Introduction

Across much of Central America this past July, climate change breathed hot and dry. Corn ears withered on brittle stalks, stunted before kernels had a chance to mature. In the wake of catastrophic crop losses, the recent Global Water Initiative (GWI) conference, “Revitalizing Investments in Rainfed Agriculture” couldn’t have been more timely. Over 180 farmers, scientists, economists and policy makers gathered in El Salvador to probe how Central American farmers practicing rain-fed agriculture could best prepare themselves for an uncertain future.

Food intake worldwide will double by 2050. Cargill and Monsanto may have large advertising budgets to advance claims that they are the future of food, but the UN reports that small farmers working with basic technology still produce 70 percent of the planet’s food. Policy makers would be advised to consider how best to support their family farmer population working without irrigation and dependent on the rain. There is perhaps no greater challenge to these farmers’ ability to ensure food security than the diminishing availability of water and the deterioration of soils. Competition for water among agriculture, industry, households and plants and animals is fierce. According to Jennie Barron of the Stockholm Environment Institute, groundwater is increasingly depleted, surface water contaminated and rainwater unpredictable. To narrow the gap between the food we have and the food we need, water productivity must increase - a measure of crop volume produced relative to the volume of water needed to produce it. Conservation Agriculture and robust agroforestry systems offers a solutions, Barron explained: Retain the moisture in soil, known as “green water”. Good soil management is, in essence, water management.

The greatest crop yield gains will occur not in large-scale irrigation systems but among rain-dependent, small-holder farmers who already produce most of Central America’s food. Farmers conserving green water can make the most dramatic
yield increases in the shortest amount of time with the least amount of ecological disturbance. The debates at the conference were about how to do just that.

The problem and the opportunity

“Latin America’s lands are dying,” said José Benites of the Food and Agricultural Organization of the United Nations (FAO) way back in 2004. Total area under cultivation hasn’t grown much in recent years, but what has been growing, according to Amir Kassam of University of Reading in the UK, is the amount of land no longer apt for cultivation. The website, www.yieldgap.org, reports that the volume of degraded land previously productive and now unusable is nearly 500 million hectares. Compare that with 700 million hectares currently under cultivation for cereals worldwide and imagine the crop yield increases (and decreased pressures on expanding the agricultural frontier into forested lands such as the Amazon) if that land could be restored and brought back into production.

Under-nourished, degraded soil costs more to work (the weak soil requires expensive inputs) and puts public health and the economy at risk. For example, poor soils compromise potable drinking water quality, increase sediment in ports, and crush houses in landslides. Sadly, explained Kassam, it is practically taken for granted that soil erosion is an acceptable consequence of food production, which is he said, “a measure of the depth of our ignorance”. Ask the average person how to grow more food and he’s likely to suggest irrigation and chemical inputs - rarely addressing soil degradation.

And yet, what may surprise that average person is that crop water needn’t come principally from “blue water” sources - surface and groundwater collected in streams, wells and reservoirs, channeled through irrigation ditches, sprinklers and hoses. Dr. Kassam showed slides comparing two rain-fed corn plots with similar soil nutrient profiles and rainfall. The difference between the withered and the vibrant was not irrigation, but conservation agriculture techniques to maximize green water use.

Lifting up rain-soaked soils requires something of a paradigm shift. Water Smart Agriculture asks politicians to prioritize budgets for extensionists to work with farmers to establish soil baselines and mulching plans rather than large dams and irrigation districts. It suggests a change in scale, storing water less in giant reservoirs but rather closer to farms. It acknowledges that successful agriculture is tied to healthy soils that store water, a dependence on nature about which humankind is at best ambivalent. In a sense, it challenges traditional notions of modernity, where modernity means high input agriculture. Will ministries of public works and agriculture and vendors of chemical fertilizers embrace “green infrastructure” over “gray infrastructure” and chemical inputs? Resistance is not surprising.

Suggesting that Water Smart Agriculture is key to sustainable agriculture is not an ideological environmentalist position. It is a practical response to the limited quantity of the earth’s blue water and the fact that that water is not always easy to access. Water Smart Agriculture rises in importance with the understanding that soil resilience is the ultimate guarantor of global food security.

Mobilizing extension services for rainfed agriculture

If Water Smart Agriculture represents the future of food production and sustainable agriculture,
how will it take root amongst farmers? Since the
1950s, explained Keith Andrews of the Cooper-
ación para la Agricultura (IICA), a primary tool
for agricultural learning has been extension ser-
vices through which agronomists and promoters
conduct workshops and visit farmers in the
fields to, for example, assess crop diseases and
research solutions.

Today, extension services have been slashed
across Central America. Private market exten-
sion services, predicted to fill the void, have not
materialized, especially for small-holder farmers
of rain-fed agriculture who can not afford to
purchase professional advice. Twenty years after
cutting Ministry of Agriculture personnel in
Honduras, described Pedro Vázquez of DICTA,
“we have 600 extensionists who formed private
technical assistance enterprises that are still
waiting for state contracts.”

The extension services that remain are often pri-
marily concerned with delivering input packages
- principally seeds and fertilizers. While profita-
able to agro-industry and politically appealing to
politicians seeking to deliver goods to constitu-
ents, this input-dependent form of extension is
not well-suited to knowledge-based, farm-by-
farm problem solving. Soils and microclimates
vary from region to region, sometimes farm to
farm. Extensionists must learn with farmers
about local conditions, said Ian Cherrett of the
FAO but this sort of knowledge-based system is
hampered by reduced research capacity; there
are fewer field labs and stations to experiment
with new practices, from new seed varieties to
mulching methods.

A new type of extension service, apt for rain-fed
agriculture, would have two pillars, suggested
Keith Andrews. The first is to recognize that
small farmers, no matter how lacking in formal
education, know something about the conditions
in which they farm and have likely experiment-
ed with solutions. This is not to romanticize
small farmers or scorn agronomists but to recog-
nize their complementarity; scientific
knowledge ought to build on local conditions
rather than offer cookie cutter solutions. The
second pillar is related to the first; extension
must be characterized by authentic learning and
dynamic experimentation between extension
agents and the farmers they serve.

Curriculum used by schools of agronomy will
have to deepen exploration of conservation agri-
culture techniques and offer agronomy students
effective ways of teaching it to farmers. Minis-
tries of agriculture will require restored funding
for extension and investigation. “The extension
programs of the past are not adequate for today,”
Keith said. “We need a new approach and a dif-
ferent institutional set up.” Keith suggested an
“ecosystem of actors,”, seeking
“complementarities among public and NGO ex-
tensionists and the private sector,” and including
farm products’ dealers and banks.

**Financing Rain-fed Agriculture**

To close the yield gap and feed the world, rain-
fed agriculture will require financing. Yet ac-
cording to Julio Flores of Nicaragua’s Fondo
para el Desarrollo Local, currently only 14% of
Nicaragua’s farmers receive formal credit. Cover-
age rates are even lower in El Salvador and
Honduras.

Conference panelists described a dilemma. Bank
loan officers are accustomed to extending loans
to finance crop cycles - say for purchase of
seeds, fertilizer and pesticides that can be repaid
once the harvest is hold. Conservation agricul-
ture may have different timelines, not as closely
tied to crop cycles. Take agroforestry, a time tested technique for soil health, but one that doesn’t yield annual harvests, especially in early years. It requires an extraordinary loan officer to understand a conservation farmer’s approach.

Public financing instruments that might have been useful for long-term investments such as agroforestry have been dramatically scaled back in the overall shrinking of public budgets known as structural adjustment. Public agricultural development banks such as El Salvador’s Banco de Fomento Agropecuario (BFA) make far fewer loans. The newer financial institutions such as micro-finance that are filling some of the void left by the retreat of public sources of credit are only beginning to learn how to invest in soil and water management.

The revolution needed in extension services must be just as far-ranging within financial services. In fact, the two are closely tied. Without extension, lenders may worry that their small farmer clients won’t be able to resolve production and marketing challenges, often abundant. “If I were listening to this conversation from the point of view of a bank,” commented Ivana Fertziger, from the Ford Foundation said, “I probably wouldn’t fund this sector.”

A representative of a Salvadoran small farmer advocacy organization, La Mesa Agropecuaria, shared his frustration. Family farms provide the bulk of the country’s food, yet they’re often neglected by the banks for being too high risk. With more droughts and floods, he said, we’ll be perceived as increasingly risky. The withdrawal of public financing, like extension, has weakened small farmers’ ability to guarantee El Salvador’s food supply. The banks need social values, the farmer leader said.

Water Smart Agriculture (Green water) minimizes crop losses and in that sense, is an excellent form of risk management. Water Smart Agriculture improvements reduce impacts of disasters (reducing the need for loans for disaster recovery) and increase resilience. Lending for resilience and risk mitigation, before rather than after a drought, said Roberto Lenton, Executive Director of the Water for Food Institute, requires new skills and practices for financial institutions - a path into unknown territory.

Of course, the investment needs of rain-fed agriculture can’t be resolved by banks alone. Water efficiency and crop yields rise with the educational level of farmers, suggesting a public commitment to rural development. Social service programs deepen the impact and effectiveness of public and private credit. Honduras’ Minister of Natural Resources proposed broad support to farming communities to, “democratize production via access to markets. We must localize production.” To lower interest rates to small holder farmers, banks may need to mix in public subsidies. “Taking away a farmer’s cow that he used as collateral is just not a good solution,” the Minister said.

Remittances are perhaps the only increasing source of farmer financing. Ironically, as small holder agriculture falters and farmers’ children emigrate and send money back home, more working capital becomes available. It’s a tenuous dynamic - if too many more farms fail, the remittances will simply be used to buy food – perhaps imported – rather than produce it.

The new institutionality

The conference began unusually. Lina Pohl, El Salvador’s current Environment Minister, addressed conference participants, speaking to the nexus of agricultural and environmental concerns.
- the sweet spot of conservation agriculture. The two sectors are often portrayed as being at odds with one another. She spoke to the challenges and promise of coordination between the sometimes competing ministries.

Conservation agriculture lives within a complex institutional landscape. Deborah Barry, Regional Coordinator for the Global Water Initiative, described how frequently politicians promise institutional reform, but fail. Unravelling bureaucratic logics is always difficult. The cooperation between El Salvador’s Ministries of Agriculture and Environment was a source of inspiration for conference participants.

The logic of moving beyond institutional “silos” is plain to see. Knowledge doesn’t begin and end in one ministry, but is rather a product of interdisciplinary learning and programs. As rain-fed farmers and extensionists discover value in cooperative learning and experimentation, it stands to reason that public agencies ought to do the same. Without that cooperation, agencies can contradict one another. A politically popular fertilizer distribution program may undermine a soil conservation initiative.

Water Smart Agriculture Practices Old and New

“Many of the technologies of conservation agriculture,” observed Roberto Lenton, “are not new.” Professor Lenton’s point isn’t that the technologies aren’t crucial, but that conservation agriculture is more than technology transfer. It’s as much about overcoming political and institutional barriers. Simply because a technology offers proven efficiency gains in water and plant productivity doesn’t mean it will catch fire at the farm level. The structure and priorities of agribusiness, extension and the financial sector can conspire against conservation agriculture, which is often relegated to dispersed pilot plots that never achieve scale.

Philip Owens of the Committee for a Universal System of Soil Classification demonstrated how soil mapping can help farmers understand the soil types most conducive to underground water storage. Without a soil map offering details of chemical and physical properties, it’s tough to know how to increase the soil’s water retention. With extrapolations, soil maps can cover virtually every farm. Victor Suarez of Mexico’s Asociación Nacional de Empresas Comercializadoras de Productores del Campo (ANEC), suggested pushing further - maps describing a soil’s microbiology to guide understanding of fertility. Technological solutions tend to work best when adapted to specific contexts. “Solutions are local,” Lenton said, stressing the importance of using, “a combination of technologies, not just one.” Such is the case with combining silvopastoral agroforestry, which are mutually supportive. Similar to institutional arrangements, technological packages work best when they overlap one another.

Marta Xóchit Flores, a Mexican rancher of the Fundación Produce Michoacana offered a challenge: We want everything to change, she said, “except ourselves”. Are we willing to learn and apply new practices? She lamented the expansion of clear cut ranching practices into forest areas; her works seeks to show how ranching and forestry can be compatible. The important thing, she said is to break with old paradigms and tap our local knowledge.

Conclusion - Invest in Knowledge

There's much talk about climate smart agriculture, said Amir Kassam, but little clarity on what it means. Much of agriculture exacerbates rural pov-
erty and further concentrates corporate domination of the food supply. How will climate smart agriculture be different? We continue to treat soil “like dirt”, Kassam lamented, not as a complex biological organism. The agricultural profession, he said, is “medieval”, in how it abuses the essential foundation of plant health and ecosystems services. If agriculture were a medical system, lawsuits would be so abundant that, “we wouldn’t survive for a week.”

In the rainy season, said Paul Hicks, Director of the Global Water Initiative (GWI), farmers lose water, soil and crops to flooding and runoff. In the dry season, plants can’t withstand prolonged droughts. Green water remains poorly understood, he suggested, within both extension and financial institutions. Data describing soil and hydrological conditions is not always available, without which investments are difficult to direct. “The proposition of GWI,” he said, “is revitalized investment in the storage of water in the soil.”, including investments in information gathering and knowledge building. Principles of conservation agriculture guide those investments: minimum tillage, soil cover (cover crop and biomass), and agrobiodiversity. While conservation agriculture is not a panacea and can be implemented poorly, building healthy soil remains the best form of insurance for farmers. Techniques like integrated pest management work best on top of good soil.

Paraguay is an example of conservation agriculture at large scale, where 99% of land is enrolled in soil conservation programs. There have been important advances in Honduras through the mucuna and maize system. New allies are surfacing. Ian Cherett suggested creating simple messages about conservation agriculture and its link to healthy foods to expand the base of consumer support for farmers of rain-fed agriculture. One can imagine, said Deborah Barry, a streamlined set of conservation agriculture techniques – there are currently so many techniques to sort through - to be used in an extensionist’s teaching curriculum. Or cooperation at the central government level on soil and precipitation maps that can be used by municipalities in their territorial planning. Barry proposed supporting youth enterprises to manufacture simple, no-till planting equipment, rudimentary machines to ease sowing. They might capture the imagination of young people interested in restoring the countryside and earning non-farming income. It’s no secret; you reap what you sow. Conference participants were insistent that smart sowing occurs on soils kept healthy with abundant green water. It is on this moist foundation that Central America’s farmers of rain-fed agriculture assure the greater good: feeding our families and stewarding our landscape.