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FARMING MATTERS

Experiences in family farming and agroecology

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The wisdom of water

"Water is the engine of change"

Protecting the páramo

Cisterns transform lives in the Brazilian semi-arid

My name is Márcia Patrícia and like the great majority of women in the semi-arid I was destined by local custom to travel long distances to fetch water for the most basic of household needs. I was born in the municipality of Queimadas, in the rural east of Paraíba. As a child I worked hard to help my mother raise my 13 siblings. I married too early and faced deprivation and violence.

When I started to participate in the rural workers union of the municipality life took a new turn. Contact with the union allowed me to meet and exchange experiences with others. I also gained access to two hydrological structures: a cistern to store drinking and cooking water and one for food production.

The cistern is a technology that can capture and store rain water that would otherwise be lost as runoff. This removes the burden of travelling long distances to fetch water, especially for women, and enables them to grow food.

The 'pavement-cistern', which stores 52,000 litres of rainwater from a 200 m^2 pavement, allows me to produce food, bringing autonomy and freedom. Today I market my produce and have become a community leader. I am the director of the rural workers union and the coordinator of the comission on animal husbandry within *Polo da Borborema*, a network of family farmers' organisations and trade unions.

My experience is not an isolated one. In the *Polo da Borborema*, an initiative of 14 rural unions and more than 5000 women farmers led to the construction of about 1200 'pavement-cisterns'. This technology has strengthened a network of women farmer experimenters who are building autonomy through food production that can withstand even the most severe droughts.

In the past few years, more than 120,000 families across the entire semi-arid region of Brazil have mobilised around access to water for food production. They are transforming their own initiatives and experiences into public policies that can alleviate poverty, guarantee food security and, above all, empower women family farmers.

Interview by **Adriana Galvão Freire** of AS-PTA, Brazil.
Photo: AS-PTA

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Agroecology: living wisely with water

Water is vital for the survival of every living being. Agro-industrial farming, non-farm industries, urbanisation and mining continue to pollute water. Droughts and floods are more frequent due to climate change. And, the competition for water between different sectors is intensifying. This issue of *Farming Matters* looks at efficient and resilient ways of using water for agriculture. It includes stories of farmers that have created their own solutions, by building upon traditional management, by organising themselves and by adapting and creating new techniques. And to complete the picture, these pages contain stories about innovative water governance and struggles for water justice and water rights.

ILEIA team

Our relationship with water is not only positive. It can be our best friend, but also our worst enemy. Diverse, often contradicting cultural and philosophical perspectives on water reflect these 'mixed feelings'. While oriental philosophy and religion (Confucianism, Taoism, Hinduism, Buddhism) and the beliefs of most indigenous peoples emphasise respect for water and consider that water teaches us modesty, occidental thinking focuses on the need to control water. Technology has been developed to increase our control over water and has resulted in impressive infrastructure, such as hydropower dams, large scale irrigation schemes, water defence infrastructure and canals.

However, notwithstanding its successes, criticism and evidence of failure of this 'control thinking' approach are growing. In the past century it has become clear that water is *not* a renewable resource, but rather a finite source of life that cannot be fully controlled. In fact, it can be easily destroyed by contamination, over fishing, over extraction, and by modifying water flows, to name a few. This resulted in growing awareness that water cannot and should not always be controlled. Furthermore, based on the fact that the most successful examples of equitable water management happen when water is considered as common property, economic control of water through privatisation and public-private partnerships is being more frequently challenged.

Beyond control

Because of these insights, at a local, national and global level, politics and practices related to water management are changing. The failure of water privatisation in several countries has led to the so called 'remunicipalisation' of water services in countries such as Bolivia, Argentina, Uruguay, Tanzania, Mali, France, Indonesia, Ukraine, Georgia, Kazakhstan and Uzbekistan. At a global

Water is multi-functional, for instance it is used for domestic purposes and for farming. Photo: Alejandro Criado Antonio

level, in 2010 the General Assembly of the United Nations recognised that the right to safe and clean drinking water and sanitation is a human right essential for the full enjoyment of life and all other human rights.

Mega hydro infrastructure and water-contaminating agriculture and industry are no longer considered the most enlightening features of modern civilisation. New trends such as resilience theory and practice are becoming mainstream. The importance of social cohesion and the approach to water as a human right are receiving more attention in academic and political arenas.

More specifically, water related development projects evolve from mere infrastructural works towards integrated projects with more attention to participatory planning, water justice and sustainability. In the Netherlands, which lies for a large part below sea level, policy changed from the construction of very expensive zero risk dykes towards the promotion of resilience to floods by recovering traditional flood plains and riparian zones. In countries such as the United States and Spain, dams and water reservoirs have been demolished in order to restore original river flows. In many places water contamination has been reduced thanks to water treatment, waste regulations for industry and integrated (transboundary) watershed management, for example in the Rhine Watershed that spans nine European countries. In India, China and several sub-Saharan countries, such as Ethiopia, water storage landscapes have been regenerated and water resources replenished successfully. In South America, as explained by Elizabeth Peredo on these pages, the transformation of several conflicts around water control yielded positive results for the users and policy changes at the national level.

Water plays an important role in both irrigated and rainfed farming. Photo: Maria Carolina Feito

Threats But we should not turn a blind eye to the worrying processes and actors that still aim to control water without consideration for environmental and social impacts. In general, contamination and water depletion caused by urbanisation, mining and agribusiness are still increasing. And we continue to see the construction of large scale hydropower dams in Asia, Africa and Latin America; damaging fragile areas such as the Amazon Region.

Occupation and 'grabbing' of agricultural lands can be seen in most parts of the world. Land is under increased pressure due to indifferent public policies that facilitate control by large farmers and other private actors. Their preference is to grow capital and water intensive crops such as sugarcane which further

deplete groundwater levels and contribute to increased rural out-migration of family farmers.

Moreover, the dominant perception that water should be privatised, in line with the myth that public institutions cannot be run efficiently or sustainably, prevails. In August 2015, it emerged that the debt agreement between the European Union and Greece requires that Greece privatise two large public water companies.

Water and agroecological practice

This issue of Farming Matters offers alternatives to 'control thinking' on water. The articles show that water plays a key role in agroecology, often unpredictable, sometimes devastating, but always as a 'soft power' giving life to agriculture. The major challenge is to construct a new relationship between human beings and water, instead of trying to understand and manage all its possible behaviours. The examples documented here show that such a new relationship takes into account diversity, complementarities and uncertainty, and starts from the grassroots level with tailor made approaches; avoiding the disastrous impacts of many top-down large scale projects that were implemented in the past.

Examples from Africa and Asia show that communities are not passive and their culture, experience and environment shapes their coping mechanisms. There is an increasing need for public policies that allow family farmers to live a dignified life in their semi-arid environment. And, when farmers are given the space to innovate and build on local wisdom, effective negotiation and collaboration between farming communities, civil society, academics, and state institutions may occur. Likewise, over the past decades considerable experience has been gained in integrated and participatory watershed management in semi-arid regions.

In regions with water 'abundance' or where 'water is born', greed and competition make water more scarce for some than for others. Exploitation of water as a mere economic resource creates artificial scarcity. Therefore, in such landscapes the struggles for so called 'water justice' are a challenge too. Both Latin American stories in this issue provide a perspective on this. Water need not to be scarce if managed fairly and wisely.

The wisdom of water

There is great danger in considering water as only an economic resource. Instead, the articles presented here embrace the complexity of water, its multi-functionality, and its behaviour. In this way, we can learn a lot from 'the wisdom of water'.

In 2014, the International Year of Family Farming emphasised and demonstrated how family farming and agroecology can improve agrarian policy and practice. The articles in this magazine reveal that family farming is one of the keys to better water management, and that there is a two-way relationship between farmers and water: water influences farmers' decisions and farmers' decisions impact water quality and quantity. 2015 is the Year of Soils. Water and soil cannot be separated. Current thinking is re-evaluating the origin of both occidental and oriental philosophy that considered the four elements, soil, water, air and fire, as the basis of everything. Worldwide, traditional knowledge and spiritual practices do not hamper but rather give additional value to current water management and agroecology. Today's challenges of climate change, food production and increasing urban demand for water need to be addressed through this sense of complexity, interrelationship, and respect for water, which require that current power imbalances in water management and use are turned around.

Family farming is one of the keys to better water management. Photo: Natasha Bowens

Our water, our right

Nnimmo Bassey (nnimmo@homef.org) is a Nigerian environmental activist, author and poet who chaired Friends of the Earth International from 2008 to 2012 and was director of Environmental Rights Action Nigeria for two decades. He is currently the director of the Health of Mother Earth Foundation.

In August 2015, I spoke at the Lagos Water Summit. As part of a social movement process for strong, democratically controlled water systems across Africa and around the world, the Summit provided a platform for sharing activists' struggles against corporate control of water in places ranging from the Philippines, Indonesia to Ghana. I will share snippets of what I said at the summit.

Water is an essential right, without which no other right can be enjoyed. This is because water is the basis of life and of living in dignity. But today this is the most violated of the human rights. Let me explain.

Policy frameworks such as the Sustainable Development Goals (SDGs) emphasise *access* to water rather than the *right* to water. But in a situation where water supply has become a business and not a public good, it is clear that the private sector will determine who has access to water and at what cost. Public-private partnerships in water supply have boiled down to access for those that can afford the water rather than water as a right for all.

By 2025 all African countries will be vulnerable with regards to water supply. With climate change, increased flooding, droughts and desertification, the hope of securing ample fresh water supply continues to recede. Lake Chad used to be one of Africa's largest lakes, but has diminished to less than 10 % of what it was in 1960. Fisher folks and pastoralists who depended on it for their livelihoods have been displaced.

In Europe the average person gets as much as 200-300 litres a day for domestic use, while in countries like Mozambique it is a mere 10 litres. Our reality across Africa is one of a punishing daily search for water of dubious quality, especially by women and children. Our nations groan from the pains of lack of clean water.

What to do? First, agroecological and traditional knowledge on water management must be valued and supported. Second, the water sources our peoples depend on must not be treated as dumpsites for toxic waste. And the privatisation of water in any form must be rejected. In several countries the public sector has successfully provided water through public-public partnerships. Governments should analyse and learn from these to distil best practices.

Water is nature's gift to the Earth. Attempts to deny anyone the right to water is an inexcusable disconnect from nature. When governments realise that a healthy population living in dignity is the best form of security, no expense will be spared to secure the enjoyment of the right to water by everyone.

Farming for healthy urban tap water

Photo: WAC Photos

New York City's water is kept safe and clean by an innovative cooperative agreement with farmers that benefits both the city and rural communities. The programme demonstrates that water utilities can go beyond applying traditional engineering solutions and pioneer innovative governance, management and financial arrangements with upstream farming communities.

Daniel Moss

At the heart of how New York City's public water supplier has preserved a pristine water supply to its nine million customers – described as 'the champagne of public water' by its fans – is a story of urban-rural collaboration. Upstate dairy farmers – over 100 miles away from the giant metropolis – have become watershed guardians, working hand-in-hand with their thirsty urban neighbours. How did this unusually cooperative partnership develop?

Beginning in the 1830s, with the urban population exploding, New York City leaders reached north and west to find rural environments that could provide pure, affordable water. They created a series of reservoirs and built an engineering marvel – a massive concrete tunnel surging with millions of gallons of water per second by gravity alone. The water system was the envy of cities throughout the world that struggled with diseases like cholera and dirty, scarce water.

By the 20th century, the sources were no longer so pristine. As industrialised agriculture began to undermine the economic vitality of the small family farms, the landscape changed. The upstream Catskill farmers, seeking desperately to remain economically viable, began industrialising their own farm operations. Nutrient use increased, dairy herds concentrated, erosion accelerated, and pathogens showed up in New York City's water supply. City dwellers populated suburbs and second homes in the watershed and farmers sold off forested lots that had previously served as crucial natural filters.

By the end of the 1980s, public health specialists and the US Environmental Protection Agency (EPA) determined that the city would need to increase treatment of its drinking water and regulators began to apply pressure. The costs for new treatment facilities were estimated to be over $US4 billion to build and $US200 million annually to operate, which would double the cost of water in New York City.

From 'grey' to 'green' infrastructure

When Al Appleton was appointed as Commissioner of the New York City Department of Environmental Protection and Director of the New York City Water and Sewer system in early 1990 he stood at an interesting crossroads. He could deliver the bad news to an economically-strapped city administration that new 'grey' or 'built' infrastructure was needed to treat the water. Or he could propose a greener alternative – restoring the ecosystems to their natural filtration capability – knowing that it meant swimming against the dominant mentality of solving water quality problems with engineering solutions.

Appleton's team judged that it made little sense to allow Catskill drinking water purity to continue to deteriorate while making costly investments to meet water quality standards. The team's guiding philosophy was: a good environment will produce good water. Three steps logically followed: 1) identify pollution points; 2) convince politicians, regulators and engineers that less expensive 'green infrastructure' was a smart and profitable investment for New York City and; 3) enforce existing environmental regulations.

From regulation to cooperation

The city organised strict regulatory enforcement against non-point source pollution runoff from private farms. A primary culprit was cattle excrement flowing freely into creeks. This 'big stick' approach towards environmental protection angered some farmers and rural landowners. They resented the city for undermining their livelihoods without consultation and spoke loudly in community meetings. To farmers struggling to remain afloat, water quality regulation is top-down imposition by urbanites who don't understand the rural economy. Appleton's team returned to the drawing board.

The New York State Department of Agriculture proposed a slower process of co-design. Farmer associations in the watershed were strong and the Depart-

Watershed friendly farmers subscribe to a set of best management principles. Photo: Andy Ryan

ment of Agriculture encouraged the city to work cooperatively with farmers. The city's interests were affordable, clean water. The farmers' interests were sustainable, rural-based livelihoods. The negotiating task was to find the common ground. It took 18 months of back and forth, often tense, negotiation between the city and the Catskill farming community but, in the end, an innovative and far-reaching agreement was crafted.

Watershed friendly farming

With the city's support, the Catskill farmers formed the Watershed Agricultural Council and created a programme called 'Whole Farm Planning', which incorporates environmental stewardship into each farm's management strategy. 'Whole Farm' farmers subscribe to a set of best management principles to mitigate pollution. Rather than a one size fits all approach, a pollution control plan was developed for each participating farm, by the farmer and with technical support from agricultural experts from agencies such as the United States Department of Agriculture. Importantly, these plans often lightened laborious tasks like collecting cow manure and therefore helped the farm become more profitable. Pollution mitigation measures would be 100 % paid for by the New York City water authority – largely through urban consumers' water bills.

There were still significant hurdles. The farm community insisted that farmer participation be voluntary. But, could a voluntary programme deliver clean water? The city ultimately relented on the condition of a critical mass of participation. No individual farmer would be required to participate, but the Watershed Agricultural Council would guarantee that 85 % of all watershed farmers joined within five years. If they failed, participation would become mandatory or penalties would be levied. A further sticking point was whether the farmers would be subject to water quality regulatory enforcement. The city agreed that farmers participating in the programme in good faith would be exempt, barring flagrant and excessive violations. After five years, 93 % of all Catskill farmers enrolled, with spectacular results:

- 75 to 80 % reduction in farm pollution loading
- The pristine quality of the city's drinking water was restored
- The clean water was generated at an affordable price

The programme more than paid for itself through cost savings and helped stabilise water and sewer rates which benefited low-income households. The fact that watershed conservation would be folded into consumers' bills created a sustainable pool of conservation financing, far more stable than many of today's popular NGO-led watershed funds.

The programme proved popular with the public – and undoubtedly with the flora and fauna as well. It helped shore up urbanites' support for additional watershed protection strategies, such as restoration of stream corridors and purchase and stewardship of city and state owned lands. Some of these forests and reservoirs have been opened to recreational use. The Watershed Agricultural Council launched a line of farm products under the label Pure Catskills, bringing urban consumers closer to rural growers. There are a range of products, some conventional and some organic but all are grown in ways consistent with a healthy watershed. Concern for the watershed health has become so great that in 2014 the New York legislature banned fracking in the watershed, due in no small part to vocal urban water consumers protecting their water supply.

On a broader scale, the Catskill programme has inspired watershed protection and environmentally-friendly farm programmes throughout the world. It catalysed interest in non-traditional conservation strategies by the US water industry, including investments in 'green' rather than, or in addition to, 'grey' infrastructure. This case is a much-cited model of environmental or ecosystem service payment programmes. Ironically, the core feature of New York's success is often lost in the design of programmes that have followed. That is, many current programmes pay farmers on an annual per hectare basis to set sensitive land aside for forests. This approach can be fragile because it creates tension between food production and conservation and is often funded by NGOs or transitory public programmes that are vulnerable to budget shortfalls.

Success factors

While the New York programme offered both payments and tax incentives to farmers, the real practical and philosophical innovation in New York was supporting farmers to continue to grow food and fibre based on principles that maintain a healthy working landscape.

The programme is not a temporary fix. Support to upstate farmers, via the Watershed Agricultural Council is a core item in the New York City water system's annual budget. According to Al Appleton, the pro-

gramme captures, "the environmental profits from the services rural ecosystems provide urban areas and then funnels those profits back to the rural communities that provide them." The programme demonstrates that water utilities can go beyond applying traditional engineering solutions and pioneer innovative governance, management and financial arrangements with upstream communities. The farmer-led Watershed Agricultural Council decides how to spend funds; the New York City water authority forms part of the board of directors, but with only one vote is much in the minority.

Beyond New York Across the world, water operators, municipal governments, NGOs and rural communities have taken keen interest in the New York City example, despite obvious contextual differences and challenges in its adaptation. In the global south, water rates alone are unlikely to cover the full cost of a watershed recovery programme – the majority of water consumers are low income and cannot afford a rate increase. Weakened by relentless public spending cutbacks, public water utilities tend to be cash-strapped, often unable to even build proper sewage treatment facilities. Ministries of agriculture, forestry, mines and energy and public health, among others, are likewise financially challenged and reluctant to share costs of watershed restoration.

Likewise, the political challenges to overcome fragmentation and contradiction among water and land use laws, jurisdictions and public programmes are formidable. Environmental NGOs will need to partner with government agencies to strengthen their capacity to steer water and land use planning. Development banks will need to provide low-interest financing for green infrastructure. Despite the difficulties the spirit of innovation is high. At a recent congress of the Association of Latin American Water and Sanitation Operators, the New York case – alongside Latin American examples – provided fertile ground for rich debate.

Milk producer managing cow effluent for New York City's water quality. Photo: Andy Ryan

Those examples included Bogotá and Quito, public water systems which have purchased and preserved sensitive lands high in the Andes where the cities' water is sourced. Quito is home to a widely-admired watershed restoration trust fund, capitalised primarily through annual contributions from the municipal water utility, with private contributions as well. Lima has a small watershed fund, funded privately, whose resources are no match for the damage caused by the pollution from the booming upstream mining industry.

Public water utilities aren't in the business of cleaning up watersheds and most prefer to steer clear of upstream problems and chemically treat compromised water. Those that become involved know that they can't solve the problems alone. The UN Habitat-affiliated Water Operators Partnership for Latin America and the Caribbean supports a learning community among its affiliates interested in collaborating with upstream rural communities for watershed restoration. The American Water Works Association's Source Water Collaborative is an important reference point.

The optimistic view is that better practices will follow instructive examples. The New York case demonstrates that an integrated form of urban and rural planning can bring environmental and economic benefits to both landscapes. Those links are growing stronger within movements for local and agroecological food systems. The bumper sticker, 'No Farmers, No Food' speaks to urban–rural interdependence and cooperation. In fact, the relationship runs deeper, right down into the aquifer. Healthy farming produces healthy water. Here's a modified message to consider: no farmers, no water.

Pure Catskills farmers at a farmers' market. Photo: Andy Ryan

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Water harvesting: nourishing the land, body and mind

Bouwas Mawara and his wife Nyengeterai, small scale farmers in the semi-arid Zvishavane district of Zimbabwe, are renowned for their innovation in water harvesting for crop and animal production, and for setting up local structures and systems to spread innovations amongst fellow farmers. Today at least 160 farming families in their community are more resilient in the face of droughts, dry spells and the long dry season.

Mutizwa Mukute

Bouwas Mawara received little formal education and was formally employed for six years before returning to his home in Mazvihwa communal area to become a full time farmer in 1976. His wife, Nyengeterai, completed primary education and worked as a shopkeeper before also becoming a full time farmer. Mazvihwa lies in a hot, semi-arid region that receives 450-650 mm rainfall annually. Severe dry spells during the rainy season and frequent droughts are common. The area has inadequate water for the production of maize, the staple crop, but generally enough for drought tolerant crops such as sorghum and millets and for the growth of palatable grass for livestock. Nyengeterai says, "before we started harvesting water, our produce would not last the year and our cattle were too weak to provide draught power just before and at the beginning of the rainy season."

They farm summer and winter crops and a range of fruit trees on four hectares. Their livestock graze on the communally owned pastures. In 1976 Bouwas' major focus was low-risk horticultural production, which depended on manual watering. But the 1976 drought caused the well to run dry before the beginning of the next rains. Bouwas' initial solution, to dig a bigger well, proved fruitless. He realised that the real challenge was not how to harness the little groundwater that remained, but how to increase its volume.

More recharge, less runoff

The breakthrough occurred between 1976 and 1980 when he experimented with the idea of using a dead level contour above the well to recharge it. Dead level contours are different from the contour ridges that were promoted by the government that drained water away. A dead level contour is a channel dug into the field with a zero gradient. Water is stored in the channel and then slowly infiltrates the soil. Bouwas used a spirit level to mark the contour. His contour trapped and retained water and the spring was

"Water means to the soil's life what blood means to a person's life"

Members of the Hupenyu Ivhu Farmer Innovators Group use their farms as demonstration sites.
Photo: Mutizwa Mukute

effectively recharged. This motivated his family to convert the other contours on their land into dead level contours to increase groundwater recharge and make more moisture available to crops on the farm during the rainy season. By 1986, most of their contours had been leveled. Today they have nine dead level contours ranging in length from 85-320 m with an average width and depth of two by two metres.

Over the years, the contours have become streams of water, from which they draw water for irrigation during the dry season. They made the following improvements:

- Widening and deepening the contours so that they could capture more water
- Constructing small dams in the contours to retain more water
- Introducing fish in the water-filled contours
- Installing locally made clay pipes in the fields between the contours to transfer water to where it's needed

Food and nutrition security

Bouwas' philosophy is "water means to the soil's life what blood means to a person's life." The family has integrated the water harvesting with their production system to create a healthy and productive farm. Water harvesting has enabled them to be food and nutrition secure since the early eighties, which is quite a feat in Zvishavane. Even in 1992, during Zimbabwe's worst drought in living memory, Bouwas' family produced surplus food. Income from agricultural production has enabled them to buy 70 head of cattle, build a decent house and educate their children. Nyengeterai likes growing groundnuts and finger millet, whose sale and income are under her control. She has used some of her income to buy chickens, goats and cattle.

Bouwas introduced relay cropping, which allows them to farm across seasons and harvest two or three

Bouwas and Nyengeterai realised that the challenge was how to increase the volume of groundwater.
Photo: Moses Ndhlovu

Their contours trapped and retained water and the spring was recharged. Photo: Moses Ndhlovu

times per year from the same plot. He grows fodder for his livestock and ensures that his soil has adequate manure, which he gets from his livestock and organic material from the farm. Their average maize production is five tonnes per hectare, when most smallholders in similar areas get less than one tonne per hectare. By 1986 the family had so much water in the contours that Bouwas introduced three kinds of fish, bream (*Tilapia sp.*), catfish (*Clarius sp.*) and *masinde* (*Barbus sp.*). He says, "we used to have fish in the well and we built on this idea." It is a major source of income and nutrition for the family. It is less labour intensive than cropping and has a good local market.

Neighbours also benefit through access to water on Bouwas and Nyengeterai's farm during drought years. And, some of the water they harvest flows into the local stream and recharges the groundwater.

Learning together Bouwas has learnt from government agricultural extension officers, from ENDA-Zimbabwe and from fellow farmers. He travelled in Zimbabwe to Bukwa in the eastern districts of Chimanimani to learn about local farming practices, and got inspired to grow fruit trees effectively. On a visit to the Land Care Programme in Australia in 2000 he learnt about soil erosion control using bana grass (*Pennisetum purpureum*).

He works tirelessly to share the knowledge he has gained with his community and is an important player in what is now a key strategy for family farmers' resilience in Mazvihwa. He worked with Zephaniah Phiri, another innovative farmer well known as 'the Water Harvester', to set up the Hupenyu Ivhu (Life is Soil) Farmer Innovators' Group in 1989. They received transport, networking and communication support from the Zvishavane Water Project. Currently, Muonde, a community based organisation, provides a platform through which dead level contours are scaled out. "Muonde also organises workshops and field demonstrations for farmers on using A-frames to peg dead level contours," says Abraham Mawere, director of Muonde.

At its peak Hupenyu Ivhu had about 550 members in three districts – Zvishavane, Chivi and Mberengwa. The members learnt about and practised water harvesting and how to use the water to increase agricultural productivity. The group is still functional in Zvishavane, where the current membership stands at 160. The reduction in membership can be explained by the economic difficulties from 2000 to 2008 which made it hard for farmers to save money for group activities and this was worsened by the shrinking budget of the Zvishavane Water Project. Hupenyu Ivhu was more resilient in Zvishavane because "it has a longer history, is deep rooted and had a higher concentration of leadership. However, it has also produced outstanding innovators in the other districts," says Bouwas. The current members are organised into groups of about 20 each. They organise meetings and host *look and learn* visits to spread and adapt the innovation to different ecological environments. Mrs Maggie Mukando, a member of Hupenyu Ivhu since 1992 says, "women have been active adopters of water harvesting. The water has enabled us to grow a wider range of crops,

"Women have been active adopters of water harvesting"

Today Bouwas and Ngengeterai have nine dead level contours across their farm. Photo: Moses Ndhlovu

Current members of the innovators group are organised into groups of 20 each. Photo: Mutizwa Mukute

especially small grains and horticultural crops. I grow tomatoes, leafy vegetables, and beans on the ridges of my contours. This improves household nutrition and income security."

Scaling out Further scaling out of the innovation is challenged by a lack of resources, equipment and capacity to compile training materials. There are plans to link the groups and revise ward and district structures and form regional structures that facilitate the spread and strengthening of innovative, sustainable and productive farming. However, they experience transport and communication challenges as the distances between farmers are large.

Women's interests The clay pipes that are used by Bouwas and Nyengeterai were made locally by a female potter. Nyengeterai is concerned about the lack of young women's interest in traditional and nutritious crops, which are drought tolerant, noting that, "the young women are discouraged by the labour-intensiveness of growing and processing sorghum and millets." To overcome some of these challenges the local strategy is for the members of Hupenyu Ivhu to use their farms as demonstration sites. A related strategy is to strengthen each local group through joint production for the market and to organise production training meetings with government extension workers. Maggie Mukando says, "we have just had a meeting in our area. It was attended by 39 farmers, 22 of them women and we agreed to produce sweet beans for the market as a group."

Bouwas won the 2014 Phiri Award for Farm and Food Innovators and he has been elected as an executive member of the Zimbabwe Small Scale Organic Farmers' Forum (ZIMSOFF). This formal recognition makes his work more visible, accessible and appreciated and this prominence in turn supports collective innovation and promotion involving researchers, academics, policy makers and funding partners. In July this year, Bouwas led a team of eight farmers to teach water harvesting at Mlezi Agricultural Training College. Such occasions, though rare, are gaining ground in recognition of the relevance of traditional wisdom, local knowledge and innovation.

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Bouwas continues to receive formal recognition for his work, making it more visible and accessible to others. Photo: Moses Ndhlovu

A technology to drastically save irrigation water

Photo: Centre for Environment Concerns

At the Centre for Environment Concerns, an NGO based in Hyderabad, India, the challenge was clear: develop an inclusive irrigation technology suitable for low rainfall areas. Alongside farmers and female farm labourers, they developed a system that provides assured moisture directly to the plant root zone. Initial trials show two unique benefits: it requires about one fifth of the water needed for drip irrigation and it supports a healthy soil ecosystem. Key to the effectiveness of this technology appears to be the gradual wetting of the soil rather than abrupt provision of water in 'concentrated' loads.

K S Gopal

In semi-arid areas of India, low rainfall with frequent and long dry spells during the monsoon makes farming ever more difficult, taking its toll on large numbers of smallholders, many of whom rely on seasonal rainfall for irrigation. In the light of water scarcity the Indian government has looked to canal irrigation from tanks and dams, tapping groundwater from ever deepening aquifers, drip irrigation and now greenhouses. Although the provision of copious irrigation water to selected areas for cereal crop cultivation has helped India move from 'begging bowl to bread basket', much of these 'green revolution' areas are affected by severe salinity and falling productivity. Moreover unsustainable use has led to alarming rates of groundwater depletion. It is amidst these circumstances that the Indian Prime Minister has called for "more crop per drop." Unless water efficiency and soils are improved by 'out of the box innovations' and farmer centric practices, the Prime Minister's ambitions will not be met.

Why irrigation technology? The Centre for Environment Concerns has been working for the past three decades to improve farmers' livelihoods in drought prone areas of Andhra Pradesh. Based on this experience, the centre became convinced that irrigation is crucial for successful farming. Further, through work on the National Rural Employment Guarantee Scheme (MGNREGS), a programme providing 100 days of employment per rural household per year, the toil of women added another dimension to the centre's challenge.

Under the employment scheme many women were employed on massive fruit tree plantations. The saplings require irrigation for the initial three years. Women need to head load and fetch water from long distances in the hot summer months. Although the work is hard, the wage is crucial. Yet, in the hot summer months, women have had difficulty to even find enough water. We needed alternatives that would use less water. We need an irrigation system that drastically saves water and labour so that all farmers in water scarce regions can access and use irrigation when needed.

Traditional roots During interactions with farmers on how to reduce irrigation water requirements and increase its efficiency, we learnt that many sacred groves of fruit, ornamental and medicinal plants were successfully grown with little water by using buried clay pots. This traditional way to grow trees with less water uses the suction capacity of the soil and root system in tandem with the sweating properties and slow release of moisture by clay pots. But it had problems; each tree had to be served with water, pots were not standardised and had problems of clogging, for example. We decided to probe further using modern sciences and materials and farmers' experiences.

Key criteria guiding design of a new irrigation system were: drastically reduce plant water requirements by serving water only at the root zone in the form of adequate, well spread and assured moisture. In addition, the system should function without electricity and it must be automated to eliminate drudgery.

We learnt that many sacred groves of plants were grown successfully using buried clay pots

During two years of action research, the first model was developed and tested. The basic principle was served – water was reaching the root zone. But there were problems such as clogging of pipes. After two years of technology iteration, at the beginning of 2014, the final product, named System of Water for Agriculture Rejuvenation (SWAR), was implemented on a fruit tree plantation under the national employment scheme.

How does it work? Rainwater is harvested or water is fetched from nearby water bodies. This water is then pumped to an overhead tank using a pedal pump. From the tank outlet large diameter pipes deliver water to the field. From this pipe, smaller, UV and rat resistant lateral pipes deliver water to rows of plants. Near each plant a measured dripper lets water slowly through a pipe into the specially

The first model of the irrigation system was developed during two years of action research.
Photo: Centre for Environment Concerns

baked buried clay pot. The pot is buried about 30 cm below the soil surface next to the plant root zone. From each pot two micro tubes half way up the pot, fitted with a sandbag, let water slowly ooze into the soil. After some time the pot begins to sweat and this is based on the suction capacity of the soil and the plant roots. Water supply to the pots is regulated through control levers so that all plants can be reached with gravity flow. To facilitate microbial growth and spread of the moisture, we apply microbial inoculants that are prepared on site.

First results The results are highly promising. Above all, water requirements are one quarter to one fifth of those prescribed for drip irrigation. And, despite much less water use, all plants grew well in terms of stem, leaf count and size and early plant maturing. Soil moisture remained for over a week after irrigating. There was no weed growth as there was no water on the soil surface. And, soil organisms grew well, likely as a result of the enabling environment of oxygen and moisture in the soil.

In 2015 we established trials comparing drip irrigation with SWAR and so far the latter have performed much better. As we faced a severe heat wave and water shortages across the state we could observe its impact on the trial sites. We noticed an interesting result. With SWAR, water could be further rationed to keep the plant alive until the next rains, an impossible situation under drip irrigation. Women made an interesting observation: "it works like a mother who feeds everyone in the household with the available food, while drip irrigation is akin to a man eating most of the food and leaving little for the rest of the family."

With ongoing trials we are exploring the scope to further reduce water requirements of SWAR. In 2015 we also started using the system to grow vegetables and flowers. This helped show immediate results in terms of both soil and plant health and farmers' incomes. In vegetables and fruits, where close planting is done, we found that one eighth of the water compared to drip irrigation suffices.

Road ahead It was due to these promising early results that SWAR received the Global Champion Innovation Prize for Water and Forestry at the 2015 Paris International Agricultural Show. Accepting new technologies takes time. Though farmers have been involved in experimentation, further on-farm testing and development of the technology will reveal more about the practical value of this technology for farmers struggling with drought. India is a large market with a desperate need for water efficient irrigation technologies. Serving the market is difficult as it is dominated by heavy subsidies exclusively targeting technologies owned by large corporations, scientists guard their knowledge and government procurement procedures have high transaction costs. But together, farmers' satisfaction with SWAR, the desire to bring more low rainfall areas under irrigation and the Prime Ministers' call for increased water use efficiency opens enough opportunities to scale it up.

The time has come to shift from rain dependent farming to harvesting and storing rain water and using it efficiently to cultivate crops. Optimum use of water – providing moisture rather than 'concentrated' loads of water – combined with healthy farming practices such as soil improvements, will make agriculture in India more sustainable and offer improved incomes to smallholder farmers.

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Trials are underway to further reduce water requirements and to explore the use of SWAR for vegetables.
Photos: From left to right, Centre for Environmental Concerns, Edith van Walsum



Agroecology: an antidote to the Greek crisis

Greek farming has failed to provide healthy and diverse sustenance for the country's population while at the same time protecting soils, water and biodiversity for future generations. Causes of this failure are many – lack of political will, European farming subsidies, increased mechanisation, the systematic eradication of traditional seed varieties, export oriented production, complete lack of educational support for farmers and a large urban population that is mostly oblivious to the quality and origin of its food – to name a few.

Five years of financial colonisation have made farming in Greece ever more difficult, creating the biggest threat to the resilience of our food system. Over the last two years we have gone through 48 amendments to the tax system! Taxes on land, water, electricity, transport and communication have all increased. Land grabbing by foreign multinationals, cheap imported food and decimated incomes all undermine the work of farmers.

At Corinthian Orchard we are addressing this crisis by working through food and farming. We are an informal network of young and old agroecological farmers. We collectively grow and market grapes, oranges, lemons, mandarins, apricots, figs, pomegranates, wheat, vegetables and herbs. We also produce lemonade, grape syrup, resins, sundried tomatoes, tomato sauce, herbal tinctures and more. By cultivating and healing the land we cultivate and heal ourselves. Respect for the people, respect for the Earth and fair distribution of the surplus and abundance the Earth provides are the ethical principles that brought us together. We are united by action based on reflection and wanting to transform our reality. We work the land and experiment together, we believe that every plant and animal under our care deserves to be given the conditions to reach its potential.

Antonis Diamantidis
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is a young farmer and a member of Corinthian Orchard.

We keep, use and exchange traditional varieties of seeds, an action considered illegal in most of Europe. We try to meet with the people that eat our produce to build connections, trust and to exchange knowledge. To achieve this we created a community supported agriculture scheme where 17 farmers provide 30 families in Athens with fresh, local vegetables and fruit all year round. We also participate in organic farmers, markets, the no-intermediary food movement and many other initiatives supporting agroecology.

We would like to make an open call to all readers: *meet the people that grow your food!* Save from growing your own, this is the best way to start reconnecting with yourself, your food, the land, its people and nature…. And when in doubt, smile.

The páramo, where water is born

San Isidro is an indigenous community in Ecuador's central Andes that collectively built and manages an irrigation pipeline. The pipeline has brought life back to family farming and created more space for the community to protect the páramo, a source of water and life for farming communities and urban residents alike. This story proves the strength of longstanding models of community organisation allied with the national indigenous movement.

Tristan Partridge

Before I ever made the half-day hike from San Isidro up to the páramo, I heard about it almost every day. People told me about its beauty, lakes, and the hot springs. Deep valleys, rivers and 4500 m peaks. Its stories, the cold climes and dramatic views, the struggles to own it and to protect it. In Ecuador's central Andes, the indigenous community of San Isidro collectively owns 1060 ha of this high-altitude moorland, typified by rugged peaks and straw-like grasses (*paja*). The area is known by its Kichwa name, *Chaupi Urco Chilca Tingo*. It is a place where collective action has intensified in scope and scale since the completion in 2010 of the community's irrigation pipeline, which sources water there from two small rivers.

With a population of around 500 people, the majority of households in San Isidro rely on small scale agriculture (growing many varieties of maize, beans, root and leafy vegetables) in combination with wage labour. San Isidro is distinct in the local area for the number of residents who travel regularly to and from the Amazon region for shift work in the oil industry. This work has become increasingly precarious, and has further driven interest in communal projects that seek to meet community needs.

Collective action

Collective organising in San Isidro, as in many other indigenous communities across the Ecuadorian highlands, is structured with a *directiva* or community council elected every two years by all residents. Led by a president and vice-president, ultimate authority rests with the 'assembly' of community members whose agreement is required to support

A day of communal labour in the San Isidro páramo repairing a section of the community's irrigation water pipeline. Photo: Tristan Partridge

any major decision. Since the 1960s, this structured approach to collective decision-making has enabled San Isidro to engage in alliances with nearby communities, and to operate within a recognised branch of the national indigenous movement. In the last decade alone, these networks have successfully fought campaigns against local plantations for more equitable access to water, countering land grabs that have sought to buy collectively held land without full communal agreement, and pressing for tighter control of the use of agrochemicals within industrial agriculture.

Though active for many decades, after national indigenous uprisings in the 1990s and a strengthening indigenous movement since, collective action in San

The páramo: a water-storing ecosystem

The páramo ecosystem spread across the northern Andes is of great importance locally and globally – a vital source of water and part of functioning hydrological cycles, and also a carbon sink critical in regulating broader climate patterns. In Ecuador, the páramo hills are known to form part of a 'water-storing ecosystem,' an indirect source of water for the majority of urban and rural populations across the country, especially in the *sierra* regions. They are said to function almost like a giant 'sponge' absorbing rainfall, storing it, and releasing water gradually. Páramo lands can produce one litre of water per day per square metre and, in Ecuador, 85 % of water sources used for drinking water, for hydroelectric power systems, and for agricultural irrigation originate in the páramo. Increasing competitive interest in these resources has seen timber companies trying to purchase communal páramo lands to establish plantations of trees that consume a lot of water, such as pine or eucalyptus.

Panoramic view of the Chaupi Urco Chilca Tingo páramo and surrounding hills. Photo: Tristan Partridge

Isidro has gathered pace and achievements in recent years – registering as a community in 2009, and capitalising on constitutional rights attached to *Buen Vivir* (Harmonious Living) introduced in 2008.

In partnership with the nearby community of Yacubamba, who share the water from the pipeline, the 2009 *directiva* of San Isidro successfully applied for funding from the National Institute for Irrigation (INAR). The application was successful because it detailed clear plans for how future maintenance work would be undertaken and shared between the communities. Don Jorge Llumiquinga, from San Isidro, brought his previous experience from other pipelines in the region to the application. Moreover, they applied at a time when government social spending had increased. The INAR grant covered building material costs for the irrigation pipeline. It also covered initial construction labour costs; although a small team of paid workers was supported by scores of volunteers for the six month project. And, under the collaborative agreements in place, ongoing maintenance work is shared equally among the 80-90 participating households.

Alpacas kept by the San Isidro farmers in the community owned parámo hills. Photo: Tristan Partridge

New possibilities

This shared infrastructure project has become a central focus of communal life, and has transformed possibilities for family farming in the semi-arid soils of San Isidro. Irrigation has made agriculture much more reliable and viable. Before the pipeline was built, access to water for farming was limited by historical water rights and agreements that favoured large landholdings. One farmer, Sra Rosa, experienced this acutely: "We used to get water by the minute – it wasn't just the *hacienda* estate taking most of the days each week, but by the time our quota was divided up between all of us in the community, we'd have only minutes at a time. The place was very dry. Now, we can grow much more, even alfalfa for our guinea pigs."

> This shared project has become a central focus of communal life

San Isidro has suffered from increasingly erratic patterns of seasonal rainfall and even in 'wet' growing seasons crops were struggling. The pipeline provides a constant flow of 25 litres per second, which is distributed among member households. This has counteracted a steady 'desertification' of fields, and enables farmers to increase production. For example, Raúl Allauca now grows irrigated crops on his family's steep plot. After the pipeline was completed his family built an extensive system of terraces. They have reduced their dependence on food purchased outside and increased their income from farming.

As well as cultivating fodder for an increased number of small meat animals in most households, irrigation has also supported a community food cooperative, and enabled more farmers to regularly sell produce at their nearest weekly regional market in Pujili. The cooperative 'Food Circle' involves weekly meetings where farmers, usually women, trade their

'surplus' produce amongst each other. Though fewer than half the community's households have been active in the 'circle' and the quantities traded are insufficient to supply a livable income, there are other benefits. It has encouraged the production of previously neglected crops (e.g. Andean tubers such as *ocas* and *mashua*), and thus, care for and use of the páramo have helped reinforce locally appropriate farming practices and food landscapes.

Protecting the páramo Páramo conservation is now another focus of collective action in San Isidro, alongside ongoing campaigns for land rights, water justice and environmental protection. In 2009, community organiser, Porfirio Allauca, worked with the *directiva* and a development NGO on a project to bring alpacas back to the páramo. He described this land as a source of life – not just for San Isidro, but for society as a whole, since the páramo is 'where water is born'.This project coincided with growing interest in páramo conservation within the development sector and with other NGO-funded projects in and around San Isidro. Ecuador, however, has seen the closure of a number of regional NGO offices, particularly in the highlands. This goes to show that long-term and self-sustaining systems of production and cooperation like those found in San Isidro are more important than ever.

Self-sustaining systems of production and cooperation are more important than ever

The páramo is also a site of significant historical importance. During land reform in the 1960s and 1970s, designed to support indigenous and rural communities through land redistribution, large estate owners were able to 'redistribute' land that they used and valued least. This included the páramo. As Porfirio put it: "at that time they handed over those lands like they were redundant or worthless." He described it as a kind of 'justice' that today the páramo is recognised as a 'source of life', bringing new resolve and vitality to the community.

The importance of the páramo in San Isidro is reflected in many aspects of life: in the work that its conservation requires, in the produce that its waters help to grow, and also in the social fabric of San Isidro. Alongside the household and community labour and ongoing indigenous struggle, commemorative celebrations are held in the páramo, remembering the landscape as symbolic of solidarity. To mark the inauguration of the pipeline, a plaque was laid near its source in the high páramo. Thanking recent ancestors for their efforts in acquiring this land, the plaque states the páramo's role as both site and source of communal action. Its words express hope for the future of San Isidro, and of the páramo as a whole: "this páramo, wellspring of life that we will look after forever and ever."

San Isidro residents repair an installation on the irrigation water pipeline during a day of communal labour. Photo: Tristan Partridge

Sra Rosa and her son Edison Guamán cutting alfalfa. Photo: Iván Guamán

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From water wars to world peace


Photo: TBS

'Harvesting the monsoon: livelihoods reborn', published in the March 2000 edition of LEISA Magazine, documents how in Rajasthan, India, traditional water harvesting was revitalised and local rivers were transformed from ephemeral to perennial. Rajendra Singh, chairman of the NGO which started the initiative, talks about his next steps – launching World Water Walks. He recently received the Stockholm Water Prize for his efforts.

Rajendra Singh

This is the 21st century of exploitation, pollution and encroachment of water resources. Meeting challenges has always been a huge part of my life. When I went to Alwar, this semi-arid area was unhealthy and impoverished. The aquifers were completely dry. We started conserving the rainwater so that it wouldn't evaporate or flow away and be wasted. Using traditional wisdom we built *johads* (small dams) to recharge the underground aquifers. And because of that wisdom and those efforts, the area became fertile, prosperous and dead rivers came to life again. And those who had abandoned their villages came back again. The unique part of the whole process was the active community participation, which gives the community a sense of ownership over the assets they have created.

Active participation by the community in Rajasthan gave them a sense of ownership over the water harvesting assets created. Photo: TBS

What now? World peace is only possible when everyone gets clean and pure drinking water. Water resource conservation and management will continue to be a climate change adaptation strategy for people living with rainfall variability, both for domestic supply and to enhance crop, livestock and other forms of agriculture. Decreasing water poverty by increasing water productivity will be key for the coming era. Demand-side control of water resources is urgent for sustainable supply-side management.

We are launching World Water Walks along the rivers and lakes of five continents over the next five years. The walks aim to connect local communities to their water and secure their water rights. Walk themes and 'outdoor classrooms' will provide the opportunity

The World Water Walks aim to connect local communities to their water and secure their water rights. Photo: TBS

Water resource conservation will continue to be a climate change adaptation strategy

to ask questions and to understand the complexity around water issues. Can reviving the flow of water in landscapes reduce the inequalities that face the world and ensure a more peaceful era for the planet? Do world spiritual traditions and the importance of water in them have a resonance and some teachings for us in this modern age? And, what can we learn from local communities which have enjoyed a symbiotic relationship with the environment for millennia?

The first of a series of walks was from Holy Island of Lindisfarne to Belford in the UK. The walkers, local community members, politicians and church leaders as well as an international contingent, participated in a powerful discussion on water and climate change. Walks are already scheduled in Sweden, the USA and Germany and by 2016 water walks in all participating countries will be organised.

Rajendra Singh (*jalpurushtbs@gmail.com*) is the chairman of Tarun Bharat Sangh, an organisation working for holistic development of all, regardless of economic situation, caste or religion in India. He also heads a national network of organisations working on water issues, Rashtriya Jal Biradari, working for restoration of all mighty and small rivers of India.

Farming communities worldwide relate to water in myriad ways. The experiences here highlight grassroots initiatives focused on equitable use and distribution of water, community restoration of degraded ecosystems and innovative water saving techniques.

Nepal

Community participation

The community of Rajha village in Gulmi district has incrementally improved water management with a combination of technology and good governance. They were oscillating from times of water excess in summer to scarcity for up to eight months each year. Limited drinking water prompted initial action in 2007 when a few community members started harvesting rainwater from their roofs. Next the community took steps to improve their livelihoods and water remained their focus. In 2009, 35 people started the Nava Durga Agricultural Cooperative. With some financial support they built a 600,000 litre rainwater storage tank, enabling 34 members of the newly formed 'water users group' to grow vegetables during the dry season and some to rear cattle. This success inspired an ambitious new project. The water users group almost doubled and the cooperative moved to set up the Pakhu Khola Dharapani Lift Irrigation Project. A focus on equitable distribution of water has allowed 70 % of the village households to increase crop production and diversity and village out-migration has reduced. The community's success started with inclusive participation and leadership – women are well represented in decision-making positions. The formation of cooperative governance structures also enabled them to build a network with public and private institutions that supported their work. And lastly, owing to the bottom-up nature of the irrigation project, it fit holistically into the community's own vision of development.


Photo: Chiranjibi Rijal

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Portugal

Water retention landscapes

Bernd Müller, a water specialist in the community of Tamera, southern Portugal explains: "there is enough water for all people and animals if we follow the logic of nature rather than the laws of capital." In the summer of 2007, the community faced conditions that were typical of the region: hot, dusty, bare soil. The winter rains had eroded the fertile topsoil, aquifers dried up, and the fire hazard was high. But today the situation is drastically changed. A perennial creek is flowing again, ponds, lakes, and ditches filled during the winter. And, vegetables and fruit trees grow even at the hottest and driest time of the year. How did they achieve this turnaround? Across 150 ha, they created a water retention landscape. This involved building a series of ditches, lakes and ponds. But they also planted many trees and modified cultivation practices adds community member, Christoph Ulbig: "the lakes are beautiful icons of our work, but the actual effect is the result of the many little things we do. Reforestation, working the ground parallel to contours, and other means which slow down the runoff of water." Water retention is a basic principle which allows water time to infiltrate the soil, and ultimately restore degraded ecosystems. It can *and is* being applied worldwide.

For more information about water retention, including seminars, contact ecology@tamera.org.


Photo: Simon du Vinage

Nigeria

Fish and vegetables save water

In the northern part of Cross River State of Nigeria, farmers in Obudu are enjoying the benefits of integrated fish and vegetable production. The approach is simple: waste water from fish farms around the homestead is no longer considered waste. Thanks to decomposed and uneaten foods and faeces of the fish, it is rich in nutrients and can be used to irrigate vegetables. How did this concept take off? In 2012, a group of researchers led a multistakeholder project during which time the importance of fish farming and conservation of water for agriculture became apparent. Integrating fish and vegetable production showed potential to improve farmers' livelihoods within the bounds of water scarcity and minimal external inputs. Young farmers clubs, churches, cooperatives and age grade associations got involved and helped to build low-cost infrastructure including holes, pots, ponds and vats for the fish. Ninety eight farmers have embraced this initiative and experience the benefits directly. Efficient use of local resources – vegetables irrigated with waste water from fish farming don't need chemical fertilizers – has improved food and nutrition security through year-round availability of healthy vegetables and fish. To enable more farmers to take up this system, improved access to fingerlings and water for the fish farms is needed.


Photo: Marcel Ugbong Agim

For more information contact Marcel Ugbong Agim (agimmarcel@gmail.com).

Bangladesh

Water saving technology for paddy rice

As water is becoming increasingly scarce in rice producing regions, concerns are growing about how to improve water use efficiency of the crop. With the alternate wetting and drying technology developed by the International Rice Research Institute (IRRI) together with partners, 15-30 % of irrigation water can be saved. But the way in which farmers in Bangladesh pay for water presented a 'disincentive' for them to try the technology. Farmers normally pay for water as a fixed amount or as a share of the crop harvested, typically about 25 %, no matter how much or how little water they use. To make water saving beneficial to farmers, IRRI works with groups of farmers in Bangladesh to facilitate deals between pump owners and farmers to allow payment for water on the basis of the volume supplied. In the 2014 winter season, 341 farmers using the alternate wetting and drying technology saved about a sixth of their irrigation expenses and raised grain yields by 5 %. In addition, greenhouse gas emissions from their fields have been halved compared with continuous flooding. The pump owners also gained as they had surplus water to sell and could increase their number of clients. This experience will be built on to upscale the use of the technology.

For more information contact Bjoern Ole Sander (b.sander@irri.org) or visit http://www.knowledgebank.irri.org/ and https://ccafs.cgiar.org/publications/alternate-wetting-and-drying-irrigated-rice.


Photo: Maksudur Rahman

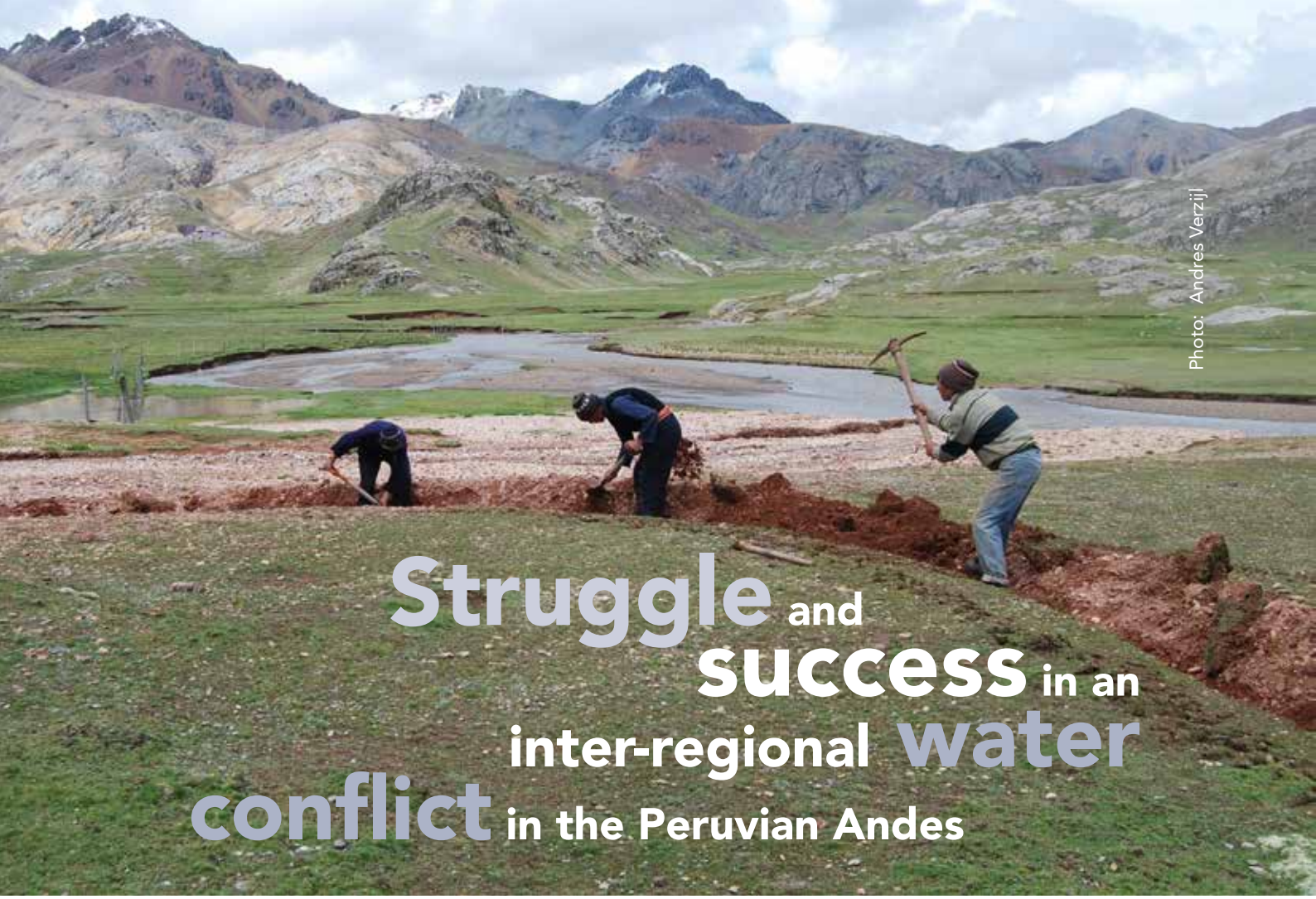

Photo: Andres Verzijl

Struggle and success in an inter-regional water conflict in the Peruvian Andes

Large hydraulic projects that aim to capture and control water flows are increasingly entering territories of local Andean communities. This is a story of pastoralists in the region of Huancavelica, Peru, who stepped up in defence of their local wetlands, pastures and water sources. After more than a decade of protest, alliance building and negotiation they have established themselves as the crucial actor in inter-regional water governance.

Silvano Guerrero and Andres Verzijl

The Castrovirreyna plateau is the *puna* environment of lakes, wetlands and grasslands in Huancavelica and comprises the headwaters of half a dozen watersheds. Lake Chocloccocha, the biggest and most emblematic, is 4500 metres above sea level and source of the Pampas River. For centuries seminomadic pastoralists have used the plateau for camelid and sheep herding. The area currently supports 1500 families, and over 200,000 alpacas, llamas and sheep. Crucial for alpaca herding are the *bofedales*, or high-altitude wetlands, particularly in the dry season, from May to November.

Source of conflict

In the 1950s a dam was constructed to raise the water level of Lake Chocloccocha and divert 150 million m^3 of water from the Pampas watershed to the adjacent Tambo-Ica watershed for commercial irrigation purposes in the region of Ica. The infrastructure submerged the village of

Choclococha and interfered with customary herd movements. What is more, the diversion canal was not just a barrier to herd movement, it also prevented runoff from reaching the *bofedales*. The canal has degraded the environment and caused dozens of human and hundreds of animal causalities. No compensation was ever made.

The herders organised a public gathering which marks the beginning of a decade-long conflict

The Peruvian government created PETACC (Proyecto Especial Tambo Ccaracocha) in 1990, a project of the National Development Institute, with the mandate to rehabilitate the hydraulic works in the Pampas watershed and study new alternatives to transfer water to Tambo-Ica. A civil war limited action for a decade and in 2003 the administrative responsibility for PETACC was transferred to Ica, home to the country's biggest agro-export sector. The prospect of new water transfers had pastoralists worried. There were several skirmishes with PETACC engineers that led to terrorist accusations of pastoralist leaders.

In July 2006, the Peruvian government issued a legal decree for an additional 50 million m^3 of water to be captured from community territories in Huancavelica and to be destined for Ica via a proposed canal, the Ingahuasi Interceptor Drain. The 73 km canal would capture all springs, creeks and runoff in the valley of Ccarhancho and transport this water to Lake Choclococha where the existing dam would need to be elevated. It would destroy hundreds of hectares of communal wetlands and again ignore the fact that the Huancavelica communities rely on this land and water.

Community action The legal decree and interceptor drain outraged Huancavelica civil society and public institutions, and above all, the communities directly affected: Ccarhuancho, Chocloccocha, Santa Ines and Pilpichaca. The communities took action to defend their wetlands, to demand participation in decisions on hydraulic projects within their borders and to demand compensation for past damages. The herders of Ccarhuancho organised a public gathering in September 2006, which marks the beginning of a decade-long inter-regional conflict. About 500 people from the four communities were present, as well as a considerable delegation from the Huancavelica regional government and (inter) national NGOs. Many at the meeting were associates of MEGAH (*Mesa Tecnica de Gestion del Agua de Huancavelica*), a stakeholder platform set up a few months earlier to protect the rights of Huancavelica water users. MEGAH was an initiative of Huancavelica professionals in response to emerging threats to local community water rights. It included representatives of agriculture, health and environment branches of the Huancavelica regional government as well as representatives of national government agencies, national NGOs and international development organisations. The communities' wetlands defence became MEGAH's emblematic case. Ccarhuancho leaders spearheaded the communities' mobilisation and insisted on becoming a full member of the stakeholder platform.

A moral victory A month after the gathering in Ccarhuancho, MEGAH organised a water forum to discuss the conflict. National water experts and invited human rights activists participated in the event and became strategic allies of the communities. After a year of approaching regional governments in Huancavelica and Ica as well as national ministries,

Biases about *bofedales*

Bofedales are high-altitude wetlands of water-saturated peat material and vegetation. These fragile ecosystems are sensitive to variations in water quality and quantity that come with climatic changes, human intervention (like mining) or herd composition. We challenge two biases about *bofedal* environments. First, the economist's bias that these wetlands are wastelands unfit for agriculture. And, as such viewed as an obstacle to progress, best drained or degraded for other economic gain, like commercial irrigation. Second, the conservationist's bias that wetlands are natural and pristine landscapes where human activity is often portrayed as an external threat.

These misconceptions overlook that many *bofedales* have been manmade and are carefully maintained by pastoralist communities throughout the Andes. As local common property systems, community *bofedales* are vital to herder livelihoods and economic prosperity. But they are also of regional (watershed) and global (climate) significance because of their ability to capture and store rainfall, glacier runoff and carbon.

Alpacas on the Ccharhuancho Village square. Photo: Silvano Guerrero

and after many negotiations and social protests directed at Ica, PETACC and the Huancavelica regional president, the communities submitted their case to the Latin American Water Tribunal. They had legal, logistical and financial support from NGOs and global water justice networks, but the development of the case, historic research and securing emergency backup funding were led by the community of Ccarhuancho and its leaders.

In October 2007, the Latin American Water Tribunal ruled in favour of the communities' water rights: PETACC had to halt the Ingahuasi drain pending an Environmental Impact Assessment and compensation for past damages. Moreover, laws that granted the Ica regional government control over PETACC and the reservation of water had to be revised.

Despite its ethical character and non-binding verdict, the tribunal strengthened the communities position in the eyes of both allies and adversaries, and was considered a huge moral victory. A period of dialogue between the communities, PETACC and other stakeholders followed. Representatives from both Ica and Huancavelica government agencies, NGOs and Ica water user associations were at the table. The main point on the agenda was an indemnity programme for damages caused by the existing dam and canal. Stakeholders from Ica hoped to negotiate the Ingahuasi interceptor drain at the same time but the communities wanted an indemnity programme in place first. Trust between the different parties has always been an issue, but constructive communication and the communities' involvement was positive. Importantly, the communities were able to reiterate their demands: water security and an active role in water related decision making.

Continued challenges The process has been full of frictions. MEGAH started to loose influence when a new regional administration was inaugurated and a new stakeholder platform, GTRAH (*Grupo Tecnico Regional del Agua de Huancavelica*), emerged in 2009. An Environmental Impact Assessment of the Ingahuasi interceptor drain was rejected because neither the Huancavelica government nor the communities had been consulted and an indemnity programme has not been approved or implemented.

> The tribunal strengthened the communities position in the eyes of both allies and adversaries

Furthermore, the key issues of the communities' involvement in decision making and their water rights have not been addressed.

In 2011 the ongoing conflict led to the loss of a World Bank loan of US$8 million. The loan was part of a modernisation project to analyse, administer and improve water management in the Tambo-Ica watershed and the area of inter-basin water transfer of the Pampas headwaters. The newly elected regional president of Huancavelica refused to approve the loan without community consent. And the communities insisted that without specification of how this money would be allocated, there was every chance they would be negatively impacted. Nevertheless, through a back channel, the Ica irrigation sector was incorporated into the modernisation project, but officially, only to focus on the Tambo-Ica watershed. The future of water management in the Pampas headwaters remained uncertain.

Meeting at the Ministry of Housing, Construction and Sanitation to discuss the water conflict. Photo: Silvano Guerrero

Towards water justice

2015 marks the beginning of new regional administrations. Similar to previous election promises, the new Ica president announced he would realise the Ingahuasi interceptor drain and again the Huancavelica president is tempted to broker a deal. Once more the communities are responding. It's a recurring story as long as the elephant in the room is not addressed. While *all* water in the Pampas headwaters is destined for Ica, and not a single drop or dollar of investment is purposefully allocated to local pastoralists, the communities continue to fight.

The consistent and active involvement of Ccarhuancho and the communities in the conflict has proven to be a crucial success factor. While regional politicians, public officials and PETACC heads of staff turnover at a rapid pace, community leaders emerge as the true experts on the conflict. Moreover, municipal mayors are constrained by ties to government and community leaders have more room to manoeuvre.

In March 2015, the communities of Ccarhuancho, Choclococha, Pilpichaca and Santa Ines denied PETACC access to their territory to do maintenance. Furthermore, community leaders communicated to authorities in both regions that social upheaval was imminent. With the situation escalating in other downstream communities, the community leaders and regional politicians have been called to the Prime Minister's office to settle the matter once and for all. Voices from within all branches of government, including Ica's, suggest that the Ingahuasi interceptor canal will have to be cancelled for good.

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Valley of the Ccarhuancho wetlands. Photo: Andres Verzijl

Photo: MetaMeta

A watershed evolving

Intense watershed management and water harvesting in the state of Tigray, northern Ethiopia, have transformed the area beyond recognition and increased food security and enhanced resilience to floods and droughts. A new way of thinking about watershed management and the efforts of local farmers have contributed to the success of a number of initiatives.

Marta Agujetas Perez, Kifle Woldearegay and Frank van Steenbergen

The watershed activities in the semi-arid regional state, receiving 400-800 mm of rainfall each year, have restored vegetation, caused groundwater levels to rise and reduced erosion. Soil moisture has increased and in many places productivity has more than doubled. Much of the change has been due to government programmes, coordinated at the regional, district and village cluster level. What are some of the keys to this success; what have farmers experienced on the ground; and with over 15 years of experience in watershed management, what next for the region?

A new way of thinking

A new way of looking at watershed management has been an important success factor in Tigray. Before 2000, the emphasis in watershed management was on controlling soil erosion. About 15 years ago the focus shifted more to water harvesting and retaining moisture. The 3R principle – recharge, retention and reuse – explains the logic behind this approach. The central concept is to keep water in the landscape by storing it when plentiful, making it available during dry periods and extending the chain of uses. The 'Rs' refer to three elements of water buffering in a landscape. Recharge is about adding water to the buffer through infiltration. Retention is about increasing the size of the buffer by slowing down the water cycle. And reuse is about circulating the water as much as possible. Enhancing each of these processes reduces unused runoff and evapotranspiration.

Many of the watershed activities in Tigray are based on the 3R principle and a repertoire of measures have been put to use by government programmes and individual farmers over the past ten years. They include

The focus shifted more to water harvesting and retaining moisture

physical measures (deep trenches and hill side terraces with earth or stone bunds, gully treatment, micro-basin and pitting for plantation) and water harvesting measures (river diversion, mini-dams, check-dam ponds, open hand dug wells and spring development). Local initiative combined with leadership by the local government supported a high intensity of work and led to large scale change.

Harvesting water with roads

An 'out of the box' solution that's also proving successful is road water harvesting. In the village cluster, Kihan Tabia, examples of road water harvesting can be seen everywhere. There are many examples of road water harvesting being started through local initiatives and

Tsadkan Berhe has been harvesting water from the road for more than ten years. Photo: MetaMeta

Farmers have built stone bunds to divert water from roads to their farms. Photo: MetaMeta

now supported by the regional and local authorities.

For example, Ataklti has two hectares of land in which he cultivates rainfed crops on a rotational basis; usually sorghum, teff and wheat. Some of his land is adjacent to the road. About ten years ago, he realised that the water from the culvert was causing erosion because it was concentrated at one point. It was eroding his brothers' land, which became unproductive. He decided to divert the water from the culvert to his farmland to help his brother and at the same time benefit his crops. It was his own initiative to build bunds, but a few years later the government and the community helped him to strengthen the structure. The productivity of his farmland has increased and his brother is again able to cultivate rainfed crops. There hasn't been any conflict with neighbours downstream over the use of the water from the road. And, when he has excess water during the rainy season, he lets the water flow to other farms.

Similarly, Tsadkan Berhe, from the same village cluster, has been diverting the water from the road to her land for over ten years. She has one hectare of land, where she also cultivates teff, sorghum and wheat. The bunds were built by the community as part of the Productive Safety Net Programme. The water coming from the road is extremely valuable, particularly for irrigation during dry spells in the rainy season. The quantity and quality of her crops have increased thanks to the water collected with the road. The extra water in the growing season allows her to apply fertilizers which increase her productivity. And, she is now able to feed her cattle during the dry season.

Bench terraces

With many watershed improvement options, selecting those that are locally appropriate is not trivial. In Wukro, Tigray, a stakeholder technology selection workshop identified bench terraces with hillside cisterns as a top priority for conversion of steep, often degraded hillsides into cultivable land. The workshop was organised at the end of 2012 by the WAHARA project, an EU-funded project aiming to increase the potential of water harvesting. Participants included representatives from the regional government, NGOs, educational institutes and local farmers.

The development of bench terraces has evolved from trials to a regional programme targeting the estimated quarter of a million landless youth in Tigray. The Embahasti sub-basin provides a successful example of the programme. A hillside of 15 ha has been converted to terraced land and is collectively owned and managed by 15 young women and 10 young men. Over the past two years the group has managed to meet its livelihood needs and make a saving of US$700.

'The elephant and the mouse'

A series of watershed programmes in Tigray is largely driving changes across the landscape. This story shows that local farmers and landless youth negotiate this evolving context and shape their experiences. It shows that large scale watershed management with strong government ownership can be successful – rather than becoming a 'white elephant' – if it includes people's participation, stimulating farmers and local experts in the watershed to adapt innovative and creative solutions to improve their livelihoods.

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The development of bench terraces in Tigray evolved from trials to a regional programme. Photo: Kifle Woldearegay

Learning from nature

Pablo Tittonell (www.pablotittonell.net) is coordinator of the National Program on Natural Resources and Environment of the Instituto Nacional de Tecnología Agropecuaria (INTA) in Argentina and Professor of the Farming Systems Ecology group at Wageningen University and Research Centre, the Netherlands. He is a board member of the African Conservation Tillage network and member of the Latin American Scientific Society on Agroecology (SOCLA). He is our regular columnist for 2015.

The need to increase water availability for agriculture through the construction of dams, channels or costly irrigation systems has dominated the agenda of development agencies and donors for over 40 years. In the Sahel, for instance, water has always been assumed to be the most severe limiting factor to agricultural productivity, yet in-depth studies from the end of the 1990s already showed that most crops in the region are mainly limited by a lack of nutrients and not by water. But a huge dam is prestigious, visible, and often pays off in political terms.

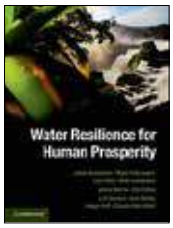
I do not mean to imply that irrigation systems are not necessary. Indeed most of our civilisations, institutions, governance and political systems emerged in ancient irrigation areas. But there is not enough water to increase our irrigation footprint much further.

What are the alternatives? The amount of water stored in the top 60 cm of one hectare of healthy soil can be enough to fill an Olympic swimming pool. Why not work on increasing water capture and storage in the soil, instead of relying exclusively on irrigation?

Back to the Sahel. The local savannah vegetation growing on extremely sandy soils and receiving 300 to 400 mm of rain per year can produce up to 20 tonnes of biomass annually. A cropping field with millet and cowpeas under the same conditions produces only one tenth of that on average. A soil under natural vegetation can infiltrate 443 mm of rain water in one hour; it can literally 'swallow' a storm, while a cultivated soil can only infiltrate, at max, 30 mm per hour.

This has at least two implications. First, that nature has found a way to produce large amounts of biomass in extremely dry conditions; we should learn from this and use it when designing farming systems for dry areas. For example, keeping trees or shrubs in the system can contribute to reducing soil surface temperature – and thus evaporation – dramatically. Second, those cropping systems that produce only one tenth of the biomass compared to the savannah vegetation, will also contribute only one tenth of the carbon to the soil, leading to less soil organic matter and therefore much less capacity to capture and store water.

So there is a lot to gain from restoring the soil's capacity to capture and store water. And, as with many agroecological solutions, there are also other benefits associated with better soil physical conditions. Amongst others, increased biological diversity, more efficient nutrient cycling, erosion control and even indeed, better use of irrigation water when available.



Water resilience for human prosperity

J. Rockstrom, M. Falkenmark, C. Folke, M. Lannerstad, J. Barron, E. Enfors, L. Gordon, J. Heinke, H. Hoff and C. Pahl-Wostl, 2014. Cambridge University Press, Cambridge, UK, 292 pages. ISBN: 9781107024199

This book aspires to a deeper understanding of new water dynamics in the globally integrated system of people and nature. The authors have chosen to specifically address water and food in a changing world. The target audience is students, water resource professionals and water planners and as a result it is rich in detail and at times technical. Resilience is the entry point, woven into chapters on the role of water in the biosphere, human induced change to water systems, food production and water governance. A consistent message is that sustainable water stewardship is about having the capacity to deal with change. Overall the book is holistic in scope and offers plenty of ideas and insights for improved governance and management of water resources.

Valuing variability: New perspectives on climate resilient drylands development

S. Krätli, H. de Jode (ed.) 2015. International Institute for Environment and Development (IIED), London, UK, 88 pages.

This book urges policy makers and development agents to overhaul present thinking about 'controlling' drylands and to consider an alternative pathway based on taking advantage of variability. The author explores vibrant dryland agricultural economies and in doing so inverts negative views about food security in the drylands. Case studies from drylands across the world, interspersed with brief theoretical and analytical text are the substance of this book. Amongst others, case studies include indigenous terrace systems, a mainstay of non-irrigated farming in eastern Sudan, rainwater harvesting in Northwest China and sheep rearing communities in Rajasthan, India. Each example demonstrates how producers use rainfall variability as an asset. A resounding message from this book is the need to better recognise local knowledge and customary wisdom of those who live with and value the inherent variability of drylands.

Specialisation or Diversification? Divergent perspectives on rice farming in three large dam-irrigated areas in the Sahel

B. Guèye, 2014. International Institute for Environment and Development (IIED), London, UK, 38 pages.

This report is based on the main lessons and recommendations from three case studies analysing the strategies, aspirations and constraints of the various types of farmers living around the dams of Bagré (Burkina Faso), Sélingué (Mali) and Niandouba/Confluent (Senegal). This document aims to contribute to national and regional reflections on policies and programmes to improve rice-based production systems in the irrigated areas and strengthen the livelihoods of farmers.

Water for food security and nutrition. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security

HLPE, 2015. Rome, Italy, 129 pages.

This report aims to help policy makers and actors around food, agriculture and water overcome the challenge of safeguarding water for the dignity, health, food and nutrition security of everyone on the planet. The authors' broad focus – linkages between water, food security and nutrition from the household to the global level – is framed by competing demands, rising scarcities and climate change. The report includes a thorough analysis, for example of availability of water resources, managing water and governing water. And this supports findings and recommendations for improved management and governance. Agroecology is

discussed and mentioned as an approach for improving management. Recommended domains for action, amongst others, include conservation of ecosystems, considering the most vulnerable and marginalised first, improving management in agriculture and inclusive and effective governance.

The Global Water Grab, A primer

J. Franco, S. Kishimoto, S. Kay, T. Feodoroff and G. Parucci, 2014, Transnational Institute (TNI), Netherlands, 40 pages.

"Water grabbing refers to situations where powerful actors take control of valuable water resources for their own benefit, depriving local communities whose livelihoods often depend on these resources and ecosystems." This revised edition of the primer provides a comprehensive analysis of water grabbing worldwide. Informative chapters, complemented with case studies and selected further reading, explain: how water grabbing takes place; who are the water grabbers; and what are the key drivers of water grabbing. The authors critique current global water governance frameworks and propose alternative frameworks making a strong case for a human rights perspective on water. The report concludes with some insights from existing resistance to water grabbing and notes that alternative models emerging from these struggles "promote water management practices forged around common values that redefine the meaning of 'public' beyond solely 'state-run' and eschew profit-seeking approaches."

More on water

Film makers, writers, academics and activists have been motivated to tell stories about water from as many angles imaginable. This box lists a few more books and films which, in their own ways, provide deeper insight into water.

Scaling up Multiple Use Water Services, Accountability in the water sector (2014) by B. van Koppen et al. is a good introduction to multiple use water services, a participatory approach that takes people's multiple water needs as the starting point for planning and designing water services.

Water, Power and Identity, The cultural politics of water in the Andes (2015) by R. Boelens addresses the complex conflicting relationship between communities managing water on the ground and national/global policy-making institutions and elites; and how grassroots defend against encroachment.

Daughter of the Lake (2015, 87 minutes), directed by Ernesto Cabellos Damián, follows an Andean woman's struggle for justice in the midst of a life and death water conflict between farmers and a goldmine in Peru.

DamNation (2014, 87 minutes), directed by Ben Knight and Travis Rummel, explores the change in American attitudes from pride in big dams as engineering wonders to the growing awareness that the future is bound to the life and health of rivers.

One Water (2008, 67 minutes), directed by Sanjeev Chatterjee, looks at the myriad ways water has touched human lives around the globe. Viewers are left with the critical question: is water a human right or a commodity?

There are plenty more books, films and multimedia resources on water. **The Water Channel** (www.thewaterchannel.tv) is an online open resource that proves just this. The website is home to hundreds of videos and dossiers on key water themes, providing visitors the opportunity to upload videos and join online discussion forums.

"Water is the engine of change"

Photo: CIDSE

All her working life, Elizabeth Peredo has been engaged in defending human and environmental rights. Until August 2015 she was the director of the Bolivian organisation *Fundación Solón* that aims to contribute to people living in harmony with each other in a world of solidarity, with respect for life and nature. From 2000 onwards she shifted her focus from the rights of domestic workers to water rights. "Our fight has become a worldwide model for struggles for water justice."

Interview: Henkjan Laats

What happened in 2000? In early 2000 the 'Water War' took place in Cochabamba, Bolivia's third largest city. It was a series of public protests in response to the privatisation of the city's municipal water supply and the water price increases. Tensions erupted when the new firm, Aguas del Tunari, a joint venture involving the US multinational Bechtel, dramatically raised water rates. Protests, largely organised through the community initiative, Coalition in Defense of Water and Life, took place in January, February, and April, culminating in tens of thousands of people marching downtown and battling police. One citizen was killed. Finally, on 10 April, 2000, the national government reached an agreement with the Coalition to reverse the privatisation. As a consequence of the 'Water War', in 2004, the Irrigation Law was approved, giving family farmers and indigenous peoples control of their irrigation water sources. Worldwide this 'Water War' is recognised as one of the most important conflicts undermining globalisation. After this, I decided to dedicate myself to the struggle for the right to water, as the conflict made me realise water is the engine of change.

What role did water play in Bolivia's political change? The 'Water War' was followed by a chain of other water related events that led to radical political change in Bolivia. A second revolt took place in 2005 – this time by community organisations in the city of El Alto. They ousted the French multinational Suez Company from the recently privatised La Paz-El Alto water district. In the same period, activists prevented the use of groundwater for mining purposes in Chili and Bolivia. These events, in which the *Fundación Solón* was very active, crystalised a growing movement demanding popular control of Bolivia's water and other natural resources. What followed were the 'Gas Wars' of 2003 and 2005, the overthrow of two neoliberal presidents, and the subsequent election of Evo Morales and the MAS (Movement Towards Socialism) party as a 'government of the social movements.' The Morales government has sought to develop a new institutional framework that positions the state as a direct provider and regulator of water and sanitation services. The Water Ministry, created in 2006, to integrate the functions of water supply and sanitation, water resource management, and environmental protection, is the first of its kind in Latin America. Bolivia's new constitution, enacted in 2009, proclaims that access to water is a human right, and outlaws its privatisation.

How did this experience influence other countries? The 'Water War' and its aftermath helped to inspire a worldwide anti-globalisation movement and provided a model for struggles for water justice. And in close coordination with the governments of Uruguay and other like-minded countries such as Ecuador, the Bolivian government led the successful push for the recognition of water and sanitation as a human right by the UN in 2010. The same countries are at the forefront of a new international campaign for a UN declaration against water privatisation.

What are the current threats to water in Bolivia? More recently, the government of Bolivia has adopted an unsustainable growth-oriented and extractivist policy. In its National Development Plan, Bolivia aims to become an energetic and agro-industrial power. This policy objective is reflected in plans for the construction of mega-hydropower projects, such as the El Bala, Rio Madera and Rositas dams. If these dams go ahead they will have devastating environmental and social impacts. Moreover, Bolivia plans to extend its agricultural frontier by converting millions of hectares of forests and other natural areas into arable land. Needless to say this would imply massive deforestation and an increased pressure on water resources, causing scarcity and contamination. It is important to understand that in many ways Bolivia is even more vulnerable to water problems than other countries. High temperatures, droughts and floods caused by climate change have harsh impacts on its glaciers and fragile ecosystems. And being a landlocked country, Bolivia's main waterways and resources, such as the Titicaca Lake, are particularly susceptible to contamination.

Women celebrate ten years after the 'Water War'.
Photo: Peg Hunter

The extractivist approach will not contribute to the well-being of the Bolivian people. It will violate human and environmental rights and cause increasing inequity and injustice.

What is the role of family farmers and indigenous peoples in the struggle?

Although these recent policy changes are very worrying, I believe that the Bolivian farmers and indigenous peoples are prepared to continue to fight for control of the water that they use for their livelihoods. Our strength is that we consider water as a common good. Irrigation water users' organisations and water cooperatives are still well organised and have developed efficient water management mechanisms, including for dealing with conflicts, and sharing scarce water. Notwithstanding the tendency of becoming more extractivist, the Bolivian government also continues to support water projects for small and

> Our strength is that we consider water as a common good

medium scale farmers, for example by means of the *Programa Mi Agua* (My Water Programme). In 2006, *Fundación Solón* started to organise *Octubre Azul* (Blue October) with about 100 participating organisations, of which many are grassroots farmers' organisations. *Octubre Azul* raises awareness of Bolivia's vulnerability to water problems, and promotes the right to water from four angles: water as a human right, contamination, agriculture and climate change.

What does the future hold?

Thanks to *Octobre Azul* and other water programmes, the Bolivian people and government are increasingly aware of the vulnerability of our water sources. Local governments, communities, and individual farmers are tackling these problems through many initiatives, such as the policy of the municipality of La Paz to improve the city's water management, the joint activities against the contamination of the Titicaca Lake, and there are examples of successful management of small watersheds. It is my conviction that the Bolivian government should not continue its current extractivist development approach, but rather support these promising grassroots initiatives and go back to its original vanguard policy that promotes water as a common good and a human right.

Water contamination due to mining activities in Potosi, Bolivia. Photos: Henkjan Laats

How global food traders manage our water

Photo: Esa Sojamo

To many analysts, global water governance is about getting the institutions right: more accountable water users and more public participation in decisions. But are we barking up the right tree? In this analysis, we argue that when analysing global water governance, one needs to look at the global players that really matter – *an exclusive group of global food traders*. These traders must be held accountable for their water footprint.

Jeroen Warner, Martin Keulertz and Suvi Sojamo

Agriculture is the main water user in the world. 70 % of water is withdrawn by the agricultural sector, 20 % by the non-farming industry and 10 % by domestic users. These figures hint at the hidden water that is traded when food and commodities are bought and sold. Thus, global corporations that trade the world's food and heavily influence agricultural markets also influence how water is used.

Global agricultural trade

Ten years ago, global agricultural trade was exclusively dominated by five Western agribusiness conglomerates: ADM (Archer Daniels Midland), Bunge, Cargill, Louis Dreyfus and Glencore, together accounting for about 80 % of all staple commodities. These companies are free trade advocates, yet they are among the biggest recipients of public agricultural subsidies in industrialised countries. Cargill can hoard so much grain that it can single-handedly create scar-

Hoover Dam, one of the largest US water infrastructure projects in history. Photo: Martin Keulertz

city or manipulate the price – up in times of scarcity, and down in abundant times. This has severe consequences for farmers as it can make farming uneconomic in particular regions. These players have prime state of the art information systems and excellent relations with political and economic movers and shakers on the global scene. They dominate food marketing and even dabble in the banking business, offering 'risk management solutions'. In other words, these corporations *control* the world's agricultural markets. Through that, they also manage and control a large part of the world's water resources, as we will explain.

After the food price spikes of 2007/8, and food riots in some 30 countries, public and private actors faced with food scarcity started to look for direct investment opportunities, e.g. through state companies and state-owned investment funds. In particular, the Chinese owned investment fund, CofCo, purchased the food unit of Noble Group, a large trader of bulk commodities, in 2014. The goal was to counter Western control over food trade by establishing a trader similar to Cargill, but based in China.

Hidden water The 'virtual water content' of a product is the volume of freshwater used to produce that product at the place where it was actually produced. The volumes of 'virtual water' traded around the world are large but remain hidden. In particular, South America, the water tower of the world in terms of availability per person, is of fundamental importance for the production of food that is shipped to other less water-endowed regions. Global traders are not forthcoming about their water use. They account for all inputs such as fertilizers, pesticides, labour and energy. The only resource missing is water. And their dominant role in 'virtual water' trade and therefore global water governance must be made clear.

Farmers' stewardship of water and soils is disregarded

Gross international virtual water flows from 1996 to 2005. Those greater than 15 km³ are illustrated with arrows. Source: Hoekstra and Mekonnen

Traders influence water resource management through market power and active sourcing decisions. The relationship between traders and farmers can influence whether management will be sustainable. For example, if traders support their suppliers to grow food using sustainable water management options, the world's water resources could be under less pressure.

Mismanagement Although 30 % of the world's aquifers are heavily depleted, this increasingly scarce water is still used for unsustainable irrigation projects and often traded in commodities. Water is not managed wisely because it is not officially counted as an input factor. Irrigation leading to higher yields, often subsidised to keep prices low, is the preferred option to keep the global food trade system going. Even though about 40 % of food is wasted globally due to inefficiencies in the food system, the powerful minority are intent on maintaining the status quo. And in the process, farmers and their sustainable stewardship of water and soils are disregarded. Instead of addressing sustainable water and soil management another round of externalising environmental costs is taking place.

Land grabbing Next to unsustainable and wasteful use of water, the control over water by Western and increasingly Asian traders has led to a scramble for land with water. The land and water grabbing we witness today works like a new enclosure movement, effectively undermining farmers' traditional rights to water and land. Globally, millions of hectares have been leased by investors 'betting on a quick buck' at the expense of local populations. In

Accountability of the few is not an option but an imperative

Africa and Asia, land rights are often not codified, or contradictory, so that investors can easily treat these plots as 'unoccupied' and 'underutilised'. For pastoralists, enclosed lands impede traditional grazing patterns and access to vital natural resources. Governments collude and facilitate land grabbing to make money. And these are not small plots: the ProSAVANA land development project in Mozambique, a cooperation between Mozambique, Brazil and Japan in the name of increasing agricultural production, covers an area equal to Austria and Switzerland combined. Ethiopia is likewise carved up among domestic and even foreign investors. Europe is not exempt. Land and water grabbing is notably visible in the fertile lands of

Farmers protest in response to water cuts.
Photo: Martin Keulertz

Romania and Bulgaria. These are only a few telling examples. This is a dangerous situation for the quantity and quality of water resources and a threat to family farmers whose lives and livelihoods depend on sustainable access to clean and affordable water.

More accountability While trade is global, water management takes place at the local level. This raises important questions about power asymmetries because money and power is accumulated in the hands of a few global traders who largely ignore the needs of the many farmers that manage and use the water. Accountability of the few for their role in water governance, management and use is thus not an option but an imperative to avoid an all-out water crisis. This is our key message for actors working to improve global water governance. Obligatory accounting for water use would force corporations to disclose their water footprint via their balance sheets to allow investors and the interested public to compare and contrast performance. In that way, global agricultural traders would not only disclose their water footprint but their full power in global trade would be made public.

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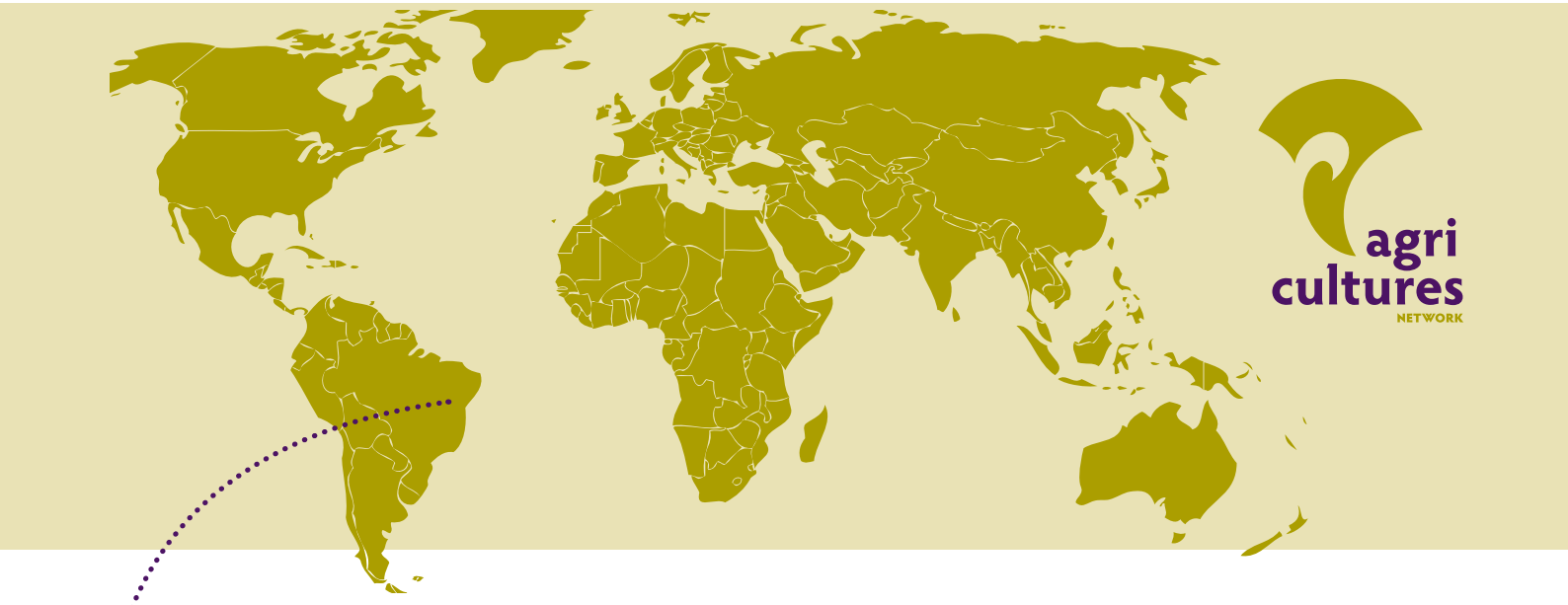

Members of the AgriCultures Network are working together to advance family farming and agroecology. Here is our latest update.

Latin America commits to agroecology

In June, the first regional agroecology seminar organised by FAO led to a strong commitment to 'boost' agroecology and food sovereignty as a way to strengthen family farming and food security in Latin America and the Caribbean.

"This seminar is an important step, and now we need to take the next. Agroecology should be incorporated in policy and practice in line with how it historically developed in Latin America: not as a niche, but as a vision for the transformation of agrifood systems that contribute to food sovereignty, social justice and environmental sustainability," commented Paulo Petersen of AS-PTA, who also moderated part of the seminar.

Photo: Karla Vieira

The event facilitated dialogue about the benefits, challenges and opportunities of agroecology. A statement was endorsed by representatives of governments in Latin America, FAO, civil society and regional bodies. The participants emphasised the value of ancestral knowledge, traditions, local wisdom and cultural identities as pillars of agroecology, and call for an intersectional and interdisciplinary 'knowledge dialogue' to foster agroecological innovation. Furthermore, they proposed agrarian reforms, land policies that guarantee land rights for indigenous and traditional communities. They call for greater support for the agroecological initiatives of women and the recognition of "the active role of families and communities, including women and youth, as guardians of biodiversity."

The statement points at the need to restrict the practice of monoculture, the use of agrochemicals and the concentration of land ownership, to "foster the increase of agroecological production by rural smallholder farmers in the region."

The regional agroecology seminar for Africa will be held in Dakar in November, and for Asia and the Middle East in Bangkok in December. The AgriCultures Network will document the contributions of outcomes of each seminar in a forthcoming report.

More updates from the AgriCultures Network at www.agriculturesnetwork.org/news,

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Co-creating knowledge in agroecology

Knowledge building and sharing are central to agroecology and family farming. It is a dynamic process and knowledge increases by sharing and learning; both practice and theory are important. Each farm and each community is unique. Given the great diversity of agroecosystems the world over, there is a need to continuously build situation-specific knowledge that, moreover, allows farmers to develop under unpredictable and changing circumstances.

Knowledge co-creation between farmers, scientists and others is key in agroecology. This type of knowledge co-creation, based on practical experience in agriculture and the latest scientific insights, is fundamentally different from mainstream 'lab to land' agricultural science. The latter produces standardised prescriptions, while the former supports farmers to take their own decisions, connects the local situation with the global context (e.g. mitigating and adapting to climate change), and draws from the many different ways of knowing.

The March 2016 issue of Farming Matters will explore how knowledge is co-created and shared by and between farmers, scientists, educators, communicators, input suppliers, citizens, politicians, and others; especially women and youth. And how this helps to spread and scale up agroecological approaches. We invite you to share your concrete experiences with co-creation and sharing of agroecological knowledge. The possibilities are infinite: farmer to farmer knowledge exchange continues developing itself, joint learning processes between farmers and scientists become more common, and online communication technology provides new possibilities for knowledge co-creation. What 'new' knowledge was created and shared? How effective was this? How did it influence the lives of the people involved? What is the greater socio-political relevance of your experience?

Articles for the March 2016 issue of Farming Matters should be sent to the editors before 1 December 2015. Email: info@farmingmatters.org

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"ATTEMPTS TO DENY ANYONE THE RIGHT TO WATER IS AN INEXCUSABLE DISCONNECT FROM NATURE."
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"There is a lot to gain from restoring the soil's capacity to capture and store water."
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"WHAT CAN WE LEARN FROM LOCAL COMMUNITIES WHICH HAVE ENJOYED A SYMBIOTIC RELATIONSHIP WITH THE ENVIRONMENT FOR MILLENNIA?"
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"Accountability of the few for their role in water governance, management and use is thus not an option but an imperative to avoid an all-out water crisis."
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2015
International Year of Soils

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