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Irrigation Outreach in Afghanistan: Exposure to Afghan Water Security Challenges

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Abstract: The authors, from Colorado State University were invited by the United Sates Department of Agriculture's Foreign Agriculture Service and Afghanistan's Ministry for Agriculture Irrigation and Livestock to lead a "train-the-trainer" workshop with Afghanistan's best and brightest irrigation outreach professionals. The six day workshop on the outskirts of Kabul helped clarify that prolonged conflict has damaged agriculture's access to what should be a plentiful supply of irrigation water. The violence of two wars still lingers today continuing to inhibit foreign aid's ability to rebuild Afghanistan's water resources infrastructure. In spite of these challenges participants in the workshop demonstrated remarkable resourcefulness and courage helping producers throughout Afghanistan take advantage of improvements as they came online. With continued assistance from Western researchers and extension professionals that is sensitive to the traditional methods of water administration, there is reason to be hopeful for the future success of Afghanistan's agricultural sector.

Keywords: *Irrigation, Afghanistan, workshop*

In recent years Afghanistan has emerged from the obscurity of its remote South Asian location to become one of the most scrutinized nations on earth. It's a landlocked state that represents some of the most sparsely populated and ethnically diverse landholdings to emerge from the ancient Mongol and Persian empires. Perched on the south western corner of the Himalayas, its topography includes a range of elevations such as the remote valleys and steep peaks of the Hindu Kush range. From altitudes of up to almost 8,000 meters, snowmelt and rains form four major river systems: the Amu Daria to the north, Helmand to the south, Harirud or Herierod to the west, and Kabul to the east. Reports vary on arable land and available water resources in Afghanistan (Cookson et al. 1992; International Union for the Conservation of Nature 2010; Qureshi 2002). The United States Department of Agriculture Economic Research Services describes an annual average water yield of about 75 billion m^3, or around 60 million acre feet. Of this about 21 percent or 15.8 billion m^3 is river water used for irrigation, 4 percent or 2.8 billion m^3 is ground water used for irrigation, and roughly 2 percent or 1.4 billion m^3 is either river or well water for other uses including domestic (International Union for the Conservation of Nature 2010; Persaud 2012). The remainder is either untapped or unmeasured. Additionally only 2.6 million hectares or half of the country's irrigable area is currently being farmed (Kelly 2003; Qureshi 2002). Despite its arid appearance Afghanistan is far from short of farmland or water.

A unique feature of land-locked Afghanistan is the rivers never reach the ocean (except for the smaller Kabul that joins the Indus after a steep white-watered descent into Pakistan). This amplifies Afghanistan's remote and complex nature since its rivers are impractical as trade byways and underutilized as sources of electricity. Water storage is also limited and the few large reservoirs that exist are vulnerable to sediment problems since watersheds have been heavily deforested for fire wood and timber. Even with these challenges, the potential for irrigated "reclamation" – 55 billion m^3 of water is potentially available to water the remaining 2.4 million hectares of irrigable land (Persaud 2012) – is large, but the nation's fragile

politics and poor security situation have inhibited water's effective utilization during the prolonged recovery process (The Asia Foundation 2006). Being a headwaters state without any legal obligation to deliver water downstream, the lack of infrastructure versus lack of water has become the primary obstacle preventing Afghanis gaining access to water (Peter 2010).

Of the 28 million people living in Afghanistan, about 5.5 million live in the larger cities such as Kabul and Kandahar. The majority rural population is spread across about 20,000 villages, most with 1,000 people or less. Farms less than 20 hectares account for about 60 percent of land ownership; in irrigated areas 97 percent of land holdings are 6 hectares or less (Qureshi 2002). Villages depend heavily on surrounding agriculture and town planning is dictated by if land is irrigated (abi) or dryland (lalmi), with canals and wells having priority. In western and southern Afghanistan some areas depend on underground well and canal networks (khareez, qanat, or herez), ancient Persian systems that reduce evaporative losses. The majority of irrigation occurs in the lowlands with wheat being the dominant crop. Wheat is also the foundation of the Afghan diet, making up 54 percent of the average Afghans' daily caloric intake. In the higher elevations, larger tracts of land are prepared for hardier small grains, such as barley, to be watered by snowmelt or spring rains. Fruits and nuts are also an integral part of upland agriculture. Livestock (mostly cattle and goats) management usually involves moving herds to summer grazing pastures and stalling over the winter. Nomadic pastoralists account for about 6 percent of the rural population and follow seasonal pasture year round (Barfield 2010).

Afghanistan's water resource challenges are reflected in its recent food security problems. While food availability and distribution are sensitive to a number of variables, insufficient irrigation, water, or delivery problems have consistently stifled crop yields. In one assessment of 163 nations, Afghanistan ranked last in food security, the next 11 worst being African nations (Morales 2010). Afghanistan was once known for its dried fruit exports (e.g., pomegranate is showing export potential), but the ghosts of two major wars and an entrenched opium poppy industry are greatly inhibiting growth in the horticultural sector.

As Afghanistan and its allies embark on an ambitious nation building effort, its agricultural sector is seen as the linchpin for hastening recovery and sustainable growth. Even with the brutal nature of prolonged and recent conflict, personal security for Afghan citizens is showing signs of improvement. In the Kabul valley, and to a smaller degree outward into the more remote and war-torn provinces, well-publicized suicide bombing events are decreasing and the repair and construction of infrastructure is gaining momentum (The Asia Foundation 2006). As communities rediscover their entrepreneurial spirit after years of being trapped in survival mode, local agriculture and reliable access to irrigation water has become the subject of increased attention and investment (The Asia Foundation 2006).

The fact that irrigated agriculture is considered a key piece in the Afghan recovery puzzle was evidenced by the invitation extended to Colorado State University Extension, and Agricultural Experiment Station, to lead a 6-day train-the-trainer workshop on irrigated agriculture for Afghan irrigation and agricultural professionals. Colorado State University staff in cooperation with the U.S. Department of Agriculture

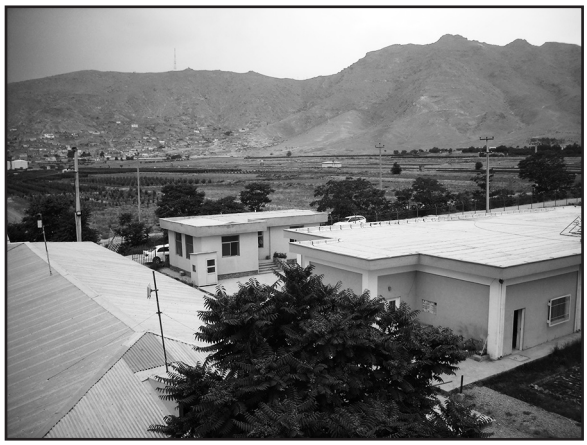

Figure 1. A view of Badam Bagh Farm. Established by the United Nations Food and Agriculture Organization in 2006, it is now owned and managed by the Afghani Ministry for Agriculture, Irrigation, and Livestock.

Foreign Service, U.S. Agency of International Development, and the Afghan Ministry for Agriculture, Irrigation, and Livestock, organized a series of workshops at the Badam Bagh Farm outside Kabul (Figure 1) to train federal and provincial extension personnel on the latest techniques and science in irrigated agriculture.

Workshop Insights

It makes good sense that irrigation expertise from Western Colorado was invited to assist with the educational aspect of Afghan on-farm water management. The irrigated areas of the Upper Colorado Plateau, though half a world away from Afghanistan, share many similarities. They both feature extensive high altitude runoff irrigating dry arid valley bottoms concentrated with alkaline clay soils, and plenty of bindweed. Also they both have many hectares of wheat, orchard fruits, melons, onions, alfalfa with some corn, and a plentiful mix of livestock. The commonalities Colorado State University personnel enjoyed with the workshop hosts enhanced the discussion around on-farm water management immeasurably. Six days is a short time to make a lasting impact, but it did provide some insight into Afghanistan's status as an agricultural nation, and how it might inform international water resource security.

Utilizing Afghanistan's water optimally is a key piece of the nation's security status. Even with reprieves from the violence, water security problems (usually caused by conflict) also compromise efforts to permanently stabilize the region (Qureshi 2002). While few would dispute such a salient observation, it's a little harder to define "water security" in the Afghan context. Afghanistan is an old nation, culturally, technologically, and structurally that doesn't compare easily to mainstream definitions of water security. Settlement in Afghanistan is still governed by access to river or aquifer water, since storage is limited and capital works projects to move water outside basins of origin are not on aid agencies' immediate agendas. Each country has its own water security challenges. In India water delivery infrastructure is reasonably well developed, and access to water depends mostly on healthy precipitation and snowpack. In the West users tend to be comforted by their own ambivalence to this "most precious resource," which perhaps explains why water in the United States often "evades institutional classification and eludes legal generalizations" (Wolf 1999). In Afghanistan water is plentiful and water access is generally limited infrastructure. More importantly, long and healthy lives remain a rare commodity, so most Afghans are yet to enjoy the luxury of academic debates over their water resources future. Small incremental improvements are often received with much joy and gratitude.

Afghanistan spent many centuries needing little in the way of institutional or legal frameworks for water. A land of many ethnicities, with some of them extremely isolated, the nomadic societies and valley-centric provinces within its boundaries enjoyed low population densities surviving on a predictable if not excessive supply of water (Qureshi 2002). These villages and hamlets remained largely invisible to outsiders until the Russian invasion of the 1980's (Cookson et al. 1992). Today there are approximately 11, mostly Sunni Muslim tribal groups (the dominant being Pashtun), that co-exist relatively peacefully in the Afghan region, as they have for some time (Barfield 2010). It might be surprising to learn prior to the upheavals of the late 20th Century, the central rulers were often heavy handed maintaining the status quo. It was a "political horse trade" of sorts: rural communities gave up wealth and control in return for an absence of federal interference. This understanding usually included, (a) protection should a community be threatened from outside Afghanistan's borders, and (b) swift arbitration if an internal dispute escalated (Barfield 2010).

Without interference from Kabul, most of these smaller rural societies were able to effectively maintain the ancient Mongol system of local governance for millennia, sometimes known as the "three M's." A leading Mullah was responsible for overseeing religious matters, a Malik for land and commerce administration, and the Mirab for administering water distribution and resolving disputes. Some townships elected these positions while others preferred the titles to be inherited (Brick 2008; Thomas 2009). With modern

Afghanistan attempting to replace the ruins of multiple conflicts with a new internationally viable society, the benefits of foreign funding has had unintended consequences on this elegant system.

Development aid and the accompanying spike in cash flow has improved water delivery in a number of areas (The Asia Foundation 2006). Replacing the heroin poppy trade with alternative food crop mixes has provided additional incentive for many of these delivery improvements (Boone 2008; National Solidarity Program 2011). While some of these efforts are successful, others have compounded the rapidly shifting balance of water distribution among neighboring users (Scott 2008) and exacerbated local water quality problems such as salinity. Corruption over water allocation has also increased (The Asia Foundation 2006). Such challenges have surfaced at a pace that has often outstripped local governments' ability to resolve them. A water administration system that relies heavily on a few individuals, such as the local Mirab, means these schisms can quickly undermine any sense of restored order for the local farming community. With trust so integral to rebuilding local governance, such compromises are hard to reverse. Each time local leaders are stretched beyond their authority, it highlights the demoralizing effects of inequality that are always lurking when striving to improve quality of life in the developing world (Watkins 2005).

Without considerations by foreign development agencies for how ingrained the Mongol approach is in the psyche of Afghans, it's fair to expect significant growing pains bringing Afghanistan into the 21st century. Block grants from the National Solidarity Program initiated in 2003 have helped address some of the many small-scale technological and structural problems with approximately US$300 million disbursed in the water resources sector (National Solidarity Program 2011). What is unclear is how sustainable such projects will be as program recognition among Afghans is limited (The Asia Foundation 2006). Some of these projects are designed to encourage entrepreneurship and a more commercial approach to agriculture. Historically, water has been allocated at the family or field level since the labor-intensive nature of subsistence farming has removed the incentive to aspire for more (Barfield 2010). Whether capitalism can be successfully integrated into a society that strives to preserve its communal nature, sometimes at the expense of the individual, remains unproven.

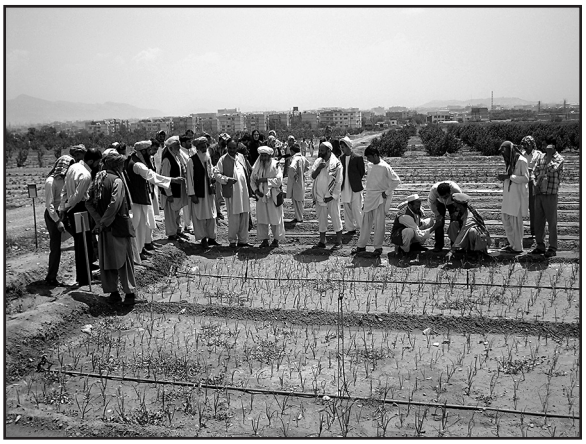

Figure 2. Workshop participants practice soil moisture measurement techniques in research plots at the Badam Bagh farm.

As the workshops progressed, the traditional roles of instructor and participant were gradually replaced by a more collegiate atmosphere and open exchange of experience and knowledge. Field visits enhanced this interaction which included hands-on examination of live systems. Additional hands-on sessions included strategizing effective technology demonstrations, new methods for measuring crop water use (Figure 2), and effective irrigation scheduling. Employing a train-the-trainer model, the Colorado State University workshop agenda was designed primarily for end users who are already benefiting from recent equipment upgrades. The objective for workshop participants was to ensure this group of irrigators translates these improvements into yield increases. Those still awaiting improvements would ideally report some increase in availability through the collective reduction of wasted water. As extension agents, this collection of engineers, agronomists, and hydrologists clearly had the ambition, scientific understanding, and relationships with local producers to execute highly impactful irrigation outreach in their provinces. Providing effective programming in spite of persistent provincial violence was the primary concern for most

attendees. Helmets and bullet-proof vests were only seen on security personnel in Kabul, but there is much to suggest that rural Afghanistan has yet to become a safe place to work (The Asia Foundation 2006).

Many of the larger Afghan tribal groups are wise to the value of diplomacy even if neighborly cooperation has often been imperfect (Barfield 2010). Water may have sparked some smaller skirmishes, but between these groups a pragmatic peace has generally prevailed (Barfield 2010). Academia is somewhat divided on where human access to water resources fits into the larger national security discussion. The traditional view has been that as water scarcity spreads, it is inevitable that conflict potential across the globe will increase due to a perceived or real lack of access to water (Gleick 1993; Remans 1995; Samson 1997). The progressive and increasingly accepted view is that water is valued separately from land, oil, or mineral wealth. It is also more likely be a catalyst for cooperation between nations, even those that might otherwise be at odds (Carson 2004; Wolf 2003). Afghanistan poses a slightly different question since the reverse problem applies: conflict is creating scarcity. The inability to utilize Afghanistan's abundant water is in most cases caused by outdated or war-damaged infrastructure, and a lack of safe opportunity for repair.

Today, a new democratic Afghan government is struggling to establish credibility in the face of a creatively persistent insurgency. This challenge is exacerbated by how little Afghans have previously needed or wanted to consider the political and personnel shifts inside the palace walls. The ability to divert water safely and consistently for local use will undoubtedly be the most potent catalyst for how Afghans measure immediate and long term recovery. The group of extension personnel attending this workshop were clearly fearful that many of the ditch-level gentleman's agreements will be ignored as the current wave of irrigation upgrades and reforms are implemented (International Union for the Conservation of Nature 2010). Foreign aid is being injected into the rebuilding effort at a rate of about US$2 billion a year, with the United States the largest contributor, delivering about 85 percent (Hersch 2012). As a pertinent example, Japan has been supporting the rice growing efforts in Nangahar, Kabul, and Bamiyan provinces, providing improved water delivery and opportunities to expand rice growing acreage. Rice is an important staple in Asian countries. Not only does it underpin the domestic food supply, but its shelf life and transportability opens doors for international trade long closed by war. In spite of this, rice's thirst for irrigation water is notorious and regional expansion of its acreage has profound implications for neighboring users. With a lack of basin-level water adjudication, Mirabs in downstream communities being shorted by upstream overages have little at their disposal to effectively serve their communities (International Union for the Conservation of Nature 2010).

Other Considerations

If Afghanistan is able to harness its significant water resources and improve its security situation, it represents a rich source of "virtual water" – the consumed water responsible for raising cereals, vegetables, fiber, and fruits – food that crosses watershed or international boundaries (Allan 1998). Some nations facing water and food supply constraints are already investing in off-shore food production – more cynically known as land and water "grabs" (Wolf 2003). A stabilized and rebuilt Afghanistan is likely to be an agricultural target for future land transactions of this nature, especially Saudi Arabian and Chinese interests, considering their growing participation in the practice and proximity. The effectiveness of the central government will be central to ensuring that, should this activity start to occur, it does so in the nation's interests.

Potable water infrastructure has also declined, often in parallel with agriculture. This problem is evidenced by limited access to safe drinking water and sanitation (Lone 2011). Less than half of Afghanistan's population has access to safe drinking water and only about a third benefit from adequate sanitation. Rapid population growth and climate change will only exacerbate these setbacks, putting additional stress on water services and food supplies already failing to keep pace with demand (Cincotta 2009).

Hydro power may be the bedrock for a successful Afghan future. Much foreign aid and human life was spent in recent years attempting to repair and expand Afghansitan's largest hydroelectric plant: the Kajaki dam in war-ravaged Helmand province (Urban 2011). Kajaki is one of six plants that account for 239 MW, or about 40 percent of Afghanistan's power-producing capacity. Many Afghans see only intermittent access to electricity, much of which is imported from Uzbekistan. Micro-hydro has had better success. Badakhshan province, for example, recently became the successful recipient of six micro-hydro plants producing a total of 1.3 MW, bringing light and power to 63,000 people. Importantly the project was preceded with three years of outreach to ensure the project was implemented appropriately and effectively. The impact has been profound with almost complete elimination of fires and smoky kerosene lamps to heat water and produce light (Wright 2012), also removing the labor and negative impacts of harvesting fire wood. While terrorist activity remains a threat, this community-based piecemeal approach may be the key to meeting Afghanistan's estimated 2020 demand of 3,000 MW (Flak 2012).

Conclusions

At the conclusion of the workshop it wasn't clear who had benefited the most. The experience was undoubtedly eye-opening and rewarding for all. Prior to their attendance, workshop participants had already achieved much with little, and their ambition and resourcefulness were a lesson well-learned by Colorado State University representatives. Armed with more refined irrigation management tools, there is no doubt that these inspiring extension professionals will quickly build on their prior outreach successes. Noticeably, there were some basic tools that would likely accelerate their progress dramatically:

- Weed control was clearly a problem. Access to backpack sprayers, safety equipment, and modern pesticides could greatly improve yields and the return on investment in new irrigation systems;
- Experimental design and management was not a task anyone in the group had been exposed to. Residency in a western university, or an extended visit to their communities from western extension or experiment station personnel would greatly assist with effectively promoting appropriate technologies; and
- While many of the attendants had water resource knowledge that exceeded their Colorado State University instructors, synthesizing this information into a concise, digestible form, whether as a brief presentation (Figure 3), or simple fact sheet was largely foreign to many; another skill that could be acquired via residency or an extended visit from accredited professionals.

Figure 3. Delivering farmer-friendly presentations were a requirement of the workshop program.

Whatever aspirations the large coalition of foreign aid agencies has for a new Afghanistan, the security of its water supply and a strong local agricultural sector are still patently vulnerable. Although critical administration improvements and the self-regulating benefits of cultural practices continue to be overlooked in favor of larger more noticeable projects, it's not unreasonable to expect continued problems in stabilizing the country. It might be easy to dismiss the Mongol water management system as antiquated, but ways to integrate it with a more advanced water adjudication system are yet to be fully explored. An interim method could be to cap diversions at the district level to more closely match crop water use, which would also provide an incentive for on-farm efficiency and more precise water accounting. When local Mirabs flag overages within their districts that

they are unable to resolve, a basin referee could be employed as a third party adjudicator. Whichever rubric is chosen, there must be some means for downstream users to peacefully protect themselves from excessive upstream diversions. Without this degree of water security for the agricultural sector, those who would seek to undermine Afghanistan's recovery will continue to have ample opportunity.

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