A Paradigm Shift in Water Management Among Colorado Farmers and Ranchers

by John Jennings, 2015-16 State of the Rockies Project Fellow

With the ongoing drought, projected population growth, and the impending effects of a changing climate, the arid Rocky Mountain region must reexamine its relationship with water. Although state water planning initiatives, such as the Colorado Water Plan, basin roundtables, and numerous local and national nongovernmental associations, address critical water issues in the West, many of these initiatives seem to boil down in large part to economics and oversimplify complex ways diverse stakeholders value water. While the importance of the economy and jobs is undeniable and should not be ignored, the lack of other values incorporated into discussions about water policy must be recognized.

Introduction

Water management has traditionally varied across the world not only because of technology, law, geography, and climate, but culture and values as well (Groenfeldt 1991, 2013; Linton 2010; Stefanovic 2015). Appreciation of this natural variation in management, though, has been wanting as numerous water scholars have argued for greater recognition of the social side of water management (Allan 2005; Brown and Schmidt 2010; Cortner and Moote 1994; Gleick 2000; Groenfeldt 2013; Linton 2010; Pahl-Wostl et al. 2008; Pahl-Wostl et al. 2010; Pinkham 1999; Schoeman et al. 2014; Wolff and Gleick 2002).

Although many authors argue that the paradigm which has governed water management needs to and is changing, many differ in how they describe this change. For example, Schoeman et al. (2014), Pahl-Wostl et al. (2008), and Pahl-Wostl et al. (2010, 8) describe the receding water management paradigm as a command-and-control approach where "control is exerted centrally, adhering to rigid and detailed plans for the fulfilment of established goals." This approach "infers that management interventions can be optimised and their impact, in principle, be fully calculated" (Pahl-Wostl et al. 2010, 8). Instead of describing this paradigm as command-and-control, Pinkman (1999) and Wolff and Gleick (2002, 1, 5) describe a newer "soft" path for water management in contrast to a traditional "hard" path of water management, which "relies almost exclusively on centralized infrastructure and decision making: dams and reservoirs, pipelines and treatment plants, water departments and agencies" and "is governed by an engineering mentality that is accustomed to meeting generic needs." Finally, Linton (2010) and Krause and Strang (2016) provide a more conceptual perspective in their description of how we understand water and natural resources generally. They point to a change from regarding water as an "object of social and cultural production" to considering "water as a generative and agentive co-constituent of relationships and meanings in society" (Krause and Strang 2016, 633). Through this, they argue for a broad shift towards seeing the relationships between the technical, environmental, social, and other aspects of water management. The shift, which all these authors point to, demonstrate that there is an emerging water paradigm.

By virtue of the state's semiarid climate, interstate compact agreements, and projected population growth over the next few decades, how Colorado approaches water management and stands in this changing paradigm are of significant interest as we move forward with the Colorado Water Plan. My capstone project focuses on the perspectives of agricultural water users in the Gunnison Basin as this group is a significant stakeholder in water management. Although conversations covered topics well-known to those involved in water management in Colorado, many themes related to water management paradigms were discussed and deserve explicit consideration. Of those themes, how farmers and ranchers saw various aspects of agricultural water use and water management as interconnected or separate stood out as a particularly informative of how they saw the nature of water, the goals of water management, and the best approaches to reach these goals. In the sections that follow, I offer further background on the dominant, command-and-control water management paradigm of the twentieth century; discuss the new, developing paradigm for water management; illustrate the influence of these paradigms in the American West; then consider this shifting outlook on water in relation to the central themes that emerged from my interviews with Gunnison Valley farmers and ranchers. I conclude that despite a number of opinions, which reflect the emerging paradigm, application of this paradigm varies greatly between people and topic, and can be more integrated into how we think of water management.

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The Receding Water Management Paradigm

Though use of the word paradigm comes from Thomas Kuhn's work defining scientific paradigms, scholars and professionals have adopted the term to describe shifts in water management. Pahl-Wostl et al. (2010, 839) paraphrases Kuhn in writing that a scientific paradigm is a "consensus on (1) what is to be observed and scrutinized, (2) the kind of questions that are supposed to be asked and answers probed for in relation to this subject, (3) how these questions are to be structured, and (4) how the results of scientific investigations should be interpreted." As such, a paradigm refers to how we ontologically and epistemologically understand the world (Pahl-Wostl et al. 2010).

While water management paradigms do not mirror scientific paradigms exactly and some authors provide their own definitions, Kuhn's work is an important foundation from which they all depart. This shared foundation is helpful as those arguing that there is or should be a paradigm shift in water management come from different perspectives and consequently emphasize different aspects and refer to different catalysts of this shift. Despite this, the shifts authors refer to complement each other. They all point to a similar shift in water management over the last century as the environmental and social aspects of water management have been overlooked by a short-sighted, technical approach to water management.

Schoeman et al. (2014) describe the receding water management paradigm as command-and-control management. They point to stationarity ("the idea that natural systems fluctuate within an unchanging envelope of variability") and the belief that any changes in natural systems can be easily reversed as basic assumptions for this type of management (Milly et al. 2008, 573). With natural systems seen as essentially stable and controllable, water management aspires to "maximize resource exploitation by reducing natural variability" (Schoeman et al. 2014, 378). Under this paradigm there is little regard for environmental consequences because natural systems are seen as immovable at a basic level.

The water management paradigm Schoeman et al. (2014) describe is similar to Cortner and Moote's (1994) description of a traditional paradigm guided by the goal of sustained yield. This paradigm holds "that the best use of resources is human consumption, and the purpose of resource management should therefore be to provide a continuous supply of market-oriented goods" (Cortner and Moote 1994, 168). While Cortner and Moote (1994) point to the development of market-oriented goods, this dynamic similarly relies on the idea of stationarity that Schoeman et al. (2014) point to—insofar as nature is seen as immovable, we can continuously extract resources for human consumption without any consequences.

Pinkman (1999) and Wolff and Gleick (2002) characterize water management over the last century as following the "hard" path of water management. This approach is oriented towards supply-side solutions (rather than demand-side solutions) and relies heavily on large, centralized infrastructure. Wolff and Gleick (2002) and Gleick (2000) point to the assumption that economy and population are dependent on increased water supplies to meet and promote growth as rationalizing this approach.

In addition to the examples mentioned above, there are more authors who point to a shift in water management in recent history. A common theme among these authors is recognition that the definition of water and thinking behind water management have been limited. We have thought of water as merely a substance available for human consumption, economic productivity, or as some other singular aim and overlooked the complexity of water's connections and significance in environmental, social, political, cultural and other important areas. Linton (2010) captures this, which perhaps is the most fundamental and significant element of these descriptions of water management paradigms, in what he calls modern water:

> One virtue of modern water is that it is not complicated by ecological, cultural, or social factors. This has made it relatively easy to manage. Another virtue of modern water is its universality – all waters, in whatever circumstances they may occur, are reducible to this abstraction. A third virtue is its naturalness – not only may all waters be reduced to H2O but the product of this reduction is understood to constitute water's essence, its basic nature (Linton 2010, 8).

Linton (2010, 14) goes on to say, "in essence, modern water is the presumption that any and all waters can and should be considered apart from their social and ecological relations and reduced to an abstract quantity." He points as far back as the seventeenth century to the Scientific Revolution, the Enlightenment, and the development of Cartesian dualism as the origins of faith in a totally rational mind and the objectivity of science, which led to this abstraction and isolation of water from its ecological and social ties. What this effectively leads to is the simplification of water. We no longer understand as context-informed, but abstract it from its significance socially, culturally, environmentally, and in other ways. In ignoring or underappreciating these connections, water is reduced to being regarded strictly as a resource, commodity, or some other (overly) simple essence. This mindset has pervaded water management over the centuries through various paradigms, but the underlying element of modern water has begun and desperately needs to be replaced as Linton and others' arguments attest to.

Finally, it is important to note that though some of the authors above include ethics in their description of changing water management paradigms (such as Cortner and Moote's use of utilitarianism, but also arguments by Brown and Schmidt [2010], Groenfeldt [2013], and Groenfeldt and Schmidt [2013] for more explicit consideration of values in water management), this paper will focus on the epistemological and ontological aspects of paradigms, as Linton does above. The main reason for this is that while how we define and understand the world and our place in it has ethical implications, paradigms are not necessarily exclusive in the system of values they engender—newly recognizing the complexity and interconnected of the world does not necessarily mean that an utilitarian ethic cannot inform our decisions. Rather, it means that this ethic merely applies to a more complex and interconnected system.

The Emerging Water Management Paradigm

To explain our movement away from modern water, Linton (2010, 50) points out that "the more we consider how ecosystems function, how the social outcomes derived from water

and water services are uneven, and how people in different places and circumstances relate differently to water, the more difficult it becomes to sustain any simple, positive identity for water, whether as commodity, resource, public good, or chemical compound." In a similar manner, Pahl-Wostl et al. (2010, 840) argue that in addition to other influences, "the transformation [of the water management paradigm] has been driven by the emergence of postmodernism as a prevailing cultural and intellectual mission, increased understanding of complex systems phenomena…and a weakening of the previously privileged role of 'science' in knowledge production." Linton and Pahl-Wostl both point to the fact that there are multiple ways to perceive and value water and that this has been reinforced by our growing recognition of the complexity of systems—particularly social and environmental systems.

In addition to this conceptual explanation Pahl-Wostl (2010, 840) says, "paradigm shifts typically occur when existing methods and models consistently fail to describe or account for our experiences, or when the interventions we base on them fail to generate anticipated benefits." As such, the failure of the receding paradigm is perhaps most easily recognized in other environmental issues where the social dimensions of these problems are more widely recognized. Linton (2010, 193) points to "climate change, desertification, deforestation, and biodiversity loss" as examples of newly recognized connections between society and nature. We now readily recognize the impacts of our eating and driving habits on climate change and desertification, and the impacts of development and unsustainable logging on deforestation and biodiversity loss. Water management trails these environmental issues in the changing recognition of our relationship with water.

Again, though there are differences among authors in how they describe both the receding and emerging water paradigms, their descriptions are complementary. The "hard" path that Wolff and Gleick (2002, 1) describe is supplemented with the "soft" path of "decentralized facilities, efficient technologies, and human capital"; stationarity and an easily manipulated nature are rejected in favor of recognizing a complex and dynamic natural system (Schoeman et al. 2014); and managing for "a continuous supply of market-oriented goods" is replaced by managing for the sustainability of ecosystems (Cortner and Moote 1994, 168).

Gleick (2000, 131) points to six major principles common among those "rethinking water policy and putting greater emphasis on development principles that reflect environmental, social, and cultural values" (see **Table 1**).

Table 1: Principles in Rethinking Water Policy

- Basic human needs for drinking water and sanitation services must be met.
- Basic ecosystem needs for water must be met.
- The use of non-structural alternatives to meet demands must receive higher priority.
- Economic principles must be applied more frequently and reliably to water use and management.
- New supply systems, if needed, must be flexible and maximally efficient.
- Non-governmental organizations, individuals, independent research organizations, and other affected stakeholders must all be involved in water management decisions.

Source: Gleick 2000, 131.

It is important to note that Gleick's point that economic principles need to be applied more frequently and reliably to water use and management includes an effort to account for "non-market environmental and social costs" and is at least in part a response to a history of water projects in the United States which had questionably "high discount rates, low-interest loans, and transfer of costs to non-dam parts of water developments" (Gleick 2000, 130). Otherwise, this list is fairly comprehensive of the points raised by other authors.

This list indicates a paradigm shift in how we understand water. The idea that water and natural resources are intertwined with social systems underlies all of the points that Gleick makes. We have to acknowledge that lack of access to water for drinking and sanitation is a political failure rather than a technological one; we directly impact ecosystems and the ecosystem services they render; and all stakeholders must be considered as water provides a multitude of benefits.

Linton (2010) and Krause and Strang (2016, 633) argue that we should not think of water as an "object of social and cultural production," but as "a generative and agentive co-constituent of relationships and meanings in society." This means that water, and more broadly nature, is not only directly connected with our social sphere, but also influences it. We can see this through climate change and how efforts to reduce emissions has created new collaborations and policies not only in the United States, but also internationally. We must recognize these far-reaching connections and the complexity and importance of resource management if water and other natural resources are to be appropriately managed.

Water and Water Management Paradigms in the West

Alhough water management paradigms operate on a global scale, they are also relevant to the western United States and Colorado. Linton (2010) points to W. J. McGee, the president of the American Association for the Advancement of Science (1897—1898), American Anthropological Association (1902—1912), and National Geographic Society (1904—1905), and regarded as "the chief theorist of the conservation movement," as an example (Hays 1987, 102). McGee provides a clear example of the modern water paradigm when he says:

> No more significant advance has been made in our history than that of the last year or two in which our waters have come to be considered as a resource – one definitely limited in quantity, yet susceptible of conservation and of increased beneficence through wise utilization. The conquest of nature… is now extending to the waters on, above and beneath the surface. The conquest will not be complete until these waters are brought under complete control (McGee 1909; quoted in Linton 2010, 150).

In addition to how this influential person perceived water and water management, one merely has to think about the number of dams or transmountain diversions built in the West during the twentieth century to see this paradigm operating in the United States. Naturally, though, there are nuances to places and circumstances that distinguish them within this broader discussion. In the West, the doctrine of prior appropriation stands out as a defining feature of water management that

both embodies and distinguishes itself from the water management paradigm of the last century.

Prior appropriation is a system that grants individuals a property use right by order of appropriation, i.e., the first to appropriate water for a beneficial use is the first in line to receive water every year. This contrasts with the twentieth century water paradigm to a certain extent. Instead of water being distributed and managed exclusively by a central agency which determines the distribution of water use, prior appropriation has granted individual water rights holders the ability to determine the landscape of water use in the West—there is no reason why water cannot be appropriated by an individual if they are putting it to a beneficial use under Colorado law. Furthermore, this system has created its own distinct culture through the assurance of this individual right and its participatory nature. However, this is not to say that prior appropriation has not operated largely in line with the receding water management paradigm.

The confines of prior appropriation have narrowly defined water for more than a century. In order to appropriate water, one has to prove they are putting it to a beneficial use. Though this is a reasonable and necessary requirement in our arid climate, how beneficial use has been defined has reflected a narrow set of values for many decades. Despite prior appropriation beginning in the 1860s, it was only in 1973 that the State Legislature recognized the need of water for the environment through the state's instream flow program and the benefit of recreational in-channel diversions in 2001 (Hobbs 2004).

While these changes indicate a shift towards recognizing environmental and cultural values, the Colorado Water Conservation Board's web page on nonconsumptive water needs (i.e., environmental and recreational) demonstrates how ingrained paradigm of the last century as it begins by explaining the significance of these needs in economic terms. Nonconsumptive needs "infuse between $7 and $8 billion into the state's economy and employ about 85,000 people across Colorado," and "continue to draw in businesses and new residents to Colorado, further underscoring their importance to the state's economy" ("Nonconsumptive Needs (Environmental and Recreational)"). This economic justification reflects the largely economic definition of water which has informed beneficial use throughout prior appropriation.

Lastly, regarding water as a property right to be bought and sold aligns with the receding paradigm as this lends itself to understanding water strictly as a resource. From this point of view, water's value is thought of abstractly as a quantity—the environmental, cultural, social dynamics of water are not directly acknowledged. This simplification of water has played into the buy-and-dry practices (which typically consists of municipalities buying agricultural water rights and subsequently leaving once-productive land barren) which have subverted communities in Southeast Colorado. One farmer I spoke to described one of these towns he visited a few years ago saying, "the only light on in that farming community was a Pepsi machine. . . . They [municipalities] absolutely took communities and left them vacant, and the state of Colorado spent millions of dollars trying to find ways to provide employment to those areas that sold their water" (Interview by author 2015).

While the receding water management paradigm has characterized prior appropriation and water management in Colorado, the examples just mentioned also indicate how we are moving away from this mindset. Though economics may still dominate how we value water, the fact that the definition of beneficial use has expanded to include nonconsumptive uses indicates a broader recognition of the value of water—it is no longer thought of as a simple equation of consumption and value—and the infamy of buy-and-dry practices has led to innovative alternatives and indicates that we recognize more than just the economic value of water.

Methods

For my research I focused on agriculture in the Gunnison River Basin. This area was chosen because of its location and the general significance of agriculture in the area. Colorado is regarded as the "headwater state" in the Colorado River Basin because of the number of headwaters and the volume of water that originates here every year (see **Figure 1**, **Figure 2**). The Gunnison Basin lies on the Western Slope of Colorado where the majority of water for the Colorado River Basin originates. Despite the fact that the Gunnison Basin comprises only a small fraction of the Colorado River Basin's geographic area, it "produces approximately one-sixth of the surface water for the whole Colorado River Basin" ("The Gunnison River Basin: A Handbook for Inhabitants" 2013, 8). Given that both downstream states and the Front Range depend on water that originates on the Western Slope, farmers and ranchers are concerned about growing water demands from these areas.

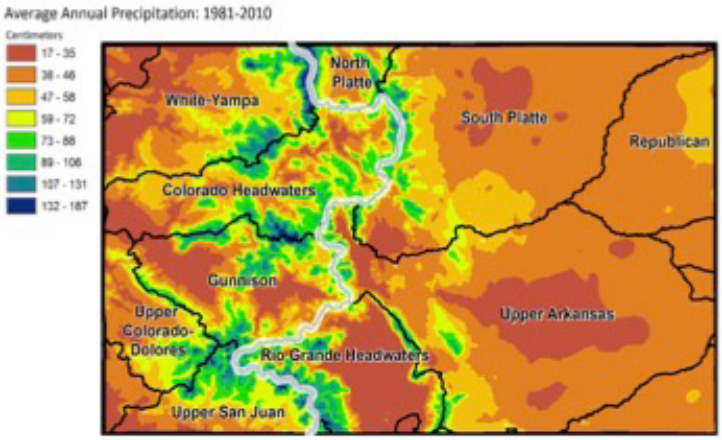
While only 5.5 percent of the land in the Gunnison Basin is classified as planted or cultivated (the majority is owned by the federal government), agriculture has had a presence in the basin since the 1870s and remains "economically

Figure 1: The Colorado River Basin

The Gunnison River Basin is circled in the oval. Reprinted from "The Gunnison River Basin: A Handbook for Inhabitants" 2013.

important in every part of the Gunnison River Basin" (Colorado Water Conservation Board 2015; "The Gunnison River Basin: A Handbook for Inhabitants" 2013, 13).

Figure 2: Average Annual Precipitation in Colorado



The average annual precipitation on the Western Slope is much greater than that of the Eastern Slope (continental divide highlighted in white). Data Source: PRISM Climate Group and Coordinated effort between USDA-NRCS, USGS, and the EPA.

As a part of the Rocky Mountains, the basin's elevation, rainfall, and soil quality vary greatly and affect agriculture. In higher elevations above ~7,000 feet with shorter growing seasons, ranchers grow hay and raise cattle and sheep ("The Gunnison River Basin: A Handbook for Inhabitants" 2013). At lower elevations, farmers are known for growing award-winning fruit, Olathe Sweet Corn, and other grains and vegetables ("The Gunnison River Basin: A Handbook for Inhabitants" 2013).

I focused on how farmers and ranchers perceive water management in order to understand where Colorado might be in this changing water paradigm. Although agriculture is just one stakeholder in water management, it is very significant to water use and management in Colorado and the Western United States. Aside from producing food for the state and internationally, agriculture in Colorado has some of the most senior water rights in the state (senior to both municipalities on the Front Range and the 1922 Colorado River Compact) (United States 2014), provides important habitat for wildlife, is a significant economic driver in Colorado (Colorado Water Conservation Board 2015; "Food & Agriculture"), and accounts for eighty-nine percent of water consumption in Colorado (though many of the farmers and ranchers I spoke to point out that agriculture consumes less than people think due to return flow) (Colorado Water Conservation Board 2015). These are just a few of the reasons why agriculture is important and significant when it comes to water management.

I also interviewed farmers and ranchers and not necessarily water professionals because including the voices of farmers and ranchers aligns with the principle of collaboration, which many authors point to as fundamental to the emerging paradigm (see **Table 1**). In fact, many of the people I talked to were a part of the Gunnison Basin Roundtable or active in other ways with water management. In contrast to a more top-down approach, though, allowing parties affected by water decisions to have a say not only creates a more democratic and just management system that is more likely to adequately address social dimensions of water management, but it is also arguably more efficient as it decreases the likelihood of plans having to be amended or changed later (Stefanovic 2015). As such, understanding the values of those who use water is critical to good water management.

To understand how farmers and ranchers think about water and water management in Colorado, I developed interview questions around "the nature of the system being managed, the goals of management and the ways in which these goals can be achieved" (Pahl-Wostl et al. 2010, 840) (see Appendix). Both Pahl-Wostl et al. (2010) and Schoeman et al. (2014) point to these three things as assumptions that define and reveal a management paradigm. These three aspects of a management paradigm help distinguish the ideas and themes previously mentioned that characterize the emerging paradigm. The ideas which largely defining the "nature" of the emerging paradigm are the recognition of an interconnected and complex world where people are no longer conceived as separate from a totally predictable nature. Recognizing this mutually dependent and not totally predictable nature of water, the goals of water management are sustainability and a broad spread of benefits. The best approach to achieve these goals entails giving greater attention to environmental and social dimensions of water management than we do now through adaptive and collaborative practices. It should be noted that this description merely includes some of the more salient aspects of the emerging paradigm as they relate to Pahl-Wostl's definition of a management paradigm and is by no means comprehensive.

I conducted semi-structured interviews with ten farmers and ranchers with questions developed around these ideas. To respect the privacy of participants, the names of all interviewees are withheld in this paper. The questions I developed were intentionally kept broad so that any assumptions I had about water management would affect people's answers as little as possible. As such, how people interpreted the questions and what examples they used varied, but there were also many consistencies between the interviews. In particular, the degree of interconnectedness and the implications of this for the goals and best approach to reach these goals stood out. These three aspects of water management were primarily discussed in terms of the role of agricultural water use, priority of different beneficial water uses, and the collaborative efforts of the Gunnison Basin Roundtable.

The Nature of Water and Water Management

When I first started to learn about water in Colorado, I repeatedly heard about the "80-20 split" between the eastern and western slopes of Colorado where 80 percent of the water in Colorado falls on the Western Slope, but 80 percent of Colorado's population lives on the Eastern Slope. Framed in this way it seems that more water should be diverted to the Front Range. However, defining water's benefit in terms of Colorado's population is reductive of the complexity of water in Colorado and neglects the varying landscape and water demands across Colorado and beyond. In many ways the farmers and ranchers I spoke with did not simplify or overlook various connections or simplify water and water management such as the "80-20 split" does. That is not to say, though, that the farmers and ranchers

I spoke with expressed opinions totally consistent with the emerging water management paradigm. How they talked about water management and reflected either the emerging or receding paradigms varied from topic to topic and person to person. One of the best examples of this lay in their views on the connections with and benefits of agricultural water use.

Unsurprisingly, when I asked most farmers and rancher about the role or benefit of agriculture, they pointed to food. Though food was the first (and sometimes only) identified benefit of agriculture, many would also point to other benefits such as the environment, economy, and culture. This indicated a difference in how deeply each person connected agriculture with other water uses and benefits as with the emerging paradigm, or with agriculture serving a single purpose as with the receding paradigm. This is not to say, that any talked about agriculture as if it were in a total vacuum. When talking about their own water, for instance, they all pointed to downstream states, the Front Range, and environmental flows as creating pressure on their own farm water. The differences, however, lay in how readily their perspective related to theme of interconnectedness.

Even when pointing to the importance of food production over and above all other benefits, many farmers and ranchers saw economics and national food security as inherently related to food production. One rancher said, "if we can't divert our water to raise hay, to raise cattle, to contribute to the nation's food supplies, we're . . . bringing in food from Brazil or Mexico that—they don't even watch what the animals eat." They added to this that, "there's a direct economic contribution [by agriculture in Colorado]. It's not tourism based, so it's not based on your discretionary money to come out here and mountain bike or something. It's an actual, tangible product" (Interview by author, 2015). Though the "tangible," i.e., economic, benefit and food security provided by agriculture are certainly of unquestioned importance, this rancher went on to say, "I think that—and I guess, you know, the esthetics. It provides wildlife habitat and a pretty . . . you know, an esthetic value. I suppose that's on there too" (Interview by author, 2015). In this the receding water paradigm is expressed insofar as acknowledging the environmental benefits of agriculture was a concession to placate environmental values. That is, downplaying environmental or other types of benefits and values and focusing primarily on how water is a resource for predominantly human uses undermine the interconnected nature of water that water management should acknowledge under the emerging paradigm.

While the majority of farmers and ranchers pointed to the nation's food supply as reason enough for agricultural water use, one farmer questioned that food production provided enough of a reason on its own for agricultural water use in their valley. "I'm not sure, to be honest with you—if this valley dried up, it wouldn't affect the ability to feed to population. And that's why I think one of the greatest reasons I think we have to learn efficiencies is that if in fact somebody can prove that if this basin didn't exist for water, what would it affect people living in cities?" (Interview by author, 2015). As this farmer pointed out, the scale of food production in the United States extends beyond their valley. This more nuanced understanding of the connection between this farmer's valley and the nation's food supply acknowledges the different scales of water and food production. Through this, food production is no longer regarded as an unquestionable benefit as the rancher above stated. Instead of seeing food production as an absolute benefit, it is understood in a particular context defined at least in part by a scarcity of water. A different rancher spoke to this idea, saying we should be thinking as far as "twenty-five, thirty years from now. And if we're going to do it [produce food for the nation] all in the Midwest, okay. And I'm not—that's not wrong as far as I'm concerned, but we should make some kind of a big picture analysis of really what we want to do and [if it is] feasible to do that" (Interview by author, 2015). Acknowledging the larger contexts of food production and water availability may weaken the case for agricultural water use in Colorado, it only does so insofar as agriculture is defined solely by food production.

Though many farmers held food as the ultimate benefit of agriculture, they also acknowledged that agriculture provides for other benefits. Of those, environmental benefits were the most commonly cited. When I asked one farmer why agriculture was a beneficial use of water, he simply said, "Well, I don't think it's just agriculture" (Interview by author, 2015). They pointed to wetlands, rivers, and the general ecology in the area as inherently connected to agriculture's presence.
Connecting agriculture and the environment like this was the norm. In a similar manner, another farmer pointed to a variety of reasons why agriculture was so important to communities:

> Is it an overstatement to say ag[riculture] is the lifeblood of the community? No. It's everything. But it provides so much more than just, you know, the employment, the food. It provides that open space. It provides an environment. Look around me. Look at where people are building their homes. They're building their homes around here so they can be surrounded by ag[riculture]. I would say it's the primary driver of the force over here. So if you take the water away, people will go away too. It'll dry up (Interview by author, 2015).

Both of these farmers point to the multiple benefits agriculture provides. They do not think of just food production as its defining characteristic, but recognize the connections it has with the environment and desirability to live in the area.

Even though the farmers above reflect a similar perspective in terms of the connections with and benefits of agriculture, this does not mean that the emerging water paradigm is necessarily embraced in its totality. One rancher I spoke with succinctly exemplified this by saying, "I'm not concerned about water in the streams for the ecology or the environment because I think one hundred years of irrigation, one hundred plus years of irrigation, like we do it today has created an environment and an ecology that's important to society. It's important to our community. It's important to me" (Interview by author, 2015). Alhough this rancher was the only one to say that agricultural water use specifically supplied enough water for the environment (at least through flood irrigation in their area), this description highlights how even if a person understands agricultural water as inherently interconnected with the environment and other things, the terms of those connections is still open to interpretation. Insofar as this rancher defines "the environment" in terms of the ecosystem he sees immediately

before him and this being adequately supplied with water from agriculture, there is no need to consider further connections between agricultural water use and the environment. This principle applies to the other farmers above as how they recognize and value the environment they pointed to also matters. Aside from the connection of agricultural water use with the local environment, farmers and ranchers I spoke with also talked about the value of the tradition and culture agriculture has created over the last century and more. That said, the dominant value of agricultural water use laid in food production—environmental and other benefits largely were considered secondary and the extent of interconnectedness was thus acknowledged in a limited manner. This is perhaps best shown in how farmers prioritized uses of water.

Goals of Water Management

Building on the theme of interconnectedness, the emerging paradigm orients water management towards a broad spread of benefits. Having this as the goal of water management contrasts with the receding paradigm where our relationship was characterized by our use of discrete and narrowly defined resources.

When asked what uses of water were most important, most farmers and ranchers prioritized water uses similarly to the 1922 Colorado River Compact where domestic use is the highest priority. While most farmers and ranchers were also quick to clarify that they did not include water for lawns within this, many argued that agricultural water use was just as important as (indoor) domestic use. As one farmer said, "Well, I think the most important use for water . . . is in keeping people alive by satisfying their needs for drinking water and other requirements just for life. But part of that is a production of agricultural goods that allow people to eat. So those two kind of go hand-in-hand in terms of allowing life" (Interview by author, 2015). The prioritization of domestic and agricultural water uses within this hierarchy that this farmer and others talked about echoed a recognition of the need for water and sanitation as basic human rights, which Gleick and other authors point to as a characteristic of the emerging paradigm (Gleick 2000). However, in terms of recognizing a diversity of values and benefits, this description of priorities is somewhat narrow in perspective as there could be greater recognition of the interconnected nature of systems previously discussed.

Two of the farmers and ranchers I spoke to had a different kind of response when I asked what they thought were the most important water uses:

> All. All uses are important. . . . they're doing something beneficial whether it's a farmer, or a miner or a, you know, whatever. They're putting water to use in some way to get something out of it (Interview by author, 2015).

> I guess I probably couldn't say that there's one more important than the other. Water to protect the environment, I think, is essential. I think water to raise food is—we have to have that. I think water to create recreational opportunities, you know, people need—they are healthy places to spend your time . . . I think they're all very important and I don't think I could say that one is more important than another (Interview by author, 2015).

While the other farmers and ranchers usually included environmental and recreational uses in their hierarchy, the above quotes go a step further in that the goals are informed by a recognition of the complex interconnected environment we live in. Although domestic and agricultural water uses are certainly important and there are certainly reasons for distinguishing between uses, isolating and distinguishing them in a context of absolute importance abets the idea that people exist outside of an environmental context they depend on. Declining to rank water uses, on the other hand, does not set a precedent for sidelining beneficial uses which may not benefit people directly.

This is not to say, that recognizing the importance of a diversity of water uses is the same as equating the value of them in practice. The circumstances of a situation dictate the relative importance of different water uses. For example, the projected economic and population growth in Colorado and resulting municipal demands are in no small part due to, as the Colorado Water Plan puts it, "vibrant communities, natural beauty, and a high quality of life" (Colorado Water Conservation Board 2015, 5-4). In proportion to the benefit environmental and recreational water uses provide (and not just to a growing economy), these uses warrant consideration and value.

The Best Approach to Water Management

As with the goals of water management, what farmers and ranchers pointed to as the best approach reflected how farmers and ranchers understood the nature of water management. Pointing to collaborative efforts recognizes the legitimacy of various values, forms of knowledge, and water uses (depending on what parties are included in these efforts) and relies on the understanding of a complex and interconnected nature.

While most farmers and ranchers valued collaborative efforts in water management, many also characterized water management as an issue with different groups not seeing eye-to-eye. When I asked one farmer to describe the water situation in Colorado, he bluntly said, "contentious" (Interview by author, 2015). Others described Colorado water in similar terms saying, "there's a battle for water going on" (Interview by author, 2015), and "it's always a fight between East Slope and West Slope for the water" (Interview by author, 2015). While this was regarded as the current situation by many, collaboration and education were oftentimes pointed to as essential to water management.

Many of the farmers and ranchers I spoke with were a part of the Gunnison Basin Roundtable—one of the nine basin roundtables in Colorado established "to facilitate continued discussions within and between basins on water management issues, and to encourage locally driven collaborative solutions to water supply challenges…" (House Bill 05-1177). One of the roundtable ranchers said:

> I think that the efforts of having collaborative discussions is highly important, and we have to tell each other—the different interest groups—what's important to us. And hopefully in that process we can come up with meaningful ways of meeting all the demands that are out there. I mean, I've been involved in lots of collaborative efforts over my career, and where there was a sincere effort made to communicate, most of the results of those efforts have been good (Interview by author, 2015).

They went on to say that most collaboration is motivated by parties wanting to avoid going to court, but this addition does not detract from the emphasis of collaboration between parties and recognizing the potential for mutually beneficial results.

This rancher was certainly not alone in pointing to collaborative efforts as essential to water management. Another farmer said, "it's just a matter of everybody [downstream states, east slope, west slope, etc.] working together. I think that's one of the very important things. I really do" (Interview by author 2015). While collaborative efforts were commended by many farmers and ranchers, many also argued that there is room for more collaboration to happen between interests and basins.

While collaboration was an explicit aspect of water management important to many farmers and ranchers, others pointed to education and legislative efforts in a similar manner. When talking about what was not working well in water management, one farmer said:

> It's education just as much as anything. We have a number of projects here in our immediate area where we're trying to do more with piping and pressurized systems, and a lot of farmers just are not willing or convinced, I guess, that this approach will benefit them. . . . We need more examples. We need more farmers talking to other farmers saying, 'I put in this center pivot and it's working great. I'm cutting more hay than I ever did' (Interview by author 2015).

Education in this context relies on sharing of information and data rather than undermining the interests of other groups as one farmer seemed to call for when they said, "people are not getting together and coming up with solutions. You know, the Trout Unlimited wants water for the fish, and they want to leave more water than I think they need, and people just need to get together and come up with a solution that really works" (Interview by author 2015).

In addition to education, one rancher pointed to legislation saying:

> Probably one of the best ways we could make that situation better would be to educate the county commissioners, the city councils, and the legislators with regard to how the current system works, and then establish closer relationships between decision makers and users. To move forward on water management concepts, you pretty much have to go through the legislature (Interview by author 2015).

Although these farmers and ranchers pointed to education and legislation as a means of improving management, they still relied on collaboration as a part of these efforts. Pointing to educating county commissioners and others is done with the intention of having the experiences and values of those who use water being more adequately represented and considered. Saying that legislation is necessary for water management to move forward does not conflict with the emerging paradigm as this does represent an imposition of values, but a recognition of values in this case. However, whose interests are being represented is another important aspect of this. Legislation should aim to represent the values of the diverse interests of citizens.

Conclusion

The tendency for many farmers and ranchers to see agriculture as interconnected with the Western Slope culture, economy, and environment showed that agriculture was more than just food production for most farmers. They valued the lifestyle, community, and landscape it provided them so much so that they wanted to ensure agriculture remained viable on the Western Slope for future generations. Other farmers and ranchers, though, were resistant to defining agriculture as anything other than an economic activity that provided the essential benefit of food. Seeing agriculture as an isolated practice that does not directly impact or relate to the environment, culture, or other aspects of society undermines its value and the value of the water it depends on. The same can be said for narrowly defining the goals of water management or approaching water management in an exclusive manner where the knowledge and values of all who depend on water are not recognized.

The farmers and ranchers I spoke to embraced the receding and emerging water management paradigms to varying degrees. While many pointed to collaboration when discussing how water management should be approached, there could be a greater recognition of the interconnected nature of water in understanding the goals of water management—though two people I spoke with talked about recognizing the value of all uses of water, there were a number of others who simply said agriculture was the most important use for them. The examples and ideas farmers and ranchers used, which reflected the emerging paradigm, were not outweighed by those which reflected the paradigm of the last century. There was a surprising integration of the emerging paradigm in how some farmers and ranchers talked about water and water management, but there is still much progress to be made.

Although the water management paradigm of the last century has enabled food production to largely keep up with population growth, reduced greenhouse gas emissions through hydroelectricity generation, and created safe water supplies for most developed countries, there have also been serious consequences of this approach (Gleick 2000). Billions of dollars have been invested in water infrastructure in the United States alone, but this approach has also resulted in "the destruction of ecosystems, loss of fish species, dislocation of human populations, inundation of cultural sites, disruption of sedimentation processes, and contamination of water sources" (Gleick 2000). As we continue to recognize the connections between natural resources and society through water, climate change, deforestation, and other environmental issues, the need to change how we approach resource management grows. Natural resources should no longer be thought of exclusively as a resource and the interconnected nature of the environment and society needs to be recognized. We must realize that natural resource systems are dynamic and prioritize sustainable and adaptive practices, and in recognizing this complex and dynamic system, we need to not rely exclusively on technical solutions or a single approach to management, but learn to collaborate and recognize the benefit of a diversity of perspectives.

We have prior appropriation to allocate water uses, but innovation and the acknowledgement of social influences are necessary in this system as we begin to recognize the broader connections and importance of water. How this manifests exactly

remains to be seen, but perhaps part of the solution to the overly mechanistic and top-down approach, which has characterized water management, requires a greater consideration of ethics such as the human right to water. Whether considering human rights or our more subjective desires, there will always be competing interests for water. As one rancher said, "I believe we need to have green space in the city, and parks and recreational options, but… it's a hard value call because when you raise turf for people to play ball on, what is the value of that turf versus the value on hay ground out here? Those are hard decisions."

Appendix

How would you describe the current water situation in Colorado and the Gunnison Basin?

What do you think is the cause, or causes, of our water situation?

Do you think there is more water to develop in the Gunnison Basin or in Colorado?

How do you understand the projected water demands reported in the Colorado water plan?

Do you see yourself as having a voice or as having influence in water management? In the Gunnison Basin? In Colorado?

How do current water policies affect you as a farmer?

What do you think are or should be the goals of water management in Colorado and the Gunnison Basin?

What is working well with current water management? What is not?

What uses of water do you consider to be the most important? Why?

What do you see agriculture contributing to the Gunnison Basin and Colorado? Why do you think agriculture is a beneficial use?

What do you think is the best way to achieve those goals of water management?

What are your thoughts on prior appropriation? Public trust doctrine? Is prior appropriation fair?

How would you like to see the future of water management develop in the future?

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