other future scenarios. Thus, a local 'champion' with a clearly elucidated unifying motivation and single, unified vision is essential.

Such a unifying vision more easily leads to the building of a common **understanding** of the solution(s) supported by site-specific research and evaluation. In turn, the analysis and scientific evaluation of research results (e.g., water use and crop quality parameters) and brings the desired **confidence** to the producer reinforcing their **motivation** to participate.

Important Summary Points

- Successful programs require unified motivation
- Producer-driven pathway to newer management and technical tools need to have broad understanding and "buy-in," and acceptance
- Technical evaluation and guided research needed to support behavioral and technical changes
- Guided involvement and scientific research is needed to inform and to inspire confidence
- Independent project data that support scientific conclusions help inspire sufficient confidence to support broadscale adoption and provide answers to deal with doubters and skeptics
- Niche-market agriculture focused on profitable cash crops can support and lead transition to adoption of new technologies in the face of technical challenges
- Incentivization (i.e., funding) for continued and expanded participation is needed
- A local champion (e.g., NCB EC along with water districts such as UVWUA and Conservation Districts is needed for organizational and funding support and to ensure broad adoption

- Conservation technology and water efficiency should play an important potential in "demand management" and potential ATMs.

Implications for Future ATM Projects and Related Colorado Water Plan Activities

Although CU may increase under water efficiency projects, such projects can nevertheless be consistent with CWCB-funded ATM Projects and related Colorado Water Plan Activities that are designed to address current and projected water shortages. In fact, there is an important role that WUE can and should play in Colorado's water future

Better management (drought response) and preparation for long-term water shortages by employing improved infrastructure, with long-term, well planned technological fixes are important tools to secure water availability, despite the known undesired effect of increased CU and reduced return flows. Although this project was not focused upon how much water could be physically saved, this project was a good fit for ATM funding, as it was an investigation designed to help define the role that water efficiency can and should play in addressing water supply issues in time and space.

As such, the NCB Partnership would advise the CWCB and GBRT to continue supporting funding efforts to build upon the project successes to date. Specifically, the following actions are recommended:

- *Support water efficiency as a multi-purpose BMP*

Additional agricultural water use efficiency research is needed to establish site-specific best management practices to meet multiple objectives and benefits for maximizing productivity with minimal, or optimal, water use while reducing seepage that leads to salinity and selenium loading.

Irrigation improvements is an often-overlooked technique to increase sustainability of irrigated ag in western Colorado and specifically to address the Gunnison Basin predicament. Outgrowth of project findings can and should provide additional guidance for implementation future ATMs and CWP / GBIP projects, and to address future objectives and to reduce uncertainties associated with water availability.

- *Review and create funding tools for water efficiency*

The use of CWCB funding should be prioritized to promote additional investment into WUE and related applied research regarding water use. Such funding could then be used as a tool to leverage competitive matching funds to create practical and sustainable agricultural business practices along with local economic development agencies (e.g., DCED. Region 10, etc.). with a focus on water management. This could directly support agricultural water efficiency practices and quality-driven incentives and even low water use alternative crops. Additionally, these approaches could be combined with and expand impact investment strategies being investigated (e.g., Montezuma County, Colorado)

- *Implement Projects Using Dedicated Water Efficiency Program Manager(s)*

The need for local expertise to support farmers working on agricultural efficiency was observed and documented in the NCB. In this project, support and directed assistance was provided by CSU. Without this support, the project gains could not have been made. For example, in the absence of such direct technical assistance, it was observed that infrastructure improvements (I.e. sprinklers) were actually removed in favor of less efficient practices (gated pipe).

It is recommended that efficiency gains could be protected and expanded with the use of a dedicated water efficiency manager. Such a position could be modeled after the Northern Colorado Water

Conservancy District (or other WCDs) that have paid program managers to augment NRCS and local conservation specialists, who are typically over-subscribed.

These positions would focus on efficient use of water resources through education, collaboration, and leadership. There is tremendous progress in the efficiency industry and society is accepting the importance of water scarcity, use, management and respect. By supporting projects between public, private, and non-profit organizations, the water efficiency program manager supports reduced water consumption, improved performance, and reduced costs using new methods, products, and ideas.

Overall, it was observed that conservation associated with water efficiency involves the confluence of social, scientific and economic factors and these complex and overlapping issues are best addressed by a dedicated water efficiency manager that can assist agricultural producers.

Research for Policy Development and Decision Support

Going forward, additional research support is needed to assist producers to be competitive in the marketplace. Quality-driven parameters are powerful incentives for participating in water efficiency practices and associated conservation practices.

In the future ATM funding may be applicable to support potential, market-driven crop switching to lower water use crops (from perennial to annual crops), niche markets and possibly to support the transition to organic crops, if deemed more profitable and if consistent with natural resource conservation goals (soil health, climate action, etc,).

Lastly, ATM funding might be appropriate to support the monitoring and verification of conserved consumptive use from water conservation irrigation practices and / or niche and alternative crops.