



INTERNATIONAL CONFERENCE

Revitalizing investments IN RAINFED AGRICULTURE in Central America

September 30 • October 01 **2014**, San Salvador

CONFERENCE PROCEEDINGS





"There is no time left to continue doing the same thing, and it is not time to be pessimistic. Degradation cannot continue. It is urgent that we open our minds and return to the earth, to understand that Agro-systems are what sustain production and productivity. Finally, I want to emphasize that the event has a guiding thread regarding rainwater in a natural hydrological system as the principal factor to increase productivity and guarantee the production we need in this region, for everyone, for large agricultural production, but above all, according to our priorities, for family agriculture. With this, we expect that when you leave this place, you will understand that what we mean by Water Smart Agriculture is the very rainwater in its natural cycle, we are using only 50% of its productivity."

Deborah Barry
Regional Coordinator for
Central America, GWI



GREEN WATER, THE SLEEPING GIANT.. IN RAINFED AGRICULTURE

Green Water is water from rainfall, soil humidity and plant hydration (transpiration) and evaporation. It represents 90% of the water in the hydrological cycle, but productivity from its use is below 50%.

Rainfed agriculture produces 70% of food grown in the region and constitutes 80% of lands used for agriculture. In recent decades, investments in rainfed agriculture –particularly for small and medium-size producers– have been limited and have deepened environmental degradation. This is reflected in the low yields from the principal crops, and it contributes to food insecurity.

Far from maximizing capacity in the use of rainwater, the current technical approach in agriculture has contributed to greater loss of its productive use. What is urgently needed is a new approach, one that is less dependent on harmful external inputs, and based rather on demonstrated knowledge of successful practices that increase productivity of rainwater in the ground, mobilizing scientific and technological advances at the service of family agriculture. The Global Water Initiative (GWI) hosted an international conference to assess the current state of rainfed agriculture in Central America, to learn from relevant international experiences, and to promote new approaches that can revitalize investment in rainfed family agriculture.



Minister of the Environment in El Salvador Lina Pohl inaugurated the Conference charging her peers in the region with coordinating their own objectives with their ministries of agriculture "We are working together."



JENNIE BARRON,

*Senior researcher in agriculture and
water management, Stockholm
Environment Institute*



Green Water is water from rain, soil humidity, plant hydration (transpiration) and evaporation. As a world average, this green water represents 90% of water that comes from rain. However, currently in Central America we only use 50% of this green water productivity. Additionally, water management in agriculture has long been related to blue water—the liquid bodies underground or on the surface— which represents only 10% of rainwater.

In Central America, and in the context of climate change, maximizing the use of "green water" represents an opportunity to increase productivity and food in rainfed agriculture.

World demographic growth, the population's new diet, and climate change exert pressure on water and soil resources. In this new context, green water management can increase productivity of crops. Nowadays, we already know how to utilize green water to reduce yield gaps in crops. We know that managing green water increases benefits, particularly in degraded landscapes. We have experiences that show that the surest bet is on low yield agriculture systems, such as Central American production systems, where the margin in potential yield is large.

On the other hand, optimizing the use of blue water requires more resources and investment than green water. It is much more expensive. Therefore, the challenge is to leverage all types of resources aimed at change, in order to improve green water management, including Integrated Water Resource Management (IWRM)

We possess the knowledge, and we know how to address it; however, we need the private sector, farmer families, and global and local governments to work together, because green water is the new opportunity of the decade.

MANIFESTO AT THE WORLD WATER WEEK, Stockholm, August 2014

*"We urge the United Nations
General Assembly to include in
its goal on hunger an objective
regarding rainwater management
(...) aiming for an over 50% increase
in the productivity of rainwater."*

Signed by 15 scientists



CONSERVATION AGRICULTURE

*"We have the wrong paradigm now,
and it is of no use for the future."*

Amir Kassam

*"If you want water, treat your soil
well."*

Amir Kassam

*"I would like to conclude with hope
for the future of production based
on conservation agriculture and
focused on small farms."*

Amir Kassam

*"Conservation agriculture is
recognized more and more by
researchers as a viable approach
to sustainable intensification of
production and there is already
a global program for conservation
agriculture."*

Amir Kassam



AMIR KASSAM,

*Advisor for sustainable agriculture
intensification, FAO*

The global context seems more alarming with impacts associated with climate change, the intensity of environmental degradation and the loss of biodiversity, and seriously limits worldwide capacity to respond to the growing demand for food, and to current food insecurity. All agricultural land is showing signs of degradation. This conventional agricultural paradigm with its Green-Revolution approach coexists side by side with a new No-Till Agricultural paradigm that promotes soil conservation and restoration and nurturing the agro-ecosystem: Conservation Agriculture. Both strive to intensify production, but their impact in terms of soil degradation is not the same.

Intensification with conventional agriculture leads to excessive soil disturbance affecting its health, causing the destruction of the life in the soil, as well as its biological processes and biodiversity. In the long run, this agriculture leads to higher production costs, and less productivity and profit. Additionally, it degrades the services generated by ecosystems. Under these conditions, the water cycle is not optimal. In Central America, with hillside agriculture, the soil has become so exposed that it is in danger of disappearing. Intensification based on agro-chemicals, and genetic improvement is not sustainable, nor is it apt for the most vulnerable populations.

Hope lies in sustainable intensification through Conservation Agriculture, an agriculture that is based more on knowledge than inputs, and that conserves ecosystem services. Nature maintains diverse vegetation, thrives in multiple levels, and protects the soil, it is nature itself that inspires Conservation Agriculture.

Conservation Agriculture (CA) has 3 basic principles: no disturbance of the soil, enhance and maintain organic matter coverage on the soil surface, and diversification of crops. In Africa, Asia, China, and even India it is being adopted.



There are no restrictions. It is the type of agriculture that everyone can put into practice: small, medium and even large farmers. In Brazil, where there are millions of hectares under CA, productivity has grown, costs gone down in terms of energy, human resources, and fertilizer; yields have stabilized with less water and fewer environmental costs. Besides, there have been improvements in ecosystemic services and in the quality of water.

However, CA in those countries is used mostly by large farms. To practice CA in Central America, it is important for it to be massively adopted by smallholder farmers on hillsides. This requires more governmental policy support to actively promote its adoption. There is a window of opportunity in the region. This is the agriculture of the future and the future of rainfed agriculture.



Green Water Management for Agriculture in Latin America



ROBERTO LENTON,
Executive Director, Water for Food Institute

Traditionally, IWRM has been limited to blue water management, ignoring almost 90% of water in the hydrological cycle, which corresponds to green water. However, the entire water balance (green and blue) can be managed, and a conceptual change in our vision of water needs to change to include green water for agriculture. We need to revise the IWRM focus, which traditionally has been the watershed, and it requires working at a smaller scale.

The Crop Yield Gap Atlas is a tool that calculates the potential and real yield, to measure the gap between them. This instrument was created at the University of Nebraska. It is essential for food security and the design of policy and investment. Presently it covers over 50 countries, and aims for total world coverage. In Central America, the map can show that the impact of rainwater management can be greater in relative terms than in Sub-Saharan Africa where efforts have been concentrated.



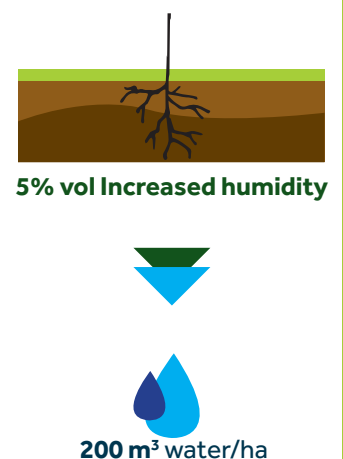
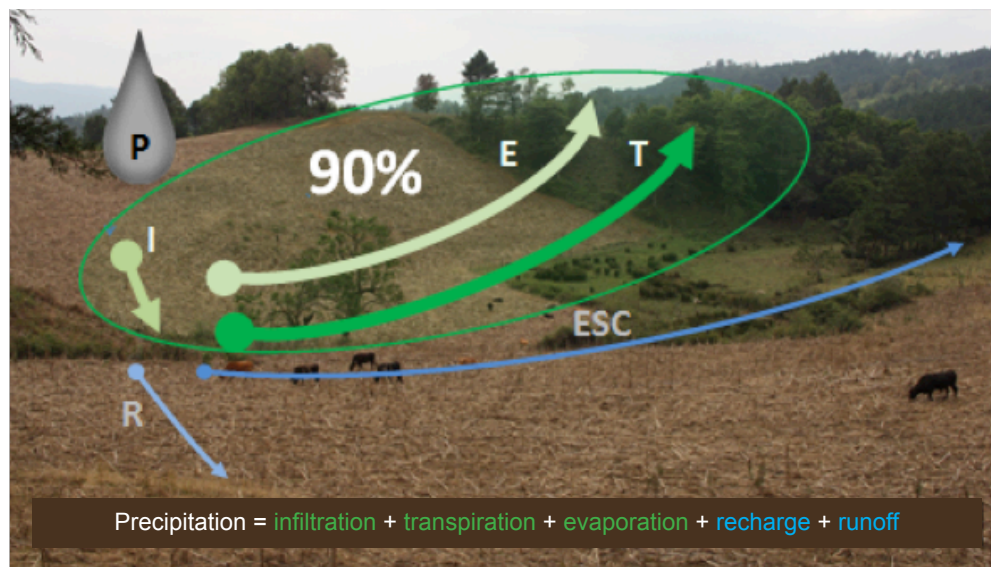
PAUL HICKS,
Regional Water Resource Advisor, Catholic
Relief Services (CRS), Latin America

Understanding the potential for green water in agriculture involves knowing the rainwater cycle, where 90% of water from rain flows as evaporation and transpiration in the form of vapor and humidity in the soil. The tendency is to believe that a greater percentage of rainwater is lost to runoff, but the truth is that globally it is only 10%. This belief justifies how, so far, 80% of investment in water for agriculture has been for irrigation. This investment represents a monetary and environmental cost that is too high, and technology that is unworkable on our hillsides.

5 Reasons to invest in Water Smart Agriculture (Green Water) & Soil Restoration:

1	2	3	4	5
It is the greatest opportunity to increase productivity, given that we are well below 50% efficiency in the use of rainwater;	Good soil management increases productivity of water (from 25% to 40%);	Restoration of soils increases resilience and productivity (by 2020 maize yield will vary -1.1% in healthy soil compared with -32,2% in soil that has been degraded);	Investment yields are greater than when only investing in fertilization (loss of over half the investment in fertilizer without healthy soil);	Improvement of soils is the best measure to adapt to climate change and it reduces the cost of degradation.

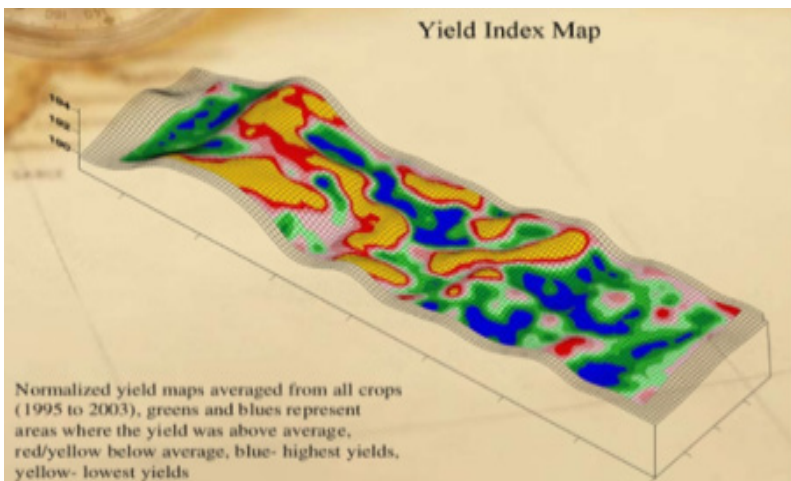
Investment in Water Smart Agriculture (green water) requires information, strategic technical assistance and appropriate inputs, especially because it is the (small) farmer who is the agent, and protagonist of sustainable change. Public sector investment will be required to improve knowledge at a macro level, with remote imaging, the national map of soils, and public policy for soil restoration services. There are ways to do so at an acceptable cost, where farmers participate in the entire process and provide samples of their own soils to generate digital maps of soils. These maps function as a guide to reorient where and what type of fertilizer to apply, where and what type of crop to plant, and how to increase yields. The following presentation includes the technical explanation on how to make this investment.





PHILLIP OWENS,
*Associate Professor of Soil
Science, Purdue University,
United States*

Digital Soil Mapping with its functional properties will change the future of soil information and offer us key information for its management, with complementary benefits for risk control, improved practices, or focusing investments, which could guide decision-makers, especially the farmer.



Understanding the soils and knowing how to interpret their capacity and limitations is fundamental to tap into Green Water. Ten years ago, this was unthinkable for farmer families with smallholdings. Nowadays, thanks to the information revolution and new processing capacity, with a relatively low investment, the public sector is able to provide small family agriculture with digital soil maps of their own farms, and teach them to interpret them. This is the first step toward being able to change the practice of agriculture. These maps will make it possible to reduce fertilizer use, the specification and amount needed, or the creation of a baseline to record the improvements (creation of biomass, or yields), for instance.

SOIL MANAGEMENT IN THE WATER SMART AGRICULTURE APPROACH

"If I were Howard Buffet, or the Minister of Agriculture of El Salvador, I would invest in a way to store water this winter to be able to use it in the summer."

Farmer from Eastern El Salvador

"The goal is to improve the productivity of water through good soil management."

Paul Hicks

"To scale this up, we all understand that public policy is key, and that the government has to take leadership and act audaciously to find real solutions."

Paul Hicks

"Digital Mapping of Soils involves changes in the paradigms in soil science, as it includes naming them for their functional properties, instead of taxonomic or morphological differences. The other change in paradigm is that we have made dynamic versions of maps, and not static maps."

**Phillip Owens, Associate Professor
Soil Sciences, Purdue University –
United States**



CLIMATE VARIABILITY

"The challenge for the famous Dry Corridor is managing the soil and water, because there is more than enough water during the rainy season, and six months go by, or four months, with no water."

Ian Cherrett

"Because the farmer's problem is not adaptation to change. His problem is not having access to information, not having access to knowledge. But he is interested in change because nobody else is more aware of the issues he faces."

Ian Cherrett

"Central America is the region that invests the least in agriculture (...). This seems really absurd when there are studies that indicate that, in order to generate a dynamism for development, investing in agriculture, and in the small farmer, has three or four times more impact than any other poverty-reducing activity."

Ian Cherrett



IAN CHERRETT

Exrepresentante de la Organización para la Alimentación y la Agricultura, FAO; asesor del Gobierno de Honduras, asesor de GWI-Centroamérica – Honduras.

The greatest of levels of global climate risk are concentrated in the erosion of soils. All four countries (Guatemala, El Salvador, Honduras and Nicaragua) have exhibited very high

rates. El Salvador, for instance, calculated the impact of climate variability, and it accounted for a 6% reduction in the country's GDP. There is also severe seasonal scarcity of rainwater in the region, and severe impacts have been registered because of the dry period in the middle of the rainy season (heat wave). Furthermore, the drought that this region is experiencing in the present agricultural cycle as a result of climate variability will once more cause considerable losses in production.

However, the problem in Central America is not the availability of rainwater. It is evident that the region has enough. Its water availability is double the world average. This means that –for Central America– the issue is not scarcity of water per se, the problem is poor management of its rainwater, particularly in soils. In the well-known Dry Corridor, from the Guatemalan border to Guanacaste, Costa Rica, six months of rain, and six months without water are observed. This means, that the challenge for this area is soil management to retain water in the soil for a longer period.

On the other hand, in Central America, the degradation of land has been caused by human action. This is also one of the regions with the greatest number of hillsides. The problem becomes more severe with two agricultural practices, which are actually associated: extensive cattle ranching, and cutting down forests that suppress regenerating vegetation. In fact, livestock impact on the soil is severe, and often underestimated.

Conservation Agriculture in the region would achieve double productivity. The figures for this are available in Central America because we have already had experiences in this regard. But, Central America invests less in agriculture than any other region, despite the fact that agriculture plays a very important role in feeding the population and in exports. There are studies that indicate that in order to generate a development dynamism in these countries, investing in agriculture, and in the small farmer has three or four times more impact than any other poverty-reducing activity.



ALFREDO MOLINAS. *Former Minister of Agriculture and Former Minister of the Environment of Paraguay*

Paraguay has 99% of agricultural land under Conservation Agriculture. Initially, it was not so easy to get Paraguayan farmers to adopt this approach. The State had great influence through its policies with the option for those decisions. Until 2002, agriculture in Paraguay was characterized by deforestation, problems from erosion and disappearing biodiversity. Nowadays, the Paraguayan region of El Chaco maintains 65% of its land under forest cover. According to the FAO, the rate of deforestation in the east of the country had reached 400 thousand hectares per year. Deforestation and soil erosion were the two environmental problems that had to be solved in alliance with the Ministry of Agriculture and Livestock of Paraguay.

It was necessary to create a Law for Zero Deforestation. NGOs signed a pact with farmers and an enormous effort was made for controlling deforestation. By seizing tractors, we were able to reduce the rate of 130 mil hectares per year to 500 hectares per year. Large-scale producers started applying conservation agriculture practices. Not because they liked it, but because it was profitable, and reduced the use of agro-chemicals, maintained the conservation of their land with less fertilizer and cut their costs. Best agricultural practices were applied because it was in their best interest, and they learned how to do this. The loggers, who were (initially) against the laws, were able to manage forests and their industries were more sustainable. After two and a half years as the Minister of the Environment, I took the office of Minister of Agriculture. For years, the government had been giving away seed, fertilizer, and many things. I avoided the policy of giving things away. We proved that when the farmers have resources, and good production, they are much more prone to adopting new practices. The important thing is for the president to support this effort, and the ministers have to work in coordination with the Minister of the Environment.

AGRO-ENVIRONMENTAL POLICY

"It was not so easy to get farmers in Paraguay to adopt Conservation Agriculture as a valid alternative. There are many stories to tell, and the State, through its policies, had a lot to do with creating options for the transition."

Alfredo Molinas

"I think that if we are going to incorporate into agriculture the use of Green Water and everything the technicians and scientists are discussing here, we need clear rules in the public and private sectors."

Alfredo Molinas



From Input-based Agriculture to Agriculture Based on Integrated Knowledge



VÍCTOR SUÁREZ.

Executive Director, National Association of Commercializing Businesses for Farm Producers (ANEC), Mexico

A new paradigm in agriculture, to us, means moving beyond input-based agriculture, which has converted the farmer into a consumer of farm supplies. We need to shift toward a "Farmer's Agriculture" based on integrated knowledge. Agriculture based on integrated knowledge is in response to the need to integrate scientific and technological advances made over the last half century, putting them at the service of the small and mid-sized farmer. There is a total disassociation of knowledge: farmer's knowledge is negated, but recent scientific and

technological advances are not made available either. In Mexico, our organization seeks to do precisely that, and we have different scientists committed to a social approach.

Our experience is if there is no autonomous and self-managed farmer organization, there is nothing left to do. There is a proposal in my institution, with a model for local, regional and national organization that provides a set of services. It provides farmer-members with a set of supports and services for production, commercialization, financing, technical assistance linked to support from committed scientists. It is also based on public support for governance, accountability, and the creation of public policy. This way, we can have results in the short- and the long term, and under any condition. Public institutions that do research, as well as scientists and technicians, must reorient their work and establish long-term alliances with autonomous and self-managed farmer organizations organized under integrated productive projects.

Another important aspect is training for farmer-leaders, outstanding producers, technicians, farmer-managers; as well as massive and significant capacity building effort for farmers and communities, based on successful experiences from the farms of outstanding producers. The "farmer-to-farmer" teaching-learning model needs to be completed with components that include "farmer-to-scientist" and "scientist-to-farmer."

ANEC MODEL OF FARMER ORGANIZATION

- *Centered on farmer agriculture*
- *Self-managed, local and regional farmer organization; farmer governance*
- *Model of technology transfer and farmer professionalization; integrate farmer wisdom and scientific knowledge*
- *Technical Assistance at the level of the field, in the hands of local organization*
- *Integration of social, economic, environmental and cultural objectives*
- *Integrated production-commercialization services*
- *Influence public policy*

Debate Topics for Rainfed Agriculture

Four simultaneous panels served for reflection and discussion around the four pillars of rainfed agriculture: agricultural practice, extension, financing and working at scale. An international expert gave the context for each, and led discussion with other experts from the region. GWI Central America contributed four prior research papers to open the discussion. These were produced in a learning alliance with GWI and organized in the countries where the Initiative is operating.



EXTENSION for Rainfed Agriculture in Nicaragua, Honduras and El Salvador

Leader: **Ian Cherrett**,

former representative of the Food and Agriculture Organization (FAO) LAC, advisor to the Government of Honduras, advisor to GWI-Central America, Honduras.

GWI Presenter: **Pedro Vásquez**, Coordinator for Transfer, Office of Agricultural Science and Technology (DICTA), Honduras.

Commentary: **Reinhold Muschler**, Tropical Agricultural Research & Higher Education Center (CATIE), Costa Rica. **Keith L. Andrews**, Representative of the Inter American Institute for Cooperation on Agriculture (IICA) in Guatemala.

A GWI document was presented offering a historical overview of the evolution of extension systems in the region in light of the models of development, and the different approaches from the Green Revolution to the our time. One of the panelists explained his experience, reflecting on key issues such as: the recipient of extension, decentralization of the service, the reason for extension should not be limited to agricultural practices when it is aimed at a vulnerable population, temporization of service, and its economic sustainability. Another panelist focused reflection on the dichotomy between scientific and local knowledge. Work done in Guatemala was presented, showing complementarity between both forms of knowledge, and how they interact in the territory, where often both are seen as two irreconcilable options.

EXTENSION

FINANCING

WORKING ON SCALE

AGRICULTURAL PRACTICE

THE DEBATE ABOUT EXTENSION

"What has been weakened is extension and research for the small farmers, the ones who do not have much purchasing power."

Laureano Figueroa

(Faculty of Economics, University of San Carlos – Guatemala)

"There is a great difference between capacity building and education. The former seeks a specific objective, but what we also require is for our farmers, men and women, to have education, there need to be professional education courses."

Representative of the Agricultural Rural and Indigenous Roundtable

"Extension (...) should share elements of investigation, experimentation and facilitation. However, what extension systems have done is repeat implementing schema and deliver supplies."

Comment of an attendant at the conference during debate



DEBATE ABOUT FINANCING SMALLHOLDER

"What is required are innovative institutions in order to be able to work in the rural sector."

Claudio Gonzalez Vega, Professor of rural financing and international consultant

"It is very important for credit officers or staff at a banking and financial institution to be from the area, and understand the local sphere very well."

Julio Flores Manager of the Local Development Fund, FDL – Nicaragua

"In order to be able to mitigate risk, it is important to understand the changes that take place in the rural sector and its context."

Julio Flores Manager of the Local Development Fund, FDL – Nicaragua



FINANCING Rainfed Agriculture in Nicaragua, Honduras and El Salvador

*Leader: **Claudio González-Vega**, Professor of rural financing and International consultant, Costa Rica*

*Document Presenter: **Tito Ventura**, General Manager for Business, Agricultural Development Bank, El Salvador*

*Commentary: **Julio Flores**, Manager, Local Development Fund (FDL) - Nicaragua. **Juan José Lagos**, Director, Covelo Foundation, Honduras*

An overview of conditions in the region shows the decline in agricultural credit, its inadequate molding to-, and discrimination toward small-scale family agriculture. Claudio Gonzalez-Vega presented the way agro-rural financing is falling further behind, as well as the cause-effect relation it maintains with poverty, the lack of investment, and deterioration of the environment. Barriers to investment notably included the temporal challenge posed by agricultural cycles, and the overload of endogenous and systemic risk tied to climate or the market, or those related to an environment of personal, legal or political insecurity for farmers.

The difficulties faced in this type of financial transaction and the existing heterogeneity make financial services more expensive, and (ironically) end up homogenizing available supply. Lessons learned from existing experiences demonstrate that it is necessary to develop special financial products, solve the information problems, and create incentives and risk mitigation. What is needed is an integrated vision that brings together financial services, technical assistance, market linkages, and options for state support. As good examples, the panel presented experiences such as the one in Honduras with the fund for reciprocal collateral, or El Salvador with the line of credit to foster organic farming.





WORKING AT SCALE in Rainfed Agriculture-Watershed & Landscape in Honduras, Nicaragua and El Salvador

Lead: **Mario Samper**, Coordinator of the Regional Platform for Technical Support for Rural Territorial Development, Costa Rica.

Presentation, Commentary: **Simon Cook**, former CGIAR program director for water, land and ecosystems, "Futuros Rurales" Foundation, Colombia. **Susan Kandel**, Executive Director, PRISMA Foundation, El Salvador.

The three experts on this panel oriented the discussion during the debate on the importance of working in agriculture at a scale that is relevant for producers, their families, and communities, their biophysical surroundings, and the agro-ecosystems that sustain them. A great deal of critical reflection revolved around on-farm pilot projects, which rarely scale up, and do not develop structures or mechanisms for locals to continue the task when projects end.

Lessons in Central America suggest that in order to work at scale with communities and authorities involves keeping in mind: i) The scale of the intervention from the start (meso scale; a scale that is pertinent to farmers); ii) the factors of the context (biophysical-eco-systemic; socioeconomic; political-institutional); and iii) the levels of intervention (technical, operational, and strategic). There are at least four key dimensions to advance in transformation of agriculture: 1) spacial scale; 2) temporal scale; 3) the degree of holding rights; and, 4) the extent of collective action.

The great opportunity is investing at scale, with a collective logic rather than individual one, locating the farm within its social and biophysical surroundings. The landscape must be a social construct, and it requires institutional arrangements at multiple levels, as well as a better understanding of poli-centric governance. Heterogeneity increases as the spacial scale expands. This complexity needs to be embraced, while working on the micro level.

DEBATE ABOUT WORKING ON SCALE

"Climate risk is absolutely dynamic. In some ways, it is unpredictable. The issue is how to see a dynamic phenomenon in those scenarios and in those rainfed landscapes, that is the green water that comes from precipitation."

Miguel Ayarza, Head of the Department of Intensive Production Systems, CORPOICA – Colombia



DEBATE ABOUT PRACTICES THAT IMPROVE WATER PRODUCTIVITY

"I learned during the 90s that, at times, we think technologies are the best, that they are going to solve all of the problems. But as a scientist, I also know we developed these technologies outside of perspective or isolated from the perspective of the farmer."

Jonathan Hellin, Researcher at the International Maize and Wheat Improvement Center – CIMMYT, Mexico

"We need an assessment of the current political situation, what are the causes and consequences of this, the organization of the people."

Francisco Gutierrez, Rural and Indigenous Agricultural Roundtable and CORDES Foundation

"Academia has been presented a very interesting challenge: we consider that we cannot continue generating Green-Revolution style agronomists."

Silvel Elias, Professor, Faculty of Agronomy, San Carlos University – Guatemala

"Research needs to be strengthened, but another important thing is changing the research model."

Laureano Figueroa, Faculty of Economics, San Carlos University – Guatemala



PRACTICES that improve rainwater productivity for rainfed farming in Nicaragua, Honduras and El Salvador

Lead: **Miguel Ayarza**, Head of the Department of Sustainable Intensive Production Systems, Colombian Corporation for Agricultural Research (CORPOICA), Colombia.
Document Presenter: **Mario Ardón**, Coordinator for Territorial Development in Choluteca Norte, Ayuda en Accion Foundation, Honduras
Commentary: **Jonathan Hellin**, Researcher, International Maize and Wheat Improvement Center (CIMMYT), Mexico. **Baltimore Ochoa**, Tri-National Program Coordinator, Forest and Watershed Protection, Plan Trifinio, El Salvador.

The challenges for improving rainwater productivity through sustainable intensification of production involve facing the impacts of climate variability, soil degradation, inadequate agricultural practices, and wrong policies and incentives. We know rainfed agriculture has high potential in Central America, it accounts for 70% of production, and rainwater productivity can be increased. Rainfall is readily available, though subject to climate variability. There are proven practices in the three countries, and there are diverse accompaniment modalities.

However, in Central America, poor agricultural management is the main cause for degradation and low crop yield. The question is why have these practices never been massively adopted. The discussion noted that research and extension systems do not include this green water approach, and have undergone significant cuts in investment. Public policy does not focus enough on managing soil, water, and forest resources. The approach to soil needs to be redirected to Conservation Agriculture, and to Agroforestry and Silvopastoral systems. In addition, legal regulations need to be adjusted and the coordination between institutions improved. The variety of systems in rainfed agriculture is great, and it is necessary to embrace this complexity, because there are no universal formulas.





In the region, there are concrete experiences with agricultural systems that make better use of rainwater: Conservation Agriculture, Agroforestry and Silvopastoral systems. The following is a reflection on the opportunities and obstacles around their promotion and adoption at significant scale in the countries in the region.



Experiences in Silvopastoral Systems for Sustainable Intensification of Livestock

MUHAMMAD IBRAHIM. Manager, Program for Innovation for Productivity and Competitiveness, IICA

In light of climate change, Silvopastoral Systems represent a great opportunity, because they generate greater species diversity, which is critical because they are multifunctional (providing shade, fodder, firewood, etc.). That is why fostering Silvopastoral systems has become a strategy for resilience. Furthermore, intercropping species for fodder with trees increases water productivity, reduces water runoff, and improves ecosystemic services. On the other hand, it is proven that livestock raised under shade increase their productivity.

The lack of dissemination of these systems can be linked to the extension system, and the lack of capital and adequate public policy. Some experiences, such as payment for environmental services, green credit, or public-private partnerships (with the livestock or forest sectors) can become instruments to further change. In fact, there are good examples where public policy is fostering the scaling up of these projects or Silvopastoral approaches.



Intensive Silvopastoral Systems (SSPi) and Water Smart Agriculture in Rainfed Livestock Land

ENRIQUE MURGUEITIO Executive Director Center for Research in Sustainable Agricultural Production Systems (CIPAV), Colombia

Cattle raising covers 77% of the agricultural surface of Latin America and the Caribbean. Small-scale livestock raising is not a business, it is a livelihood, and as such, a change in livestock raising involves an important cultural change. The impact of climate change on the sector has been devastating and the key to addressing it lies in water management. Cattle ranchers and their families manage and administer water throughout the hydrological cycle. Watersheds are "dairy sheds". However, Green Water is the most important, and almost all livestock raising in the Tropics is dependent on it: "Green Water, in livestock raising, means the trees. It is photosynthesis working to adapt to climate change."

SILVOPASTORAL EXPERIENCES

"It must be said that cattle raising is a livelihood, it is a way of using the territory, and it is a culture."

Enrique Murgueitio

"Fostering Silvopastoral systems has become a strategy for resilience"

Muhammed Ibrahim

"There is no single way, rather, it is a set of actions, public policies, and partnerships with private sector and cattle-rancher associations. This is the key to achieve the objectives and there is greater scaling-up of these systems when small and medium-size farmers are involved."

Muhammed Ibrahim

"The reasons that explain the lack of dissemination of these systems can be linked to the inadequate extension, and the lack of capital and adequate public policy."

Muhammed Ibrahim

"Now there is a need to scale up to the landscape level, all livestock ranchers doing the same thing, and demonstrating how these Silvopastoral matrixes, when all livestock ranchers start to do it, begin to change the landscape, the watershed basins."

Enrique Murgueitio

"In livestock raising, Green Water means business, blue water does not."

Enrique Murgueitio



WATER SMART AGRICULTURE PRODUCTION SYSTEMS

How to achieve this? The best way to retain water is conserving life in the soil. Silvopastoral Systems we have monitored for years, show no soil compacting because soil management has respected and preserved life in the soil. We have proof of the profitability of these systems. This is the great example from the colleagues in the south, showing that timber is the cattle raisers business, and that we have to get there producing more beef and dairy. The system, which can last 15 or 20 years or more, is much more economical than production on grasslands with fertilizers and irrigation. Green Water is the business, blue water is not. The costs rise when you maintain the same loads of 10 to 12 thousand liters of milk per hectare with blue water.

The important thing is to scale up to the landscape, for all livestock raisers to adopt these Silvopastoral systems improving landscape connectivity. This scaling up needs to be based on an intelligent combination of scientific and technological innovation, and economic and market incentives at all scale. This requires all institutions to come to consensus in what are now called platforms. Livestock raiser associations or organizations must lead the process because this sector moves with the organizational leadership. These organizations can push for required institutional (policy) change. Markets, particularly changes in demand and consumption, are forcing change in the way livestock raising is done. The FAO recently published a paper showing the weakness in public infrastructure and institutions in addressing this. Moreover, our main conclusion is that rancher associations and private ranchers need to lead this, and have to change.

Improving use of Green Water in Rainfed Livestock Raising requires:

Reducing rainwater loss: prevent deforestation and damage to plant coverage

Harvest and store rainwater at all scale

Improve rainwater infiltration in the soil

Reduce evaporation and evapotranspiration

Collect water in the soil with organic material

Collect water in the plant biomass



Experiences in Agroforestry Systems Growing Cacao and Agroforestry Systems

LUIS ZÚÑIGA. *Project Coordinator, Institute for Tropical Crops (ICT)*

Growing cacao represents an opportunity in the region, for many reasons. Central American genetic material is very interesting to the international market. This product is fundamentally geared toward external markets, because only 5% of production is consumed domestically. Notwithstanding, it requires a lot of research, along with a process of extension, to develop, validate, and transfer the technology that needs to be coordinated at the regional level, and not in isolation

in each country. The panelist notes the importance of the systemic approach, which appraises the plant, soil, environment, family and market performance. These systems require multi-strata crop management.



For 10 years, a comparative study was underway at an experimental station in Peru (El Choclino, 2004-2014) with three systems: traditional management, improved management, and coverage management. Although the processes are slow and require more time, it was clearly shown that Agroforestry Systems benefit the chemical dynamics of soil, and are very sustainable. Soil needs to be conserved to the extent that microorganism populations and number becomes stable in order to generate soil stability and sustainability. Quantitative data is also necessary, detailed information about the organisms, work on classifying and introducing them. Quality information mechanisms –with physical, chemical, and biological properties– are a tangle, to produce a giant spider's web that can define a soil's potential and how far it can go.

Ecological and Profitable Coffee-based Agroforestry Systems

CARLOS ZELAYA MARTÍNEZ. *Researcher,
International Center for Tropical Agriculture
(CIAT)*

The panelist presented some results, as well as the economic and ecological benefits of growing coffee in agroforestry

systems. These systems are good for food security and they improve family income, adaptation, and mitigation for climate change. Their implementation involves evolving from a gradual adaptation to a transformative adaptation. If we analyze historical climate records, it is evident that since the year 2000, there has been great variability and a rise in temperatures, affecting high elevation coffee farming (in Nicaragua for instance, the area will have contracted by 60% by 2050). Results are very evidently linked to water and temperature stress. In general terms, the benefits of growing coffee in Agroforestry Systems are:

- Improves coffee quality
- Contributes to Carbon Sequestration
- Fixes nitrogen (some tree species)
- Soil recovery and protection
- Soil fauna recovery
- Improves aquifer recharge
- Reduces risk of landslides on hillsides
- Reduces erosion
- Generates other income

AGROFORESTRY EXPERIENCES

"The technology, processes, opportunity, climate, man, and soil all exist. All that remains is to organize and shape the process in order to finally think long-term."

Luis Zuniga, Coordinator, Tropical Crop Institute (ICT) – Peru

"On the same producer's parcels, we tested the effect of shade on the microclimate. We are interested in being more efficient in the use of water, but we also need to avoid affecting the coffee plants with thermal stress (...) We measured relative temperatures and humidity at each of these parcels, and the results are evident."

**Carlos Zelaya Martinez, Researcher
International Center for Tropical
Agriculture (CIAT) – Nicaragua**

"The Quesungual (Honduran Agroforestry System) took many years of working with institutions, partnerships, technicians, but the farmers played the principal role."

**Luis Alvarez Welchez, ProSuelo,
Catholic Relief Service – CRS,
Honduras**

"The secret here was to design the No-Burn Technological Menu."

Luis Álvarez Welchez

"The flow of water in 62% of micro watersheds also increased; where there was no management, the flow has dropped or remained the same."

Luis Álvarez Welchez



Remember that farmers are not afraid of change, they are afraid of risk.

Quesungual Agroforestry System

LUIS ÁLVAREZ WELCHEZ. *ProSuelos, (CRS). Honduras*

In the Quesungual Agroforestry System (SAQ), “basic grain parcels that maintain a light tree cover, providing plant material that scatters covering the ground, along with mulch. This way the humidity is maintained and the nutrients are recycled.”

Other agroforestry systems have been identified in the region that are similar to Quesungual, although they are known by other names. The production systems in the region generally cause high levels of degradation and low production. Therefore, Quesungual responds to problems such as degradation, low productivity, food insecurity, and uncertain sustainability. The strategy focused on productivity and soil management. One of the central proposals was no burning, and the lesson learned is that it is not about forbidding burning, but designing a Non-Burn Technological Menu, offering farmers alternatives with technology that does not involve burning.

The system not only calls for a technological transformation affecting the productive process, it involves an organizational process as well. Technology needs to be closely linked to the social sphere. Introducing new technology involves a change in social relations, and combining theory and practice, because in the end, the goal is the wellbeing of people. Further, there is a relationship between the farm and the community in managing natural resources. On the one hand, the starting point is the farmer’s system, with the farmer’s logic, “in a sequence to accompany him toward a better future.” Often there is insistence on farmers not wanting to change, but it must be remembered that farmers are not afraid of change, they are afraid of risk.

Welchez notes that the goal was for the productive system to be as similar as possible to a natural ecosystem. The other lesson learned is that the soil management strategy needs to go hand in hand with silvopastoral or nutritional alternatives for livestock raising. In 62% of the micro watersheds managed under this system, the water flow rates grew. The rest decreased or remained the same. On the other hand, productivity per area unit is five times greater. In light of these results, mapping has been done of the locations where it can be scientifically affirmed that the system can be replicated.

TOWARD A KNOWLEDGE-BASED AGRICULTURE



GREEN WATER STRATEGY

GWI Central America is a learning and advocacy initiative aimed at improving the impact of rainfed agriculture on food security. It seeks to foster a change in development practice, agricultural research, and public policy in support of Water Smart Agriculture Strategies to help farmer families improve productivity from rainwater and in the soil. GWI seeks to achieve:

- Increased public investment in rainfed agriculture and Green Water strategies through education, research and extension
- Governmental public policy assimilates best practices from rainfed agriculture, based on Water Smart Agriculture strategies (water and soil management, water harvesting or Agroforestry and Silvopastoral systems)
- Increase access to financial services to manage water and soils in rainfed systems, with participation of public financing institutions, private sector, and micro-financing institutions
- Introduce a landscape-scale approach in the policy framework, and program design, led by farmer families and local institutions

The objective of GWI Central America is for governments to prioritize rainfed agriculture through policies and programs that improve soil and water productivity to promote food security in the region.

For more information visit our website:

www.gwicentroamerica.org