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Economic Cooperation**

Preliminary Report:

Desk research on the efficient use of agriculture water in the APEC economies.

APEC Project title and number:

**PPFS 04 2018 – Efficient and Sustainable Use of Water for
Agriculture under the New Climate Scenarios as a Contribution
to Food Security**

APEC Policy-Partnership on Food Security

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Introduction

This preliminary report consists of a review of experiences in the efficient use of water for agriculture in the APEC economies. The cases presented correspond to a selection of the best projects to improve the efficient use of water for agriculture, according to the criteria established by the sponsoring economies and the interested ones.

For information research, initially the main topics had to be defined to address on base of what is required by the counterpart.

This task of defining the research thematic was carried out together with the professionals of the National Irrigation Commission (Comisión Nacional de Riego) with the purpose of being able to include and encompass the main topics that have to do transversely with the efficient use of water in agriculture. All of this, within the framework of food safety in successful experiences that could be replicated in the APEC economies.

The relevant and contingent topics were defined as large research groups, which were called “dimensions”. Of the above, it was agreed that the topics that had to be included in these dimensions are the following: Watershed management; Water conduction systems; Renewable energy; Irrigation channel networks; Accumulation Systems; Aquifer recharge; and Others.

After this stage, the research itself is executed, supporting this activity through different digital media, websites, publications, news, magazines, among others that could throw results according to what you want to find out, and the methodology for research is done by economy and by dimension.

As a first approximation to the compilation of successful experiences, all the results that comply with the research criteria are reflected in a digital spreadsheet, which throws more than 200 results. Of the above, and so that the final document had a representative and executive character, the results are categorized by importance and fulfillment of the initially established criteria. The procedures to categorize the results are analogous to the color of a traffic light, leaving the results with greater relevance in green; the results that by some reason could not be replicated or that lacked research information in yellow; and finally, the results that for some reason had vague and/or ambiguous information or did not fully meet the search criteria were categorized with red.

Additionally, by e-mail and through the phone some private institutions (global and local), were contacted, both of implements, materials, management or other subject framed in the dimensions of irrigation research. Moreover, they were asked to collaborate, so they could share their experiences.

The format and content of the successful experiences files were defined with the responsible actors of the local economy (Chile).

The most relevant cases identified in the APEC economies

Economy: Singapore

Case N°: 1

Region / State / Province:

South west, 82 Sungei tengah rd, singapur 698985.

General Information:

Water conduction systems; water efficiency, water recycling.

Coordinates (UTM):

Zone 48 N ; East 358880 ; North 153486

Objectives:

- Perform water recycling through a method of a new water conduction system
- Achieve the cultivation of lettuce through hydroponics.

Summary / description / main characteristics:

Initially, he wanted to set up a hydroponic farm to grow lettuce but the weather here was far too hot.

He then hatched a solution: a closed-loop system, where vegetable grow trays are stacked above fish tanks to bring about a cooling effect. Water used for the fish would be piped to a filter to remove solid waste, and then pumped back into the system to water the vegetables. Getting ideas from the Internet, he started on the arduous journey - one speckled with successes, but not the ones he had hoped for. While altering the hydroponic system into an aquaponic system, he also set up several soil-based farms housed in greenhouses which would quickly grow to produce hundreds of kilograms of vegetables like kailan, chye sim and Chinese spinach a day.

Photographs / schemes:



Results obtained:

Achieve a system of aquaponics in vegetables of necessary parameters for the consumption of your premises and the sale of your vegetables. Give good use of water due to the scarcity of this, recycling it through the aquaponic system.

Source:

www.straitstimes.com/singapore/a-vegetable-fish-farming-system-that-is-truly-green

Case N°: 2

Region / State / Province:

200 lim kang lane 3 S (718804)

General Information:

Water conduction systems; water efficiency

Coordinates (UTM):

Zone 48 N ; East 357276 ; North 158105

Objectives:

- Minimize the use of land for the large amount of the population
- Generate crops without affecting the surface of the economy

Summary / description / main characteristics:

"Farming in the sky in Singapore"

The solution to the problem came in the form of a public-private partnership, with the launch of what has been hailed as the "world's first low-carbon, water-driven, rotating, vertical farm" for growing tropical vegetables in an urban environment. The result of a collaborative agreement between the agri-food and veterinary authority of Singapore (AVA) and a local firm, Sky Greens, this venture aims to popularise urban farming techniques that are also environmentally friendly.

Photographs / schemes:



Results obtained:

Sky Greens stringently adopts green technologies to achieve the 3R (reduce, reuse and recycle). This also helps to achieve sustainability for the good of the environment and to grow safe, high quality and fresh vegetables for consumers. The small amount of energy and water needed to grow vegetables, and the close proximity of the consumer potentially reduces transportation costs, carbon dioxide emissions and risk of spoilage.

Source:

<https://ourworld.unu.edu/en/farming-in-the-sky-in-singapore>

<https://permaculturenews.org/2014/07/25/vertical-farming-singapores-solution-feed-local-urban-population/>

Case N^o: 3

Region / State / Province:

NEWater Visitor Center 20 Koh Sek Lim Road Singapur 486593

General Information:

water recycling

Coordinates (UTM):

Zone 48N ; East 384150 ; North 146383

Objectives:

The main objective of the NEWater program is to provide a sustainable water source for Singapore's population. Within this framework, the work of the Public Utilities Board (PUB) has been crucial to its sustainable development. PUB strategy has included 'Four Taps' – expansion of catchment areas, water imported from neighbouring Johor in Malaysia, desalination and NEWater.

Summary / description / main characteristics:

What is NEWater?

NEWater is high-grade reclaimed water produced from treated used water that has undergone a stringent purification and treatment process using advanced dual-membrane (microfiltration and reverse osmosis) and ultraviolet technologies. It has passed more than 100,000 scientific tests and exceeds the drinking water standards set by the World Health Organisation (WHO) and the United States Environmental Protection Agency (EPA).

How is NEWater used?

NEWater is used primarily for non-potable industrial purposes at wafer (silicon circuits) fabrication parks, industrial estates and commercial buildings. This is important as the non-domestic sector currently accounts for 55% of Singapore's water demand and this could increase to 70% by 2060. During dry months, NEWater is used to top up the reservoirs and blended with raw water before undergoing treatment at the waterworks before it is supplied to consumers.

Photographs / schemes:



Results obtained:

Currently, NEWater can meet 30% of Singapore's daily water needs, which stands at about 1500 million litres a day. NEWater capacity will be increased to meet 55% of Singapore's future water demand by 2060.

Source:

<https://www.un.org/waterforlifedecade/winners2014.shtml>

Case N^o: 4

Region / State / Province:

Yishun

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 48N ; East 369424 ; North 156960

Objectives:

To bring to their consumers premium-grade hydroponics products that are pesticide-free and of high nutritional value, so as to maximize its benefits towards healthy living. To promote public awareness by providing assistance in advancing the

knowledge of hydroponics technology to organizations and educational institutions around the world.

Summary / description / main characteristics:

Oh' Farms is a one-stop supplier for its major customers. Products ranging from local-grown vegetables and cooking herbs to imports like exotic vegetables, herbs and fruits are supplied to supermarkets, hospitals, hotels, restaurants and other organizations on a regular basis.

Oh' Farms helps schools incorporate the study of hydroponics or life sciences into their curricula, from the building of greenhouses within school compound, to designing experiments to explore the area of life sciences. Similarly, community clubs and organizations have tapped onto Oh' Farms' expertise in setting up hydroponics facilities to promote the gardening hobby.

Oh' Farms also provides courses on topics like essential oil extraction, hydroponics cultivation, garden maintenance, etc., tailored to suit the needs of the customer. All through the year, Oh' Farms is opened to people of all ages and interests. We have received distinguished guests from other economies, school children and teachers, as well as community groups.

Photographs / schemes:



Results obtained:

As a forerunner in hydroponics technology, Oh Farms has played an active role in educating the younger generation on the new and efficient way to grow vegetables, aromatic herbs, fruits and flowers. Farm tours are specially conducted for students

interested in learning about hydroponics technology. At the farm, students get to see vegetables grow physically using a unique cultivation method in a pesticide-free environment.

Source:

<https://www.ohfarms.com.sg>

Economy: The Republic of the Philippines

Case N^o: 5

Region / State / Province:

Quezon

General Information:

knowledge transfer, app

Coordinates (UTM):

Zone 51P ; East 287814 ; North 287814

Objectives:

It aims to address questions and concerns from farmers, particularly on plant and animal disease management, through chat or live messaging feature.

Summary / description / main characteristics:

The FARM App is a 24/7 online-based help desk developed in coordination with key agencies and bureaus of the Department. The app also has a geo-tagging system to identify the location of the farmer. Through this, farmers, fishers, and other citizens can easily communicate with the DA.

Photographs / schemes:



Results obtained:

FARM App is downloadable on iOS and Android devices for free.

Source:

<http://ati.da.gov.ph/ati-main/news/03202019-1304/da-strengthens-connectivity-farmers-thru-farm-app>

Economy: United State

Case Nº: 6

Region / State / Province:

California

General Information:

Accumulation Systems

Coordinates (UTM):

Zone 10S ; East 583137 ; North 4105441

Objectives:

Farm ponds can be filled by rainfall and can be beneficial to irrigation water supply security on the farm

Summary / description / main characteristics:

A half-horsepower submersible pump is set-up to send the water up a hill to several 5,000 gallon holding tanks. Steven can control the flow of water from the pump house. The plumbing for this system is “very straightforward,” utilizing components that just about every farmer would be familiar with, such as PVC piping.

Photographs / schemes:



Results obtained:

To ensure that there is always ample water, they put in a 250,000 gallon plastic-lined pond. This pond usually fills up with the first rain of the season and provides them with about “one year’s worth of irrigation insurance.”

Source:

www.agwater.wordpress.com/farm-ponds

Case N°: 7

Region / State / Province:

Washington

General Information:

Irrigation Channel Networks

Coordinates (UTM):

Zone 11T ; East 297586 ; North 5217876

Objectives:

Repairing QCBID canals is a tricky operation, because work must be completed in a short time frame: from when the water is shut off in mid-October to when the water needs to be turned back on in early spring. In addition, winter snow and rain make it difficult to schedule access to the site and the installation of concrete.

Summary / description / main characteristics:

Because of canal expansions and additional pumping plants, the number of irrigated acres is over 680,000 in the Columbia Basin. In addition, the Columbia Basin Project provides power for millions of homes, controls flooding in the lower Columbia region, creates habitat for endangered species, and provides the public with areas for recreation.

Photographs / schemes:



Results obtained:

The entire operation was completed ahead of schedule and is now helping to save water throughout the Columbia Basin. So far, the QCBID has lined more than 6 miles of rehabilitated canals with an estimated water savings of more than 3,860 acre-feet.

Source:

<http://irrigationleadermagazine.com/a-case-study-in-extending-canal-life-at-the-quincy-columbia-basin-irrigation-district/>

Case Nº: 8

Region / State / Province:

California

General Information:

Accumulation systems

Coordinates (UTM):

Zone 10S ; East 555760 ; North 412353

Objectives:

Rainwater catchment and water recycling

Summary / description / main characteristics:

Harley Farms recycles its water by capturing all of the water that has already been used to clean the milking parlor, pasteurizer, and creamery and then spreading it out over the pastures as a form of irrigation. Besides an annual cleaning of the roof and drainpipes for the rainwater barrels—and some maintenance of the filtration system—the whole rainwater catchment and water recycling system takes “very little maintenance, really,” according to Dee.

Photographs / schemes:



Results obtained:

Owner Dee Harley captures and recycles rainwater as well as water from the dairy and creamery. These efforts save Harley Farms Goat Dairy 40,000 gallons of water per

year and allow for the development of specialty crop production for their on-farm dinners and other events.

Source:

<https://agwater.wordpress.com/case-study-rainwater-catchment-and-water-recycling-at-harley-farms-goat-dairy/>

Case N°: 9

Region / State / Province:

Nebraska

General Information:

Water conduction systems

Coordinates (UTM):

Zone 14T ; East 469336 ; North 4610388

Objectives:

STREAMLINING SARGENT IRRIGATION DISTRICT'S CANALS AND PIPELINES

Summary / description / main characteristics:

The screen we installed is set to handle a maximum of 70 cfs for the particular area of the canal where it is going to be placed. When we first start to run water through the system, we will operate the screen continuously until the trash from over the winter is gone. In the summer, when our water flows are around 10–20 cfs, we will run it every 30 minutes. If we have flows of about 25–40 cfs, we will use the screen every 15 minutes, and every 10 minutes when we have a flow of 40–70 cfs.

When we installed the screen, we had a local contractor construct all the concrete around the structure to International Water Screens' specifications. The installation of the screen was easy—the screen was simply lowered in. It sits in on its weight and does not require bolts, which makes it easy to install and remove.

Photographs / schemes:



Results obtained:

The farmers went from cleaning the trash screens in their pivots four to six times a day to cleaning them only once every couple of rotations.

Source:

<http://irrigationleadermagazine.com/streamlining-sargent-irrigation-districts-canals-and-pipelines/>

Case N°: 10

Region / State / Province:

4W75+F8 Oakes, Dakota del Norte, EE. UU.

General Information:

Water conduction systems

Coordinates (UTM):

Zone 14 T ; East 570188 ; North 5107080

Objectives:

The Dyna Flo Flood pump is a revolutionary pump that works great for flood use, to empty sloughs, pond transfers, and more. Whenever you have water that needs to be pumped out or transferred, the Dyna Flo Flood Pump may be just what you are looking for.

Summary / description / main characteristics:

The most versatile offers is the Dyna Flo pump, a powerful, affordable and easy to tow pump that can pump 3,000 to 4,000 gallons of water per minute. It works well to drain flooded fields, irrigate by flood or simply move large amounts of water. General

Irrigation rents many guns, pipes, engines, power take off (PTO) pumps and other equipment. Each year, we receive requests for a large pump that could pump 3,000 to 4,000 gallons per minute. We did not have one, and the pumps that could work like that were pretty expensive, so in early 2008 we decided to build one ourselves. The first time we rented our new Dyna Flo pump, the tenants returned the call and offered to buy it.

Photographs / schemes:



Results obtained:

Above all flood control. Others are being used for flood irrigation, dehydration or the dumping of water in a bank. There is one running in California in a rice field. We even have a pump running in Australia to irrigate the crops.

Source:

<http://irrigationleadermagazine.com/the-dynamic-dyna-flo-pump/>

Case N°: 11

Region / State / Province:

Nebraska / Omaha

General Information:

Irrigation control and monitoring APP

Coordinates (UTM):

Zone s/i ; East s/i ; North s/i

Objectives:

Monitor and operate irrigation equipment through an application with better ease / FieldNET® by Lindsay puts you in total control. Gain fast, easy access to your entire irrigation operation. As your fully integrated wireless management tool, FieldNET lets you view and control your systems from virtually anywhere.

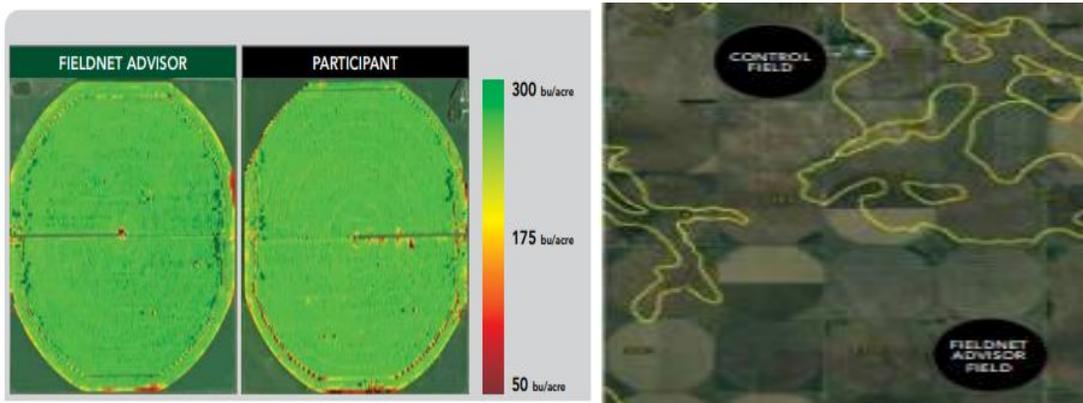
It all adds up to less time in the field, less spent on valuable resources and greater control of your operation.

Summary / description / main characteristics:

Advisor uses proven soil-water balance irrigation concepts and methods (often referred to as the “checkbook method”), along with proprietary crop growth models, as-applied irrigation data and hyper-local, field-specific weather data to generate the data needed to make more informed irrigation decisions.

- Track the available soil water throughout the field by combining a soil map of the field, proprietary dynamic crop canopy and root growth models, hyper-local weather data and the applied irrigation history.
- Forecast the crop’s future water needs and predict when and where, without additional irrigation, the yield will begin to decline due to water stress. It also estimates the amount of yield that would be lost to water stress, which varies based on the crop’s development stage and the severity of the stress.
- Create a high-resolution map showing the amount of water available to the crop across the entire field.
- Automatically generate variable rate irrigation(VRI) prescriptions, which are continuously updated and optimized to account for actual and forecasted weather, changing crop water requirements and as-applied irrigation.
- Integrate into FieldNET® by Lindsay’s remote monitoring and control platform, giving growers the ability to immediately put their irrigation decisions into action and monitor their progress.

Photographs / schemes:



Results obtained:

Located in North Central Nebraska, two test fields were planted on the same date using the same corn hybrid. The two fields were in close proximity and had substantially similar soil types.

On the control field, the grower used his traditional methods of determining when and how much to irrigate.

On the test field, Lindsay officials managed irrigation remotely using FieldNET Advisor's recommendations.

One capacitance type and one soil water tension sensing soil moisture probe was placed in each test field. Satellite imagery, including NDVI, EVI and other proprietary imagery enhancement methods, was captured by multiple satellite sources throughout the season.

An agronomist scouted both test fields weekly to ground truth crop development and record any additional factors.

Yield maps were captured and analyzed at the end of the season to assess the results.

Both fields were harvested on the same date using the same combine with a calibrated GPS yield monitor to produce the yield comparison data. FieldNET Advisor performed as expected during the growing season—delivering critical, science-based information to help determine when to run the irrigation system and how much water to apply. When compared to the control field, FieldNET Advisor provided a 3% yield increase while using 17% less water, resulting in almost \$35/acre in increased profit.

Source:

http://www.myfieldnet.com/stuff/contentmgr/files/6/3b9933136920f90ea910e03ca7e1967d/pdf/lindsay_fieldnet_whitepaper_advisor_0118_web.pdf

<http://www.h2grow.nz/2018/11/new-improved-irrigation-remote.html>

Case N°: 12**Region / State / Province:**

California

General Information:

Aquifer recharge

Coordinates (UTM):

Zone 10 S; East 653118; North 4203278

Objectives:

The Program's goal is to spread an average of 35,000 acre-feet of water annually on 800 to 1,200 acres of land generally bound by Jack Tone Road on the east, Highway 99 to the west, the Mokelumne River in the north and Temple Creek in the south. The Program seeks to enroll parcels ranging from 20 to 100 acres and construct field-flooding recharge facilities. A slope of no more than three degrees is typically optimal, allowing varied water depths from zero to 18 inches. A slight slope is beneficial as it provides a variety of water depths for various waterfowl species. Vegetation in the recharge basin may either be stubble from the prior year's crop, natural vegetation or a combination. Fields without vegetation will change as water is applied and recharged. Monitoring wells would be installed to track changes in groundwater elevation and groundwater quality, in response to percolation of surface water into the groundwater aquifer.

Summary / description / main characteristics:

Construction: Under terms of the property agreement with the landowner, construction of field-flooding recharge facilities would be managed by Stockton East Water District or the U.S. Army Corps of Engineers. Short dirt levees may be installed in the recharge basin for erosion control. Dirt levees would be pushed up around the perimeter of the recharge basin. Some levees may be covered with plastic to control wind erosion.

Operation: Surface water would be delivered to the parcels during the winter months, usually beginning with the first flood flows to the watersheds. These waters will be drawn from Calaveras, Mokelumne, Littlejohns and Stanislaus watersheds. Depending on the site's location to the water source, the final delivery may be via open ditch or pipeline. Supervision of the flow of the water is provided by the Program consultants.

Maintenance: Maintenance during field flooding would be similar to typical irrigation practices for crops. This includes monitoring for levee breaks, erosion control and other factors specific to the facility. Dry season maintenance will be site specific and could include levee and erosion control maintenance and tilling.

Monitoring: Monitoring wells will be positioned at each site and managed by the Program sponsor. These wells will monitor changes in groundwater elevation and groundwater quality in response to recharge. These wells will also be useful in determining the direction of groundwater movement. Recharge facilities that show a consistent lateral migration of water – and therefore present a likelihood to damage nearby crops – will be removed from the Program.

Photographs / schemes:



Results obtained:

The Farmington Groundwater Storage Pilot Project – the debut recharge facility of the Farmington Groundwater Recharge Program – has been named the Water/Environment Project of the Year, 2003, by the American Society of Civil Engineers.

Provided by the Society's Sacramento Section, the award recognizes completion of a 60-acre recharge facility at Stockton East Water District (SEWD) headquarters and the program on which it is based – the Farmington Groundwater Recharge Program. The \$2.4 million facility includes a 19-acre pond and three recharge basins, totaling 35 acres-. Annual recharge capabilities at the site are estimated at 7,000 acre-feet.

Source:

<http://www.farmingtonprogram.org/process.html>

Case N°: 13

Region / State / Province:

Newman, California.

General Information:

Aquifer recharge

Coordinates (UTM):

Zone 10 S ; East 689707 ; North 4103223

Objectives:

Perform the artificial recharge of the aquifer in the Newman area.

Summary / description / main characteristics:

The project is a joint effort of the Central California Irrigation District and Del Puerto Water District, said Chris White, CCID general manager. The pilot project is testing the feasibility of increasing water storage by recharging groundwater aquifers, which can then be drawn upon in dry years.

Photographs / schemes:



Results obtained:

The pilot project turned out to be very successful on the recharge side.

Based on testing a few years back, we believed we could get water into the ground at a short rate of just six inches a day. We built a 20-acre pilot facility, and we were getting two feet (absorption) per day. It way over-performed.

Source:

http://www.westsideconnect.com/news/local_news/groundwater-recharge-project-shows-encouraging-results/article_1a2c1cae-519e-11e9-adfd-c33e1cb1c2a6.html

Economy: New Zealand

Case Nº: 14

Region / State / Province:

326 Burnett Street- Ashburton,-Canterbury, 7700, Nueva Zelanda

General Information:

Accumulation Systems; Irrigation efficiency

Coordinates (UTM):

Zone 59 G ; East 560174; North 5138248

Objectives:

- Improve the use of water due to the unstable climate of the economy
- Distribute water to all farmers, retaining the necessary water to avoid deficits.

Summary / description / main characteristics:

All seven ponds cover 300 hectares (741 acres).

The biggest pond covers 48ha (119 acres) and is about 8.9m deep.

Each pond holds on average about 2.3 million cu.m of water.

At full capacity, the scheme can hold 16.5m cu. m of water.

On average, farmers are supplied 0.48 litres of water per second per hectare.

The scheme provides water to 42 ponds owned by 36 clients.

The scheme costs £67 million to build and £260,000 per year to maintain.

The ponds were built via 'cut and fill' whereby 4 m cu. m of soil and gravel were dug from the ground and used to build the bank sides of the pond.

Photographs / schemes:



Results obtained:

The site spans over 400ha (988 acres) and consists of seven storage ponds. The storage ponds supply 42 on-farm ponds which irrigate about 14,000ha (34,594 acres) of farmland.

Each pond on the irrigation scheme has the capacity to hold about 2.3 m cu.m of water, while on-farm ponds vary widely in size from 20,000 cu. m to about 400,000 cu. m.

The movement of water both into the scheme, between ponds and out to farmers is all controlled via a phone or laptop using telemetered automation or if required, via manual operation from a control hut.

Source:

<https://www.fginsight.com/news/news/the-new-zealand-water-farmer-57470>

Case N°: 15

Region / State / Province:

Auckland

General Information:

Irrigation efficiency

Coordinates (UTM):

Zone 60 H ; East 300435 ; North 5920078

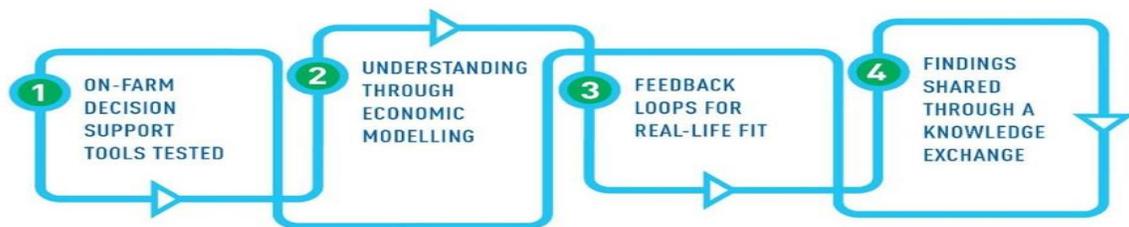
Objectives:

The programme aims to support dairy farmers in moving away from a 'just in case' or 'just in time' scheduling towards an irrigation approach that accounts for both current demand and future supply.

Summary / description / main characteristics:

Irrigation Insight is a collaborative research programme between industry and CRI's including NIWA, DairyNZ, Fonterra, AgResearch and IrrigationNZ, that builds on NIWA's earlier pilot work in Canterbury. The research examines the application and effectiveness of using improved weather forecast and drainage estimations to inform on-farm water management on irrigated dairy farms.

Photographs / schemes:



Results obtained:

The pilot farms have been set-up with instruments to profile the soil moisture and gauge rain. Soil moisture and temperature are measured at eight discrete depths, from the surface to 80 cm depth, allowing management of irrigation and drainage simultaneously. The rain gauge measures rainfall and irrigation. Data from these instruments are telemetered every hour and are available for farmers 24/7 in real-time.

Source:

<https://www.niwa.co.nz/freshwater-and-estuaries/freshwater-and-estuaries-update/freshwater-update-77-may-2018/irrigation-insight>

Case N°: 16

Region / State / Province:

level 1/167 Main St, Methven 7730, Nueva Zelanda

General Information:

Irrigation efficiency

Coordinates (UTM):

Zone 59 G ; East 552206 ; North 5168892

Objectives:

- Implement farm pressure farming techniques
- Improve yields through precision farming
- Implement soil moisture sensors to control water losses.

Summary / description / main characteristics:

One Kiwi farmer believes the adoption of precision farming is at the tipping point in New Zealand as farmers look to optimise input use and reduce environmental impact. Future Farming paid him a visit to see how technology is helping on his 200 ha arable unit near Methven, Canterbury. Environmentally, the case is convincing, since the risk of leaching or runoff of nutrients is reduced and almost all the water that is extracted for irrigation goes into production. The Aqua Check capacitance probes, installed after sowing each year and removed before cultivation, provide a continuous record of soil moisture in 35 zones along the 200 ha.

Photographs / schemes:



Results obtained:

The combination of addressing variation in fertility and water availability, tuning seed rates to soil types and adjusting sprays on the move has boosted wheat yields in the lightest areas from 7 t/ha to 10-12 t/ha, for little -if any- extra annual input, while the high-yielding bits have edged up as well.

Source:

<https://www.futurefarming.com/smart-farmers/articles/2017/10/farm-visit-precision-technology-drives-profitability-on-this-NZ-farm-1561WP/>

<https://www.agrioptics.co.nz>

Case N°: 17**Region / State / Province:**

Hawke

General Information:

Water conduction systems; Irrigation efficiency.

Coordinates (UTM):

Zone 60 H ; East 493888 ; North 5616755

Objectives:

Design and implement an irrigation system over a newly developed 47 hectare apple orchard.

Summary / description / main characteristics:

47 hectare Ebbett Orchard on the banks of the Tutaekuri River at Moteo in Hawke's Bay is the single largest development undertaken by T&G. A total of 113,000 trees were planted at a spacing of 3 metres between rows and 1.4 metre between trees.

To effectively irrigate this size orchard 165,500 metres of pressure compensating drip line was run using a 4WD quad bike.

With 1.4-million metres of wire, and 22,000 posts, the development kept teams of fencers working for seven months.

Photographs / schemes:



Results obtained:

The 47 hectares are divided into 16 irrigation zones which are run from 8 irrigation stations. Flow rate across the zones varies from 5.3 litres per second to 39.8 litres per second and can deliver 1.8 mm of irrigation depth per hour.

Twin pumps provide capacity for the irrigation zones to be co-valved to 4 stations per pump. A rotation time of 22 hours pumping per day allows for 5.5 hours per station, equating to an approximate application of 10 mm applied.

Source:

<https://www.irrigationservices.co.nz/case-studies-2/apple-orchard-irrigation-system/>

Case N°: 18

Region / State / Province:

Canterbury

General Information:

Telemetry

Coordinates (UTM):

Zone 59 G ; East 563025 ; North 5173884

Objectives:

Rubicon was outsourced to provide the district with SCADA hardware and software, including:

-145 pedestals, communication and control, in the parcelarias to remotely monitor the flow and pressure of the pipes, and to turn on and close the valves.

-The radio communication system.

-The central system SCADAConnect.

Summary / description / main characteristics:

An interesting aspect of the CPWL solution is the way in which the software manages water rationing when the demand exceeds the available supply. Instead of rationalizing by reducing flow rates, which is not appropriate for system pressure sprinklers, our standard software was adapted to rationalize the time the sprinklers can operate.

Photographs / schemes:



Results obtained:

The first phase of the system supplies water to 120 farms and it is expected to contribute approximately one billion dollars to the New Zealand economy in the form of increased agricultural production. Two other phases are planned to increase the irrigation area from 20,000 to 60,000 hectares.

Source:

<https://www.iagua.es/noticias/nueva-zelanda/rubicon-water/16/04/15/central-plains-water-circulacion>

Economy: China

Case N°: 19

Region / State / Province:

Jinlin, Heilongjiang

General Information:

Accumulation systems

Coordinates (UTM):

Zone 52 T ; East 492159 ; North 4772840

Objectives:

Optimizing product structure by connecting the hydraulic dam and bottom hinge joints into an integrated A32 and establishing the theory and method of optimal structural design.

Selecting and improving the key components of the hydraulic system, including the design and optimization of hydraulic system principles and the selection of key hydraulic equipment.

Innovating and integrating the features of electronic control system for safer and smarter operation, including powerless dam drop warning, intelligent powerless dam drop, intelligent deicing and pressurizing, and APP-based mobile real-time monitoring.

Summary / description / main characteristics:

To decrease the effects of traditional mobile dams as well as keeping as many basic advantages as possible, in a way that dams can work properly in terms of safety, applicability, durability and maintenance. This, while satisfying diverse necessities, including water storage for the urban landscape, irrigation and flood control.

Photographs / schemes:



Results obtained:

They are capable of an annual production of 10,000 square meters and the related control equipment manufacturing, engineering design and construction, and technical services. The technology developed by the study has been successfully applied in more than 30 dams of 2,900 linear meters in 15 Chinese municipalities and provinces, such as Beijing, Jilin, Shandong, Guizhou and Heilongjiang, and in foreign economies such as Myanmar and Thailand. It has broad prospects for promotion and application.

Source:

<http://www.iwhr.com/IWHR-English/research/researchProgress/webinfo/2018/03/1513764694310427.htm>

Case N°: 20

Region / State / Province:

state/domestic??

General Information:

Watershed management

Coordinates (UTM):

Zone s/i ; East s/i ; North s/i (Nationwide)

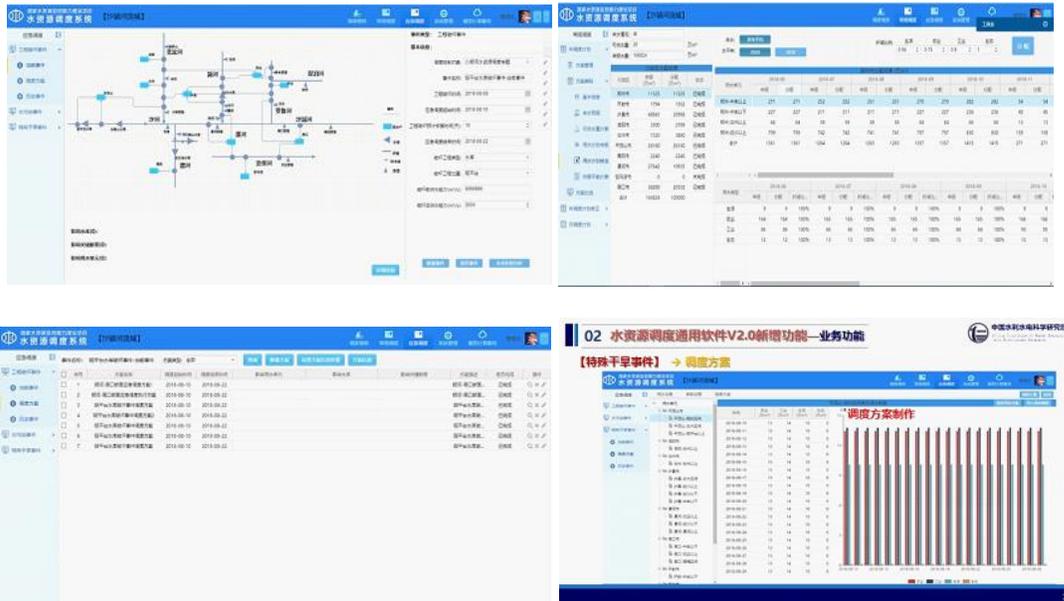
Objectives:

The domestic water resources monitoring capacity building will be carried out in two phases. The software is the most important part for the second phase (2016-2018) to monitor water resources. Regulations and interaction of information of water resources monitoring are key targets of the second phase construction

Summary / description / main characteristics:

National water dispatching software, software management system, and model cloud computing platform developing.

Photographs / schemes:



Results obtained:

The software is applied on multiple platforms including Ministry of Water Resources, 7 major basins and 32 provincial platforms.

Source:

<http://www.iwhr.com/IWHR-English/research/ResearchProgress/webinfo/2019/01/1552618843852056.htm>

Case N°: 21

Region / State / Province:

Minquin

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 48 S ; East 334062 ; North 4276695

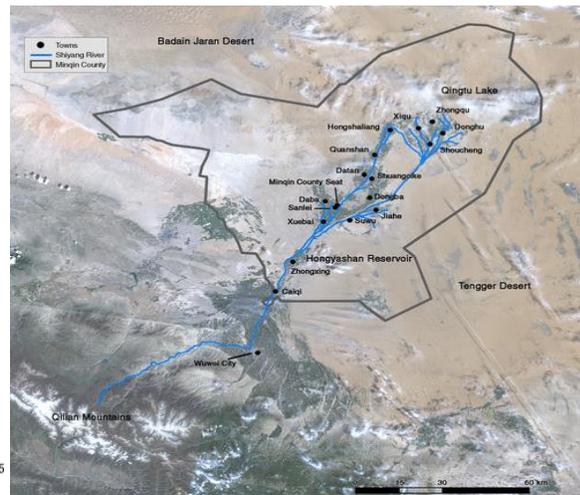
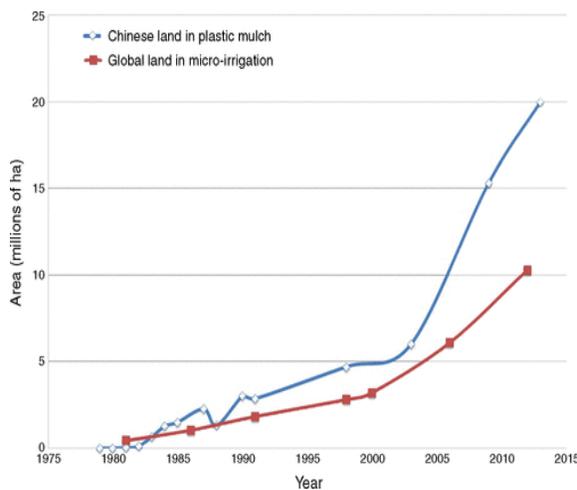
Objectives:

Study the behavior of technified irrigation in crops with plastic mulch.

Summary / description / main characteristics:

Plastic mulch is commonly used with micro-irrigation in developed economies; however, Chinese farmers use plastic mulch on a vast scale independent of micro-irrigation. For the past three decades, China's land area in plastic mulch has exceeded the world's total land area in micro-irrigation. We report results from the water-scarce region of Minqin County, where 87% of Chinese farmers interviewed responded that they use plastic mulch to conserve water and 53% to increase yields. Survey results indicated the desire to conserve water through the use of plastic mulch to be statistically equivalent to the desire to increase yields. Responses to interviews and surveys indicate that farmers perceive water savings of 24–26% when plastic mulch is used. Interview and survey responses suggest farming families are shifting to purchasing wheat from outside the region; a potential import of “virtual water” into this water-scarce region.

Photographs / schemes:



Results obtained:

Our results suggest that the use of plastic mulch provides farmers with water savings. According to interview results, farmers have reduced their annual water irrigation

events from 7 to 5.3 by using plastic mulch; a savings of 24%, consistent with farmer estimates of conserved water in our surveys (water savings of 26%). Based on these data, we estimate water savings of ~25% for farmers of Minqin County when plastic mulch is used with traditional flood irrigation methods to grow cash crops, such as cotton, corn, and melons.

Source:

<https://esajournals.onlinelibrary.wiley.com/doi/full/10.1890/EHS14-0018.1>

Case N°: 22

Region / State / Province:

Hami in the Xinjiang Uygur autonomous region

General Information:

Water conduction systems

Coordinates (UTM):

Zone 46T ; East 542112 ; North 4740779

Objectives:

Improve groundwater through an innovative irrigation system.

Summary / description / main characteristics:

This system is named as ‘trace irrigation,’ by its inventor, Beijing native and businessman Zhu Jun, who has been working on this system for about a decade. It is said that this system of irrigation cuts down on pests, and fungus and weeds. Plus, a huge amount of water is saved, and the vegetables also taste better. This system uses PV pipes, buried a foot or even deeper in soil. The pipes get narrower, and narrower, until they’re like thin straws, with something that looks like a tiny showerhead at the end, with little white threads coming out of it. These pipes are buried in the soil – and the plant sucks the moisture it needs from these threads.

Photographs / schemes:



Results obtained:

Zhu says his system saves 70 or more of the water used in surface irrigation in China, and 30 to 50 percent compared to the alternative system of drip irrigation.

Source:

<https://www.pri.org/stories/2013-06-17/low-water-lunch-chinese-breakthrough-irrigation>

Case Nº: 23

Region / State / Province:

Guangxi Zhuang

General Information:

Water efficiency

Coordinates (UTM):

Zone 48 Q ; East 743853 ; North 2477031

Objectives:

Make an improvement in the water conduction for the sugar cane cultivation.

Summary / description / main characteristics:

Coca-Cola has been helping to provide safe drinking water to farmers, boosting water-use efficiency by helping to optimize irrigation facilities and methods, and promoting reuse of the treated nutrient-rich wastewater from the sugar milling process for irrigation purposes; thereby conserving water resources and increasing sugarcane yield at the same time. In addition, Coca-Cola constructed and improved pipelines for local farmers to access to clean drinking water, making it a sustainable agriculture demonstration project.

Photographs / schemes:



Results obtained:

The Guangxi Sustainable Sugarcane Initiative has simultaneously boosted sugarcane production and replenished an estimated 2.7 billion liters water per year for local communities. The initiative benefits more than 6,000 sugarcane farmers directly and 150,000 people in local communities indirectly, including a large number of ethnic minority women and children.

Source:

<http://www.kankanews.com/a/2016-03-20/0017430311.shtml>

<https://www.coca-colacompany.com/stories/coca-cola-expands-sugarcane-irrigation-project-in-china>

Case N°: 24

Region / State / Province:

Hebei, Shanxi y Ningxia

General Information:

Water efficiency, irrigation management

Coordinates (UTM):

Zone s/i ; East s/i ; North s/i

Objectives:

Improving sustainable agricultural water management.

Summary / description / main characteristics:

The project sought to reduce water withdrawal for irrigated agriculture in Ningxia and Shanxi Provinces, and groundwater overdraft in Hebei Province. In addition, the project also provided incentives to farmers to lower the agricultural production costs and increase the agricultural yield and value in all three of those provinces.

Photographs / schemes:



Results obtained:

The Water Conservation Project II resulted in increases in the farmer's incomes, while reducing water consumption and conserving the environment. The increase in agricultural water productivity also enhanced the climate resilience of the farming communities.

Source:

<http://blogs.worldbank.org/water/china-experience-tackling-water-scarcity>

Case N°: 25

Region / State / Province:

Xinjiang

General Information:

Water efficiency, irrigation management

Coordinates (UTM):

Zone 45 T ; East 547241 ; North 4705692

Objectives:

Improve irrigation efficiency and water use in rice cultivation.

Summary / description / main characteristics:

A new irrigation system was developed for the cultivation of rice in the economy of china, which helped to improve the efficiency of the crop, improve the distribution of water and management of pests that affected the crop.

Photographs / schemes:

s/i

Results obtained:

we can observe a decrease in the use of water by farmers, improvements in crop yields, reduced waste by fertilizers via irrigation.

Source:

http://www.chinadaily.com.cn/kindle/2014-10/03/content_18694873.htm

Case N°: 26

Region / State / Province:

economy/state

General Information:

Water efficiency

Coordinates (UTM):

Zone s/i ; East s/i ; North s/i (Nationwide)

Objectives:

Improve the sustainability of agriculture through a massive experiment

Summary / description / main characteristics:

Running from 2005 to 2015, the project first assessed how factors, including irrigation, plant density and sowing depth affected agricultural productivity. It used the information to guide and spread best practice across several regions: for example, recommending that rice in southern China be sown in 20 holes densely packed in a square metre, rather than the much lower densities farmers were accustomed to using.

Photographs / schemes:

s/i

Results obtained:

The results speak for themselves: maize (corn), rice and wheat output grew by some 11% over that decade, whereas the use of damaging and expensive fertilizers decreased by between 15% and 18%, depending on the crop. Farmers spent less money on their land and earned more from it — and they continue to do so.

The results offer hope in the search for a more sustainable future on a crowded planet. After all, some 2.5 billion smallholders together farm 60% of the world's arable land. Beyond that, the project provides many lessons. First, that a scientific approach can increase agricultural productivity and cut damage to the environment. Second, that such success requires investment in what economists call the intangibles — the creation of networks to spread information and give scientists access to essential data. The scale of the research network created is impressive: 1,200 scientists, 65,000 local officials, 140,000 industry representatives and 21 million farmers across 37.7 million hectares.

Source:

<https://www.nature.com/articles/d41586-018-02742-3>

Case N°: 27

Region / State / Province:

Shiyang River, Hubei

General Information:

Irrigation management; Monitoring system

Coordinates (UTM):

Zone 50R ; East 242027 ; North 3387524

Objectives:

The aim of the project is to demonstrate that better observation and planning tools can assist decision makers.

Summary / description / main characteristics:

Client: Shiyang River Basin Management Bureau (SRBMB) with financial support of the Program Partners for Water. In northern China, groundwater depletion reached catastrophic levels. Therefore, the Chinese government was looking for improved groundwater assessment and management tools. The GMPEP (Groundwater Management and Exploration Package) project demonstrated that better observation and planning tools can assist decision makers. Focus of the project was on the Yellow River Basin and the Shiyang River Basin. GRACE satellite information formed the base in GMPEP for past and current groundwater trends. WEAP (Water Evaluation And Planning system) was used to evaluate future alternatives in sustainable groundwater management. To make the results from the WEAP and GRACE analysis easily available, a web-based tool was developed.

Photographs / schemes:



Results obtained:

In an effort to make the results from the WEAP and GRACE analysis easily available, a web-based tool was developed. Users can view maps and animations of a number of observed and modeled quantities, including groundwater storage change, precipitation, soil moisture, and GRACE-derived monthly storage estimates. The data is visualized over the target area using Google maps. To date, only analysis over the Shiyang and Yellow River basin has been generated, but could be extended to any other basin.

Source:

<https://www.futurewater.eu/projects/gmep/>

Economy: Mexico

Case N°: 28

Region / State / Province:

Torreón, Comarca Lagunera de México Norte

General Information:

Aquifer recharge

Coordinates (UTM):

Zone 13R ; East 655365 ; North 2829345

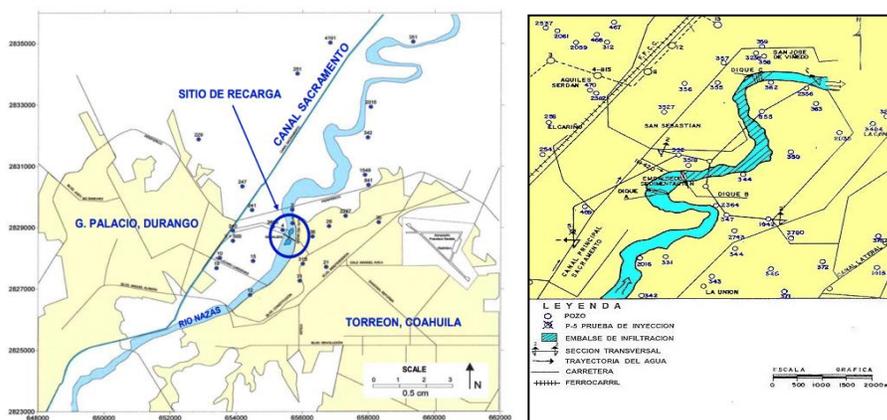
Objectives:

Perform recharge of aquifers through injection wells.

Summary / description / main characteristics:

A pilot aquifer recharge project was carried out in the Comarca Lagunera de México Norte, one of the main agricultural areas of the economy. The water supply for irrigation is based on the discharges from rivers that drain into the region, the Nazas River and the river Aguanaval and some 3,500 holes that extract groundwater from the Comarca Lagunera aquifer, for agricultural, domestic and industrial purposes. Currently, it is estimated that the extraction is at least three times greater than the recharge, which results in a significant decrease in the piezometric surface and a deterioration in the quality of the underground water. The biggest problem is the presence of arsenic in the groundwater at concentrations well above the WHO recommended value for domestic use of 0.05 mg / l, currently suggested 0.01 mg / l.

Photographs / schemes:



Results obtained:

The pilot plan used a nearby adapted sandy recharge basin to the bed of the Nazas River, in the city of Torreón, which covers an area of 13 has an approximate capacity of 197,000m³. They were implemented water supply networks to transport the surface water of the Zarco dam, through the Sacramento irrigation canal, to the basin of recharge. Two monitoring wells were drilled to observe the answers of the local phreatic level during the recharge and twelve pre-existing wells were conditioned for additional monitoring purposes of the phreatic level. During the tests carried out between May and August of 2000, a total volume of 5.2 Mm³ was transported through the channel from Sacramento to the recharge basin. Of this volume, 0.2 Mm³ It was evaporated and 5.0 Mm³ were infiltrated to the subsurface. The infiltration capacity of the water was reduced from 2.4 m / d to 0.116 m / d due to obstruction problems.

The recommendations of the pilot plan included building new structures to control the release of water to the basins, freeing up 0.5 Mm³ / week in order to avoid overflowing the basin, constructing parallel sedimentation basins in order to reduce obstruction problems, and build adsorption wells of 20 m depth and more than 0.3 m in diameter to avoid the horizons of low conductivity.

Source:

<https://agua.org.mx/wp-content/uploads/2010/04/EstrategiasGestiondeRecargaAcuiferos.pdf>

Case N°: 29**Region / State / Province:**

Querétaro

General Information:

Accumulation Systems; Water conduction systems.

Coordinates (UTM):

Zone 14 Q ; East 348701 ; North 348701

Objectives:

Construction of underground water dams for the accumulation and use of it.

Summary / description / main characteristics:

The underground dams are impermeable barriers that are placed in the permeable substrates of the floors, which is where the water flows, supported and cemented where the water stops, stores and controls and then can extract it.

Photographs / schemes:



Results obtained:

It was built in Charape de los Pelones, Queretaro, a community that suffered water scarcity for 50 years. Today, it helps to solve this problem by combining storage, collection and extraction systems that have benefited 500 inhabitants without having to wait for the rainy season.

Source:

<https://www.mexicampo.com.mx/presas-bajo-tierra-opcion-sustentable-para-resolver-escasez-de-agua/>

Case N°: 30

Region / State / Province:

Valle de Mexicali

General Information:

Water conduction systems

Coordinates (UTM):

Zone 11S ; East 645999 ; North 3610742

Objectives:

Underground drip irrigation technique, a system that reduces water demand by approximately 25 percent and increases production by 30 percent.

Summary / description / main characteristics:

The underground drip irrigation system is an irrigation technique specialized in the components of the system installed below the ground, consisting of a network of lateral lines and secondary lines that are buried for continuous use for years.

Photographs / schemes:



Results obtained:

Dr. María Isabel Escobosa affirmed that for every 10 thousand cubic meters of water that is destined for cultivation through traditional irrigation, the technique of underground drip irrigation can reduce them to six thousand 500 cubic meters per hectare, which represents a reduction of 35 percent.

Source:

<https://www.sinembargo.mx/17-06-2018/3420830>

Case Nº: 31

Region / State / Province:

Jalisco

General Information:

Water efficiency.

Coordinates (UTM):

Zone s/n ; East s/n ; North s/n (Nationwide)

Objectives:

Decrease the use of water in crops through a biodegradable polymer in non-toxic powder.

Summary / description / main characteristics:

Solid rain is a non-toxic biodegradable polymer powder that is capable of absorbing 200 times its weight in water. Upon contact with water, the powder becomes a gel and can store the liquid for up to 40 days. Farmers use it to store rainwater and use it as an irrigation method. They spread the powder underneath their crops so that when it rains the chemical becomes a gel and can store the liquid for up to six weeks. 25 kilograms of the product are required for one hectare of crop.

Photographs / schemes:



Results obtained:

The system allows farmers to save up to 80% in costs, since they use less water, fertilizers, electricity and labor.

Source:

https://agroalimentando.com/nota.php?id_notas=206

<http://www.metropolisseptica.com/charles-darwin-y-ciencias-naturales/cientifico-mexicano-sergio-rico-velasco-el-padre-de-la-lluvia-solida/>

Case Nº: 32

Region / State / Province:

State of the city of Mexico

General Information:

Water conduction systems

Coordinates (UTM):

Zone 14 Q; East 483043; North 2141926

Objectives:

Crop production under a new recirculating hydroponic system.

Summary / description / main characteristics:

It is a closed system with a main water reservoir and the constant circulation of it. Through the use of sensors, water circulation is programmed with nutrients that are injected into the system, the plant receives water shots according to production requirements and surpluses are returned to the system through drainage to the main reservoir. It is important to note that this system avoids contamination of the soil by bacteria and fungi.

Photographs / schemes:





Results obtained:

It has managed to generate surpluses so that the tomato and pepper can be destined to the export market. In addition, they supply locally the restaurants of the partners and consumers of the state of Querétaro.

Source:

<http://www.redinnovagro.in/docs/E BOOK 40 CASOS EXITO.pdf>

Case Nº: 33

Region / State / Province:

Jalisco

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 13Q; East 633932; North 2304991

Objectives:

To apply an holistic method of Innovation with the use of: tr Greenhouses, use of specialized substratums, fertigation by drip and microclimatic monitoring system.

Summary / description / main characteristics:

Bloom Farms® works with a variety of plants from Driscoll's®, different substratums and high precision irrigation systems. For the use of specific substratums, an agreement was reached with the Dutch company Legro for the acquisition of "cp Optima®" substratums, specifically developed for strawberry production. The technology used in fertirrigation by drip is an effective system that enables humidity control of substratums and the nutrients that are administrated according to the crop needs and its growth stage. It is a model of

the company Netafim™, which, besides from preparing and applying the nutrients, it monitors the plants levels through a porcelain probe that obtains at the root level the nutritional needs of the plant. In Mexico, never had such a complex system been installed and at so many levels, as in Bloom Farms®. Bloom Farms® hired the METOS® monitoring systems that make microclimatic predictions, as well as monitoring activities, analysis and follow-up with avant-garde methods.

Photographs / schemes:



Results obtained:

The main impact of technological innovations can be noted in the plant growth and the quality of the fruit. The quality fruits per plant increased, as well as its size and life span in the shelf. It is worth mentioning that the quality, flavor and size of strawberries are highly valued characteristics by Driscoll's®. Thanks to the fertirrigation methods and climate monitoring, the handling of supplies for the plant is more efficient, decreasing the costs of production, of labor and the ones regarding the application of fungicides and insecticides. A return of the investments in technologies is expected in less than two years. When using the resources better, expenses are reduced and cost effectiveness increases. The reduction of the consumption of energy can be easily noticed.

Source:

http://www.redinnovagro.in/docs/E_BOOK_40_CASOS_EXITO.pdf

Case Nº: 34

Region / State / Province:

Sinaloa

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 12R; East 728113; North 2844492

Objectives:

Irrigation using holistic programming and real-time management through internet.

Summary / description / main characteristics:

The Agricultural Farmer Users Association "Ruíz Cortínez", Module II-2 AC, is an organization that groups 1,240 producers from the social area, and 399 small owners from the Ahome municipality, in Sinaloa. Together, they represent an area of approximately 18,904 hectares. The module was born from the need of supplying water for every member of the Organization, the constant concern of the producers, due to the water amount that crops require, in the opportune moment for irrigation and the right amount to apply.

The organization, in coordination with the INIFAP and Produce Sinaloa Foundation A.C., has transferred the system "Irri-Model: holistic programming and real-time management through Internet", adapted to corn crop as a collective answer to the problem of lack of holistic management of water. The Organization promotes this innovation in the whole productive process because of "its amiability, precision and versatility" when using the collaborative software technology to determine the right moment for irrigation, among other actions:

- It calculates the crop's water demand, even under varying weather conditions.
- It elaborates irrigation plans under different weather scenarios, water availability, and irrigation systems.
- It predicts the irrigation, with a high precision level, according to the development of the crop, determined by the accumulation of day degrees.
- It helps to improve the activities administration of the production units.
- It generates and sends irrigation requests to the module that provides the irrigation services.

- It evaluates the irrigation management in each of the areas at the end of an agricultural cycle.
- It checks and updates weather databases in real time.

Photographs / schemes:



Results obtained:

Irrigation programming has shown a saving between 1,500 and 2,000 m³ per hectare, with the acceptance of technology by 80% of corn producers, the regional saved volume is 7 million m³ per cycle. The impact of the innovation lies in reducing the frequency and intensity of irrigation, by applying an initial irrigation with a sheet of only 24 cm and three irrigation measures of 15 cm each, applying the first aid irrigation 48 days after sowing, which is monitored before flowering, the second irrigation aid is made to have watery grain or 80 days after sowing, and the third aid irrigation is applied to the 106 days after sowing to reach milky grain. To each producer the module assigns a gross sheet of 90 cm per hectare (9,000 m³ / ha) whose need for irrigation or net sheet is 44 cm (4,460 m³ / ha) or net 875 mm, with the application of programmed irrigation it is reduced to 42 cm of net lamina and 69 mm of gross lamina. With this new way of watering, efficiency increases 60% and savings of 4,040 m³ / ha of the total allocation per hectare.

Source:

http://www.redinnovagro.in/docs/E_BOOK_40_CASOS_EXITO.pdf

Economy: Japan

Case Nº: 35

Region / State / Province:

Ibaraki / Mito

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 54 S ; East 446209 ; North 4031466

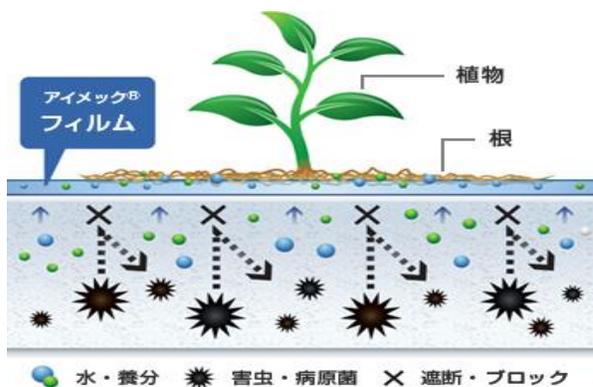
Objectives:

Use polymer film to grow food. Imec ® (film culture)

Summary / description / main characteristics:

The polymer film is the key to a cutting-edge farming method that makes it possible to grow fruits and vegetables on practically any flat exterior. Made of hydrogel – a super absorbent material typically used in household products such as disposable diapers – the film works by soaking up water and nutrients through a multitude of nano-sized pores measuring one millionth of a millimetre in diameter. Plants grow on top of the film, but instead of digging into the ground, the roots spread across the surface of the membrane in wispy, fan-like formations.

Photographs / schemes:





Results obtained:

Film farming can help by offering an alternative to resource-intensive agriculture. The Mebiol system uses 90 per cent less water than conventional farming. The polymer membrane's microscopic pores also block bacteria and viruses, eliminating the need for harmful pesticides. Since soil is not necessary, sustainable farms can be established virtually anywhere – in the desert, on city rooftops, and even on top of contaminated land. The method is being used in 150 locations around Japan and one in China – as well as on a farm in the middle of the desert in the United Arab Emirates. Mebiol plans to export its technology to Europe and other economies in the Middle East later this year.

Source:

<https://www.scmp.com/magazines/style/article/2094426/farming-without-soil-new-japanese-tech-makes-growing-fruit-and>

Case N°: 36

Region / State / Province:

Yokohama, Kanagawa Prefecture

General Information:

Water reuse, Technology for irrigation management.

Coordinates (UTM):

Zone 54 S ; East 376093 ; North 3922820

Objectives:

Produce in a more ecological way, with an adaptation to climate change, various crops under plants in the shape of a dome.

Summary / description / main characteristics:

The cultivation room is a spare, modernist operation: slick orange floors and concrete walls rising above a grid of thin metal racks. Each day, approximately 30 people mill about the plant, some dressed head-to-toe in white jumpsuits and surgical masks, tending to thousands of precisely arranged, bright green leaves. Bathed in the bubble-gum glow of 17,500 blue and red LEDs, these modern farmers spend eight hours per day doing everything from seeding empty racks to packaging heads of harvested lettuce.

Photographs / schemes:



Results obtained:

Several plants have been created at the domestic level of indoor farms, due to the fear of the population. That is because of the contamination of the agricultural crops given the varied natural and nuclear disasters that affected the economy. Many farmers see in a good way this new cultivation technique and affirm that they contain more beta carotene and twice as much vitamin C, calcium and magnesium in their products.

Source:

<https://modernfarmer.com/2014/12/salad-inc/>

Case Nº: 37

Region / State / Province:

Niigata

General Information:

Water conduction systems, Technology for irrigation management.

Coordinates (UTM):

Zone 54 S ; East 327432 ; North 4198218

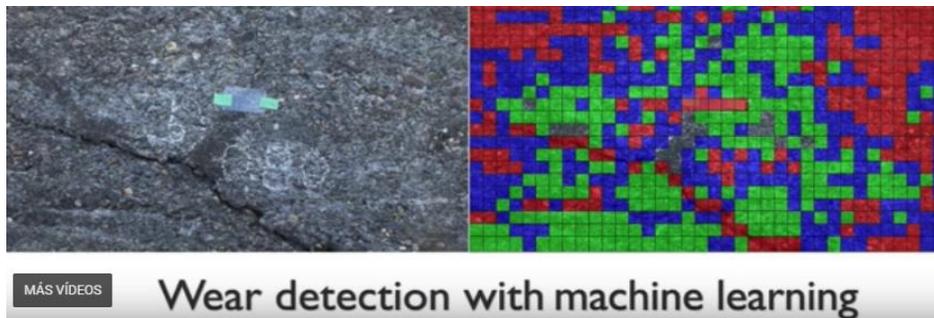
Objectives:

Implement the use of drones to detect problems in irrigation channels.

Summary / description / main characteristics:

Professor of Mechanical Engineering Kenji Shimada and his team of researchers are using drone technology to help detect and restore damaged water canals in Japan that are critical for the agricultural economy. Kenji Shimada, professor of mechanical engineering, and his team of engineers are using autonomous technology to detect damage to agricultural water canals in a town in Niigata, an agricultural district on the northwest coast of Japan. These canals are essential for the rice farming economy in the region and to a total of approximately 40,000 kilometers throughout Japan. Shimada and his team have developed a systematic framework with a fleet of drones and coordinating cars to assess the canals effectively and efficiently, extending the coverage area and minimizing inspection time. Di Deng, a Ph.D. candidate in mechanical engineering, works on the coverage planning aspect of the project. Last year, she traveled to Japan to conduct field tests of the drone in different types of water canals.

Photographs / schemes:





Results obtained:

“Over the summer, we flew our autonomous drone in Japan and tried different sizes of water canals, so the system can automatically decide the position of the drone inside the water canals,” said Deng. “We tried out the widths of the water canals that go from 5 meters to 2.4 meters. We could clearly see a lot of stone exposed, so these were the places we needed to repair.” Using public maps and research data, the research team has formulated an algorithm to plan the drones’ path along the canals. They can fly along canals of different sizes in multiple directions to record complete videos of the walls for crack detection. The type of commercial drone chosen for the project is limited to thirty minutes in the air and must stay within a range of a few kilometers from the remote controllers. This makes it impossible for the drones to cover all of the canal in one flight. To ameliorate these limitations, they are paired with cars parked within the maximum distance away that provide batteries and coordinate to pick the vehicles up when needed. Once they have recorded a video of the entire canal, the data from the images is fed into a neural network to detect damaged areas and map them in CAD models. To plan the paths of the drones, a scaled map of a canal is converted to a graph. This graph is then divided into subgraphs, which represent the areas they will cover. The team also graphs the roads to generate a route for the car that is within communication distance of the drones. The cars are programmed to automatically find alternative routes if faced with traffic.

Source:

<https://engineering.cmu.edu/news-events/news/2019/01/02-shimada-drones.html>

Case N°: 38

Region / State / Province:

Tokyo

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 54 S ; East 387043 ; North 3945975

Objectives:

A water monitoring system, developed by the Tokyo-based company SenSprout Inc., can save valuable water resources, reduce costs and promote consistent growth of high-quality products.

Summary / description / main characteristics:

A water monitoring system, developed by the Tokyo-based company SenSprout Inc., can save valuable water resources, reduce costs and promote consistent growth of high-quality products.

Essentially, the system tells farmers how much water there is in the soil for their crops.

The system was designed for dry climates where water is scarce and expensive, such as in the city of Nagpur, in central India, in the state of Maharashtra.

There, two orange farms are participating in an experiment to further develop the agricultural water monitoring system in collaboration with the Indian Institute of Technology. The sensor is an object similar to a tube, of about 50 centimeters long.

Three patches of electrodes are placed, consisting of a resin film covered by a thin layer of copper, in the part that goes to the floor. The electrodes detect the electrostatic capacity of the soil to reveal changes in the amount of water contained in the soil, which you can use to tell how much water is absorbed by the roots of the plants. The upper part of the sensor has a wireless network device that transmits the data to a nearby smart phone. The information is stored in an online cloud database, and farmers can remotely verify the data on their computers or smartphones to see if their crops need more or less water.

Photographs / schemes:



Results obtained:

Similar agricultural sensors have been produced, but they are mostly high-end equipment that cost more than 500,000 yen for a set and are mainly used in the collection of data by academics and researchers. Few individual farmers have made such an investment.

SenSprout sensor units, which consist of low-cost materials, such as resin pipes and copper film, each cost less than 100,000 yen.

Source:

<http://impactjournalismday.com/story/japan-venture-introducing-smart-irrigation-to-farmers/>

<https://sensprout.net>

Case N°: 39

Region / State / Province:

Kumamoto

General Information:

Aquifer recharge

Coordinates (UTM):

Zone 52 S ; East 671832 ; North 3640661

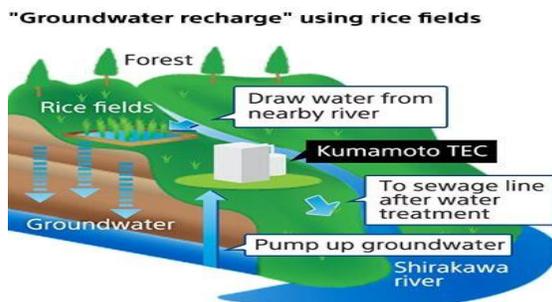
Objectives:

Project for the recharge of groundwater in the Kumamoto area.

Summary / description / main characteristics:

Kumamoto area, home to Kumamoto TEC, has always been blessed with abundant groundwater resources. However, the decline in groundwater has been a deep concern in recent years, and has been attributed to a decrease in the area of land used for rice paddy cultivation and an increase in the land used for residential purposes. Kumamoto TEC recognizes the importance of groundwater as natural capital, and is involved in continuous efforts to recharge groundwater using neighboring paddies in cooperation with local environmental NPOs as part of its responsibility as a local business. From May through October, Kumamoto TEC uses its water facilities to help fill unused rice paddies with river water, thus allowing the extra water to penetrate into the soil and ultimately replenish the aquifer

Photographs / schemes:



Results obtained:

Groundwater recharge efforts at Kumamoto TEC began in fiscal 2003, and in fiscal 2017, recharged 2.31 million m³ more water than Kumamoto TEC's yearly water usage (including tap water and groundwater).

Source:

https://www.sony.net/SonyInfo/csr_report/environment/site/biodiversity/kumamoto.html

Economy: Hong Kong, China

Case N°: 40

Region / State / Province:

Tai Po Industrial Estate

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 50 Q ; East 210537 ; North 2485811

Objectives:

Develop a new system of productive production in cloth, incorporating a series of new technologies.

Summary / description / main characteristics:

The jellyfish monitoring system can effectively collect and analyze multiple data in indoor planting fields, such as temperature, humidity, carbon dioxide content, pH value, electroplating value, etc., collect data to make adjustments, provide optimal growth conditions for the plants and show the production management system. Planting time, seedling and harvesting of each batch of crops in the sowing rack can be controlled on a large scale to improve production efficiency.

Photographs / schemes:



Results obtained:

Farm66 has been actively researching viable large-scale plantation solutions indoors. Through scientific experiments and technical practices, Farm66 has successfully developed a factory-produced planting system that incorporates a variety of technologies; "vertical multi-layer plantation structure", Hydroponic technology without soil, "symbiotic ecological cycle of fish and vegetables" and "energy-saving LED light wave planting technology".

Source:

<https://www.farm66.com/en/home/>

Economy: Vietnam

Case N°: 41

Region / State / Province:

Gia Lam district

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 48 Q ; East 581339 ; North 2325772

Objectives:

New production system for tomato and lettuce crops adding added value to the products.

Summary / description / main characteristics:

This factory is implementing two production facilities: greenhouse cultivation and vegetable factory cultivation for high value-added vegetables including medium-sized tomatoes and low-potassium lettuce leaves.

The difference of these two production facilities is that the cultivation area can be monitored remotely and fully automatically in a closed environment, which will help prevent microbes, reduce farmers' effort, and provide superior quality products.

Photographs / schemes:





Results obtained:

The lettuce leaf is slightly sweet and crispy, with potassium less than one-fifth of the normal ones which is very suitable for people with kidney problems and diet ones, who need to pay attention to the amount of intake of potassium. Since no agrochemicals are used, it can be eaten without washing.

Tomato contains high sugar contents and high nutritional value, with the amount of sugar and antioxidant lycopene approximately three times higher than conventional products.

Source:

<https://www.fpt.com.vn/en/newsroom/detail/fpt-and-fujitsu-officially-open-fujitsu-fpt-akisai-farm-and-vegetable-factory>

Case N°: 42

Region / State / Province:

Red River Basin

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 48 Q ; East 590241 ; North 2324288

Objectives:

To develop infrastructure to support decision making in the management of multi-purpose reservoirs in the Vietnamese Red River Basin.

Summary / description / main characteristics:

Programme for improved integrated planning and monitoring of water resources for transboundary water management and disaster risk management. Special attention within this cooperation is given to the use of remote sensing and Geographical Information Systems (GIS) for improved monitoring and modelling of (transboundary) water resources. The current project was formulated as part of the G2G trajectory towards implementation of an operational decision support system for water resource management and disaster risk management at the Ministry of Natural Resources and Environment.

Photographs / schemes:



Results obtained:

Infrastructure for integrated water management and disaster risk management implemented at NRSD.

Integrated model ensemble (hydrological, hydraulic and reservoir) installed in the infrastructure and ready for operation by NRSD.

Model for creating daily rainfall maps installed in the infrastructure and ready for operation by NRSD.

Knowledge transferred on operating and managing the infrastructure and using the implemented models.

First steps taken towards Cooperation between institutions of Vietnam in sharing and applying new technologies in optimizing data acquisition, access to data, and use of data standards.

Source:

<https://www.futurewater.eu/projects/remote-sensing-vietnam/>

Case N°: 43

Region / State / Province:

Đắk Lắk

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 49 P ; East 200008 ; North 1406659

Objectives:

It aims to ensure sufficient and equitable water availability in the central highlands of Vietnam and save water significantly through better irrigation management in the coffee sector.

Summary / description / main characteristics:

To support farmers in decision-making, the project is developing a regional short-term weather forecast system for the Central Highlands. This optimizes the management of the farm in terms of the use of water, fertilizers and pesticides. A large-scale training program for farmers raises awareness among small coffee producers about the rational use of water and good agricultural practices.

One of the purposes of this project is to become a model of water efficiency and contribute to the international policy debate by sensitizing relevant policy makers through their results in the form of policy documents.

Photographs / schemes:



Results obtained:

A large-scale training program for farmers raises awareness among small coffee producers about the rational use of water and good agricultural practices. One of the purposes of this project is to become a model of water efficiency and contribute to the international policy debate by sensitizing relevant policy makers through their results in the form of policy documents.

Based on the results of the baseline research, 800 farmers were trained in adaptation tools such as irrigation, fertilization, pest and disease control, and intercropping. The implementation of these tools has proven to be an effective safety measure for farmers against unpredictable weather patterns. Thanks to this work, it was possible to align the findings of several institutions and develop a collective approach to climate change, ensuring the value chain of production, as well as involving all its stakeholders.

Source:

<https://coffeeandclimate.org/vietnam/>

<https://www.hrnstiftung.org/water-management-vietnam/>

Case N°: 44**Region / State / Province:**

Hanoi

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 48 Q ; East 586679 ; North 2325446

Objectives:

The objective of the Irrigated Agriculture Improvement Project for Vietnam is to improve the sustainability of irrigated agricultural production systems in the selected provinces of the central coast and the northern mountains in the economy. The project consists of the following components:

1) improvement of irrigation water management, 2) improvements at the level of the irrigation and drainage scheme, 3) support services for climate-smart agricultural practices, and 4) project management, as well as monitoring and evaluation.

Summary / description / main characteristics:

The first component seeks to improve the institutional capacity for the provision of modern, efficient and responsible irrigation and drainage services. The second component is to improve the supply of bulk water to irrigation systems, the provision of services and management in the selected irrigation and drainage schemes. The third component aims to take advantage of the improved irrigation infrastructure and water supply activities carried out under the previous component to improve the productivity and quality of agriculture, increase farmers' incomes and reduce their vulnerability to adverse climate events.

Photographs / schemes:

s/i

Results obtained:

Direct beneficiaries of the project: 163,000 of 243,000

Water users received new / improved irrigation and drainage services: 386,091.00 out of 674,800.00

Creation and / or strengthening of operative associations of water users: 31 out of 20

Water users who have improved irrigation and drainage services: 193,292.00 out of 336,000.00

Water users that have improved irrigation and drainage services: 192,849.00 out of 338,000.00

Farmers in the scheme area who adopted improved production techniques: 30,429.00 out of 15,700.00

Source:

<http://projects.worldbank.org/P130014/vietnam-irrigated-agriculture-improvement-project?lang=en&tab=overview>

Economy: Indonesia

Case N°: 45

Region / State / Province:

Yakarta

General Information:

Renewable energy

Coordinates (UTM):

Zone 48 M ; East 704420 ; North 9313286

Objectives:

Implementation of a new water pumping system capable of supplying water without the need for fuel or electricity.

Summary / description / main characteristics:

It is a pump driven by a hydraulic wheel that uses the energy of the flow of rivers and canals to pump water without requiring fuel or electricity to operate. Its operation is simple, it does not use any type of fuel or electricity for its operation, it uses the kinetic energy of the water flow to move the wheel. Each time the wheel rotates, it will collect a little water and air, and the pressure exerted by that air is what will allow, after the water is expelled by the hoses, to get to the field. It is a suitable product for small farmers, with few hectares and because of their geographical location they have little access to electricity or fuel.

Photographs / schemes:





Results obtained:

Bomb Barsha is capable of pumping 45,000 liters of water a day without fuel. Savings of up to 70% of the total cost of irrigation (pump plus fuel), the investment can be amortized in only 2 years.

Source:

https://ssir.org/articles/entry/irrigation_innovation#

<https://www.aqysta.com>

Case N°: 46

Region / State / Province:

Yakarta

General Information:

Accumulation Systems, Water conduction systems.

Coordinates (UTM):

Zone 48 M ; East 702760 ; North 9314240

Objectives:

The objective of this project was to increase the production of rice and other agricultural products by developing surface water irrigation through the construction of weirs (head works) and dams, and the installation of pumped groundwater irrigation facilities in six provinces in eastern Indonesia, and thereby contribute to the improvement of farmers' income and poverty reduction.

Summary / description / main characteristics:

The total irrigation area developed through this project reached approximately 60,000 ha (in a total six provinces), greatly exceeding the initial plan of approximately 16,000 ha. There is wide disparity in the amount of rainfall between the rainy and dry seasons in the project area. The cultivated area in the dry season after project implementation increased nearly three times and the cultivatable period was extended. A beneficiary survey (16 locations, 132 respondents) clearly showed that the rice harvest of beneficiary farmers increased 2.3 times after the implementation of the project. Further, 70% indicated that they became able to cultivate high profit crops such as beans, chili peppers, and vegetables. Therefore, this project has largely achieved its objectives, and effectiveness is highly satisfactory.

Photographs / schemes:



Results obtained:

In light of the above, this project is evaluated to be highly satisfactory. Factors contributing to project success include the establishment of a management system that continuously covers the project cycle from initial formation through operation and maintenance, and the appropriate combination of hard (irrigation development) and soft (strengthening of water users associations) facets. Regarding operation and maintenance, there is significant reliance on ad hoc repairs made by water users associations as needed.

In the long term, it is advisable that systematic operation and maintenance can be implemented according to the system operation.

Source:

https://www.jica.go.jp/english/our_work/evaluation/oda_loan/post/2007/pdf/project08.pdf

https://www.jica.go.jp/english/our_work/evaluation/oda_loan/post/2007/pdf/project08_full.pdf

Case N^o: 47

Region / State / Province:

25 districts in six provinces (Lampung, Banten, West Java, Central Java, East Java, and South Sulawesi)

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone s/i ; East s/i ; North s/i (Nationalwide)

Objectives:

To apply and implement Participatory Irrigation Sector Project for Indonesian farmers

Summary / description / main characteristics:

The Participatory Irrigation Sector Project (PISP) in Indonesia was approved on December 19, 2003, with an estimated cost of \$126.0 million equivalent. Expected impacts were to increase rural income and reduce poverty in the targeted irrigation schemes in 25 districts in six provinces (Lampung, Banten, West Java, Central Java, East Java, and South Sulawesi). The PISP was implemented mostly in line with its original design. Executing agencies were the Ministry of Public Works and Housing, the Ministry of Home Affairs, and the Ministry of Agriculture. Implementation was coordinated among these three, the provincial and district governments, and the National Development Planning Agency.

A key goal under the PISP was to help the project areas sustain irrigation O&M. This had been a long-standing challenge for the agriculture sector. During and after the project, progress has been made to increase O&M spending for the state and provincial irrigation schemes. However, increasing the districts' commitment to irrigation O&M (and capital investment) has been more difficult than envisaged at appraisal. Because of progress made in decentralization, districts are increasingly empowered to make spending decisions and may not consistently prioritize irrigation. Under its multiyear domestic irrigation programs, the government provides a special budget allocation and transfers to the provinces and districts. These transfers become part of the local budgets with earmarked restrictions for irrigation. However, even for this funding there is a varying degree of compliance in the use of these allocations. To help address this situation, the evaluation recommends that various options are explored, including giving local governments more incentives (e.g., matching finance)

to allocate more funds to irrigation, or finding mechanisms to better enforce the earmarked use of the transfer funds (as agreed between the state and local governments). Benefits arose mainly from more intensive use of the irrigation command areas through reduction in fallow or idle plots during the drier crop growing periods (April to October). These positive effects were most pronounced in the schemes with lower water availability. There was a modest benefit gain from yield increase—mainly on rice—on the irrigated and planted areas. Modest rehabilitation costs per hectare also contributed to the robust EIRR estimates.

Photographs / schemes:



Results obtained:

The project had four outputs: (i) upgraded district capacity to manage irrigation responsibilities, (ii) improved irrigation performance at scheme level, (iii) improved extension services and farmer access to agricultural inputs and services, and (iv) an improved system for water resource management information and asset management.

Source:

<https://www.adb.org/documents/indonesia-participatory-irrigation-sector-project-pper>

Economy: Australia

Case N°: 48

Region / State / Province:

Forbes, New South Wales

General Information:

Water conduction systems, Accumulation systems.

Coordinates (UTM):

Zone 55 H ; East 593637 ; North 6306145

Objectives:

*Build Storage and reuse scheme utilising a lateral move irrigator construction

Summary / description / main characteristics:

Evan and June Baillie with Farm Manager Mick Cantwell run a 4000 hectare property at Forbes, New South Wales, where they grow winter crops on 2,000 hectares and use 200 hectares for summer crops of corn and lucerne. The remainder of the property is used for native and introduced pastures that support 400 head of Angus breeders and followers. In 2011, Evan received an On-Farm Irrigation Efficiency Program grant from the Australian Government to put towards the construction of a storage dam and a reuse system with a lateral move irrigator to maximise production during dry periods. As a result of the upgrade, Evan has saved 3.7 megalitres of water per hectare."The project will allow the production units to continue and be profitable in low allocation years. We will now use less water for similar or better levels of production".

Lift pump

The project has generated considerable interest in Forbes and its benefits have extended to supporting the local community. "Because we can sustain permanent employees, the flow on effect sees these employees using local businesses and facilities", Evan said. The water savings generated from on-farm projects are shared between the irrigator and the Australian Government. The government returns its portion of the water savings to the environment to protect and restore rivers, wetlands and other environmental assets in the Murray-Darling Basin. This will help 'bridge the gap' to the sustainable diversion limits under the Murray-Darling Basin Plan.

Photographs / schemes:



Results obtained:

As a result of the infrastructure upgrades undertaken on Evan Baillie's farm, 499 megalitres were transferred to the Australian Government for environmental watering and will hopefully be used to benefit local assets in the Lachlan Catchment, such as Merrimajeel Creek, Lower Lachlan Swamps, and Merrowie Creek-Tarwong Lakes.

Source:

<http://webarchive.nla.gov.au/gov/20150625061308/http://www.environment.gov.au/node/34845/>

Case N°: 49

Region / State / Province:

Goolgowi, New South Wales

General Information:

Rarm management program

Coordinates (UTM):

Zone 55H ; East 335754 ; North 6240706

Objectives:

Increase irrigation efficiency by implementing an integrated system for the farm.

The main idea of the owners is to use the available water more efficiently, increase the efficiency of the machinery and be able to cultivate a greater variety of crops

Summary / description / main characteristics:

Grant and Cindy Cameron own a 2400 hectare property at Goolgowi in south-western New South Wales about 50 kilometres from Griffith and have been involved in irrigation for the past 25 years.

The Camerons run 1000 heads of sheep and a winter and summer cropping program of wheat, barley, canola, soybeans, cotton, maize and rice.

With the help of an On-Farm Irrigation Efficiency Program grant from the Australian Government, the Camerons have increased the efficiency of their farm and saved an estimated 350 megalitres of water by upgrading their surface irrigation system.

Photographs / schemes:



Results obtained:

Prior to the project, the Camerons trialed two different forms of row cropping. One area was set up for laser levelled terraced bays and another area used an even slope. The terraced bay layout proved to be much more efficient, using less labour during in-crop irrigation and was easier to manage.

As a result of the infrastructure upgrades undertaken on the farm, 220 megalitres were transferred to the Australian Government for environmental watering and will be used to benefit local assets in the Murrumbidgee catchment, such as Yanga National Park and the Lower Murrumbidgee floodplain.

The Camerons can now undertake double cropping on the property, which has increased farm productivity.

"Before the project we could only double crop rice and wheat, now we can double crop cotton and wheat, and soybeans and wheat."

The increase in water use efficiency means a reduction in water loss and reduced accessions to the water table— ultimately reducing salinity.

The upgrade to the surface irrigation system provides flexibility and labour savings. Less time spent on irrigation management has given the Camerons more time for family activities with their four sons.

The Camerons project has generated interest from other local irrigators and has also been showcased at local farm field days as a working example of maximising on-farm efficiency through innovative irrigation technologies.

Source:

<http://webarchive.nla.gov.au/gov/20150630170810/http://www.environment.gov.au/water/publications/redevelop-surface-irrigation-system-and-infrastructure-upgrade>

Case N°: 50

Region / State / Province:

Domestic application

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone s/i ; East s/i ; North s/i

Objectives:

Maximize crop yields and have low-cost options that allow the monitoring and forecasting of crop water demands.

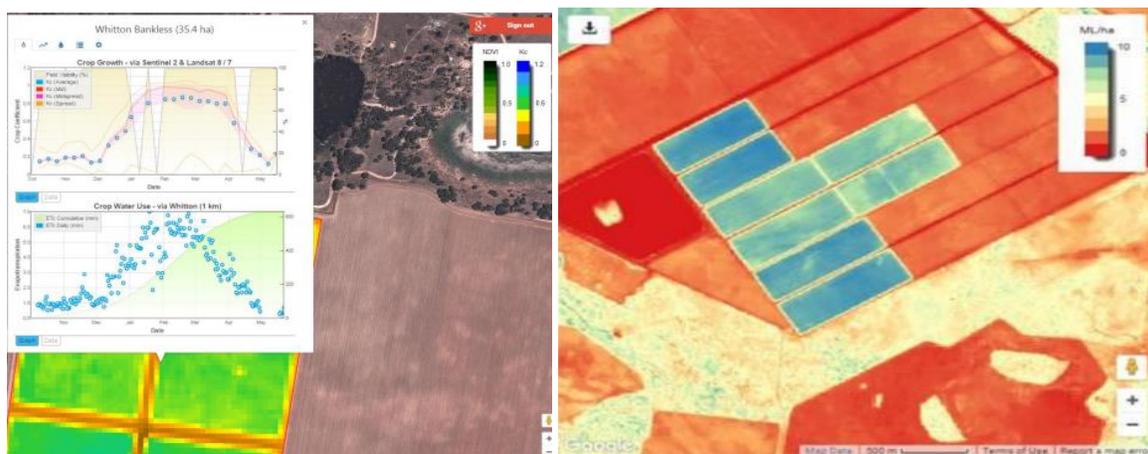
Summary / description / main characteristics:

IrriSAT (<https://irrisat-cloud.appspot.com>), is a weather-based irrigation management and benchmarking technology app that uses remote sensing to provide site specific crop water management information across large spatial scales at fine resolution. IrriSAT calculates crop coefficients (Kc) from relationships with freely

available satellite derived Normalized Difference Vegetation Index (NDVI) data. Daily crop water use (ETc) is determined by multiplying Kc and daily reference evapotranspiration (ETo) observations from nearby weather stations or doesmtically provided gridded ETo data.

IrriSAT is moving weather-based scheduling into the future. The free IrriSAT app automates satellite processing from both the Landsat NASA satellite platforms and the Sentinel ESA satellite platforms. IrriSAT has been developed using the Google Earth Engine and deliveries crop water use information to assist in irrigation scheduling and crop productivity benchmarking. IrriSAT provides daily crop water use, as well as a seven day crop water use forecast. This allows irrigators and water managers to look at crop water use on individual farms.

Photographs / schemes:



Results obtained:

IrriSAT users have reported water savings from using the tool in a number of ways. These have included:

Modifying irrigation timing to better match crop water demands / Better predicting when facing extreme climate events (i.e. high ETc days) and modifying irrigation schedules/deficits to minimize impacts on crops / Identifying poorer performing areas within irrigated crops and changing management i.e. laser levelling / Benchmarking performance of irrigated fields across farms and regions and using limited water resources on better performing fields.

The IrriSAT app was made available in October 2014 and has seen the current user base grow to over 1500 users as of April 2018. The technology was introduced to

irrigators through a range of mediums which included direct meetings and presentations to irrigators and irrigation consultants at farmer field events throughout the Australian cotton and grain growing areas. A series of workshops on using IrriSAT were also held across the Murray Darling Basin to introduce irrigators and also irrigation consultants to the technology.

Source:

http://www.icid.org/ws_technology_2018.pdf

http://www.icid.org/awards_ws.html

Economy: Thailand

Case N°: 51

Region / State / Province:

Domestic application - Northern region / Loei river basin / Lum Ta Kong river basin / Lum Pra Plerng river basin / Prachinburi province / Srakaew province / Trad province / Western region (Kanchanaburi, Ratchaburi, Petchaburi, Pranburi)

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone s/i ; East s/i ; North s/i (Nationalwide)

Objectives:

Develop mobile telemetry system to measure rainfall and stream water level, and to send data automatically in real-time. Targets are 16 sets of telemeters upstream of reservoirs and 5 sets in the Chao Phraya river basin.

Link and provide visualization in the geographic information system format via internet (Internet GIS).

Transmit data into a server at the Royal Irrigation Department and other related agencies.

Summary / description / main characteristics:

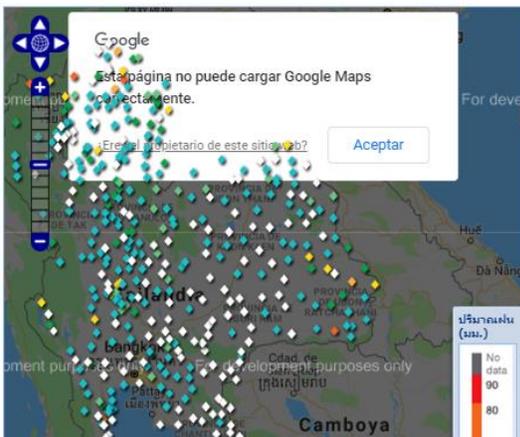
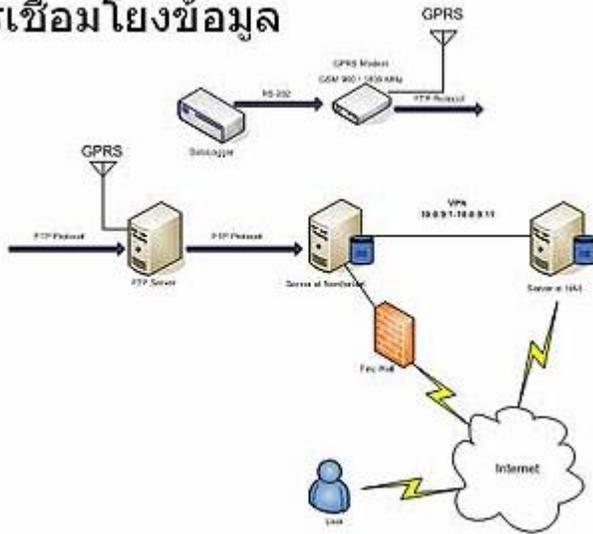
Flooding and drought are of paramount importance, resulting in significant economic and social losses every year. Therefore, to give warning, minimize loss, and manage water resource management under normal situation, it is necessary to measure rainfall and water level. Typical telemetry system used is SCADA which is big in size and is costly, thus it is not practical to install as many numbers as expected for extensive coverage.

Consequently, the Hydro and Agro Informatics Institute (when it was under the National Electronics and Computer Technology Center) has developed a small remote sensing device called mobile telemeter. It is small, portable, and can be used to replace or supplement the operation of SCADA telemetry system for rainfall and water level measurements. The data is transmitted automatically in real time and is displayed via internet, on GIS (Geographic Information System). This will be beneficial for disaster preparation, including flood warning in risk areas. The project is the result of the

collaboration between the Royal Irrigation Department (RID) and HAI to create mobile telemeters.

Photographs / schemes:

การเชื่อมโยงข้อมูล



[Manual]

Current state of storm approaching Thailand: **No Storm**

Date 31 May 2019 TIME 20:00
Past 24-hour rainfall (mm.)

Location	TIME	mm.
Chiang Mai Pong Tam Chai Prakan	20:00	67.4
Phang-Nga Thap Put Thap Put	20:00	49.8
Ranong Khao Niwet Ranong	20:00	49.2
Chiang Rai Wiang Wiang Teng	20:00	48.6
Krabi Khlong Hin Khlong Hin	20:00	46.8

Min. Temperature (°C) 31 May 2019

Location	TIME	°C
Chiang Mai Ban Kad Mae Wang	20:00	17.64
Mae Hong Son Pang Mapha Pang	20:10	21.6
Mapha		
Chiang Mai Piang Luang Piang Luang	20:00	21.6
Chiang Rai Mae Chedi Mai	20:00	22.8

Results obtained:

Currently, there are 22 sets of telemeters in use, and can be divided into 2 groups:

1) Permanent installation: 5 sets are in the Chao Phraya river basin at the hydrological stations, including C2 Nakhon Sawan station, station downstream from Chao Phraya dam, Rama VI station, Pak Hai station (Noi river), and Lopburi estuary station.

2) Mobile telemeters: Originally, they were installed in northern basins including 8 sets at the upstream area of Kiu Lom reservoir and 8 sets at the upstream area of Lum Pao reservoir (for a 3-month period). Later, the telemeters were moved and installed in western and upper southern regions instead. 8 sets were at Lum Pra Plerng

reservoir and 8 sets were at the upstream area of Kang Krachan dam, Petchaburi river basin, and Pranburi (3 months).

In 2004, the mobile telemetry system was setup and tested at different RID sites that required automatic real-time transmission of rainfall and stream water level data such as Petchaburi, Pranburi, Chao Phraya, Chantaburi, and Ping river basins. At that time, those sites did not have any telemetry system. Problems arose during the trial usage period, which led to significant improvement of the telemeters and resulted in learning experiences.

In 2005, 13 mobile telemeters were installed in Rayong province to monitor hourly rainfall as a part of the effort to solve severe drought problem. The installation took 3 days total or 3 hours per site and data was transmitted immediately after installation. Therefore, rainfall situation was observed quickly and systematically.

All data statistics are archived and accessible, and instant warning messages were sent via short messaging service (SMS) through cellular phones.

Source:

<http://www.thaiwater.net/web/index.php/aboutusen/526-tele-riden.html>

Economy: Peru

Case Nº: 52

Region / State / Province:

Ica Valley

General Information:

Aquifer recharge

Coordinates (UTM):

Zone 18L; East 425316; North 8442152

Objectives:

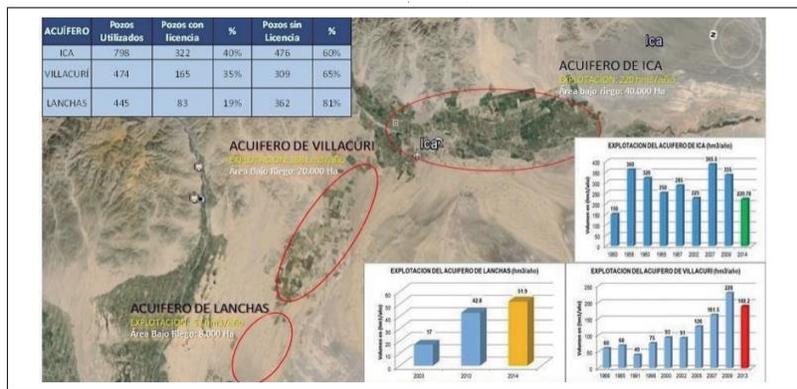
Aquifer recharge in Ica Valley

Summary / description / main characteristics:

"The aquifer of Ica (which includes the Ica Valley and the pampas of Villacurí and Lanchas) is located in the southern region of Peru. It has a high agro-industrial development based on irrigation, which is the main engine of the region and the sustenance of hundreds of families, who depend on the exploitation of groundwater. The intensive exploitation has led to the Board of Users of Groundwater Ica Valley (Juasvi) and the National Water Authority (ANA) to undertake artificial recharge taking advantage of the water surplus of the Ica River during the rainy season, through pools of water infiltration, since 2012. The operation of the artificial recharge carried out in the area, intermittent, temporary and subject to the water surplus of the Ica river, must be improved in a process of successive approximations. Some of the methodologies and lines of action already undertaken or under study are the reduction of the volume of water that flows into the ocean through structural measures and small interception works; avenues management with a certain predictive component; improvement of the knowledge of the aquifer and its hydraulic behavior, in order to locate the infiltration ponds in the most suitable places; creation of an integrated hydraulic infrastructure in which all the nodes are interconnected; improvement of the monitoring network and monitoring in real time; greater efficiency in maintenance operations, and the search for alternative sources (sewage, surplus, irrigation returns, etc.). The main lines of action carried out at present aim to overcome the main complications encountered during the implementation of artificial recharge, which are basically due to the improved coordination and communication between the agents involved, the progressive knowledge of the physical environment and the response of the aquifer, and the problems of clogging and maintenance. It is a

young recharge in which the technicians involved and the authorities are constantly learning the actions taken.

Photographs / schemes:



Results obtained:

In 2012, 41 ponds were implemented in 10 recharge zones in the Ica valley, Aquijes sector, which occupied 22.37 ha. The area of each pond oscillated, in general, between 1,300 and 2,500 m², with an average height of 2 m and a volume between 1,900 and 22,000 m³. These constructive criteria were conditioned by the characteristics of the

plots that were "borrowed" to begin the first experimental artificial recharge work, and in 2013 the artificial recharge structure was enlarged, adding new ones to the previous pits, distributed by the Pueblo Nuevo and Parcona districts of the aquifer and a first test in the Villacurí sector, up to a total of 89, occupying 37 hectares. The expansion continued in 2014 with 125 pools occupying 59.3 hectares. In 2015 they were implemented and inventoried 192 infiltration pools, which occupied a total area of 70.17 ha, and functioned as management cells and induced recharge of the aquifer. In order to expand the effective infiltration area, the Juasvi formulated a proposal, where the existing public land was provided as a temporary loan to user boards to expand the recharge area, managed directly by the ANA or by the Regional Government (GORE). This "request" is understandable in the framework of the dissemination and awareness work carried out by both the ANA and the Juasvi among the users of groundwater. In addition, the irrigation commissions and the remaining valley user boards supported the initiative. In this way, in 2016 there were 660 useful pools, occupying 234 ha. In this context, new pools and microreservoirs have been incorporated into the system in 2017, reaching up to 846 with an infiltration surface of 295 ha (unpublished Juasvi verbal information). Thanks to their distribution and joint action, an infiltrated volume of around 17 hm³ has been reached between January and May 2017. "

Source:

[http://www.dina-mar.es/post/2018/09/12/Inicio-de-acciones-de-recarga-gestionada-desde-manantiales-lejanos-en-el-valle-de-Ica-\(Peru\).aspx](http://www.dina-mar.es/post/2018/09/12/Inicio-de-acciones-de-recarga-gestionada-desde-manantiales-lejanos-en-el-valle-de-Ica-(Peru).aspx)

https://www.imta.gob.mx/biblioteca/libros_html/manejo-recarga-acuiferos-ehl.pdf

Case N°: 53

Region / State / Province:

Ica region

General Information:

Renewable energy

Coordinates (UTM):

Zone 18L; East 432758; North 8380200

Objectives:

Implementation of a Photovoltaic Solar System in the Samaca Ecological Farm, for irrigation and field work.

Summary / description / main characteristics:

A 96kWp photovoltaic system was installed to improve and extend its irrigation system. There is no connection to the public network and electricity was produced by a single 7.5kW wind turbine. The solar system replaces the diesel motor pumps and provides the entire farm with electricity. This includes the pumps with a total power of 70 hp, the reverse osmosis system for drinking water, different machinery for production, administration, kitchen and the common light of the houses. The water is pumped by solar energy to a large reservoir. The pumps, powered by solar energy, transport water to a reservoir that allows irrigation by gravity. This water storage efficiently reduces the need to store energy in batteries. With the availability in the reservoir, the irrigation is independent from the current electricity generated at the time. Neither a few days of low radiation, nor maintenance or possible repairs affect irrigation. Here, we discuss options for solar pumping. The system is capable of an annual production of 179,000 kWh of energy with a potential saving of more than 30,000 liters of diesel. It avoids 82 tons of carbon dioxide.

Photographs / schemes:



Results obtained:

The planning of the system was carried out in close collaboration between the SAMACA Fundo, the company CONSORCIO ENERGETICO DE HUANCVELICA S.A. (CONENHUA) and Delta Volt SAC. The supervision and general coordination was carried out by Conenhua. Coordination with other entities, such as the installation company of the pumps were made when appropriate. The works were carried out under mutual trust, will and collaboration, minimizing delays due to prolonged procedures or other reasons. The local work of the installation was divided among

several entities, involving the personnel of SAMACA and CONENHUA. During the development of the project, we tried to maximize the management of the systems by the local people. For this purpose, the active participation of the technicians and employees of the farm was ensured during and after the installation using the motorcycle: 'Learning by doing'. Additionally, events were held according to the needs of the staff. Apart from a general introduction on solar energy, its use and its particularities, special training classes were given on photovoltaic systems in high voltage AC and DC power networks. The visit of the SMA technician during the start-up of the system was taken advantage of for a thorough training of the personnel in charge for the proper management of the system locally.

Source:

<https://deltavolt.pe/pv-systems/mini-red-solar/samaca-solar>

Case N°: 54

Region / State / Province:

Lajas, Chota, Cajamarca

General Information:

Watershed management, Technology for irrigation management.

Coordinates (UTM):

Zone 17 M; East 760031; North 9274097

Objectives:

The goal of the Peru Sierra Irrigation Subsector Project was to increase and improve agricultural performance in the Sierra by improving irrigation technology, thus providing farmers with enough water to secure traditional harvests and, over time, to shift to higher export-value crops

Summary / description / main characteristics:

The project included four components: (i) modernization and rehabilitation of collective irrigation, aimed at financing pre-investment studies and design, execution, and supervision of subprojects to support eligible WUOs in improving their water supply service to farmers through modernization or rehabilitation of collective irrigation systems; (ii) irrigation technology improvement, aimed at financing pre-investment studies and design, execution, and supervision of subprojects to support

eligible farmers' groups and increase irrigation performance at the farm level through improved on-farm irrigation systems; (iii) capacity building and support for production and marketing, aimed at supporting building capacity of the water users' organizations and of agricultural producers and business groups; and (iv) formalization of water rights and the domestic water rights administrative registry, aimed at providing technical assistance and equipment to formalize and issue water licenses and expand the Water Use Rights Registry.

Photographs / schemes:



Results obtained:

The Peru Sierra Irrigation Subsector Project made a significant contribution to increasing agricultural production and productivity in targeted areas of the Peruvian Sierra. It was successful in increasing irrigation water flow and frequency (28 percent on average) and irrigation efficiency (72 percent compared to 22 percent). Improved irrigation led to crop intensification in the project-intervened areas, ranging between 118 percent and 170 percent, with many farmers switching to higher-market-value crops.

Source:

<https://www.worldbank.org/en/results/2017/10/30/better-crops-with-better-irrigation-boosting-agricultural-performance-in-the-peruvian-sierra>

Case N°: 55

Region / State / Province:

Ica

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 18 L; East 429793.00 ; South 8436356.00

Objectives:

Avoid breakage in fruit. Increase production and improve with it the ratio of kilogram of fruit per cubic meter of water consumed.

Summary / description / main characteristics:

The Flame Seedless variety of table grapes is known as a parting problem that occurs at the destination due to microcracks due to poor irrigation management in Pinta. In Ica Peru irrigation was achieved with productive objective by phenology in the years 2012, 2013 and 2014. Post-harvest productive objective: roots, reserves, wood finishing, avoid autumn; Budgeting productive objective: size of outbreak (use of reserves), fruit set (equilibrium), roots; Fruit set of productive objective: fruit growth, vigor, avoiding shade, fruit-sprout competition, fruit nutrition (good post-harvest), roots; Veraison productive objective: sugar, color (red grapes), fruit completion, vigour (balance), roots. In this project the client implemented 20 points that included 1 humidity probe of 4 depths (20, 40, 60, 80 cm), flowmeter in line of dropper to understand the precipitation. Finally a Meteorological Station.

Photographs / schemes:



Results obtained:

All that allowed to avoid breakage and increase average productivity by 35%. In general, the values of Kc Real dropped by phenology since 2012, especially during pint (0.4 to 0.5). The water per hectare was lowered, from 12,000 m³ / year to less than 10,000 m³ / year in 2012, 2013 and 2014 and are currently in lathes at 8,000m³ / year. The use of labor went down by cleaning at harvest. The quality and quantity of roots increased. The water use efficiency was increased from 1.16 Kg / m³ to 3.32 Kg / m³.

Source:

Wiseconn Company

Economy: Republic of Korea

Case N°: 56

Region / State / Province:

Han Stream in Jeju Island

General Information:

Aquifer recharge

Coordinates (UTM):

Zone 52 S ; East 269747,77 ; North 3703623

Objectives:

The primary goal of this study is to develop and apply the artificial recharge system at Han Stream in Jeju Island, Korea, for not only securing sustainable groundwater resources, but also mitigating severe floods occurred due to the global climate changes.

Summary / description / main characteristics:

Jeju-friendly Aquifer Recharge Technology (J-ART) in this study has been developed by capturing ephemeral stream water with no interference in the environments such as natural recharge or eco-system, storing the flood water in the reservoirs, recharging it through designed borehole after appropriate water treatment, and then making it to be used at down-gradient production wells. For optimal design of J-ART, we conducted injection tests at the monitoring well (MW5) as well as at the planned recharge site during drilling the recharge wells and performed a modeling with the data obtained. Based on the modeling results, the artificial recharge wells were developed with a design of 10-meter spacing between the wells and 35-40 meter depths, which has a capacity of more than 2,500,000 m³ of groundwater resources in a year. Characterizing groundwater flow from recharge area to discharge area should be achieved to assess the efficiency of J-ART. The resistivity logging employed to predict water flow in unsaturated zone during artificial recharge based on the inverse modeling and resistivity change patterns.

Photographs / schemes:



Results obtained:

Stable isotope studies of deuterium and oxygen-18 of surface waters and groundwaters were carried out to interpret mixing and flow in groundwaters impacted by artificial recharge. Transient models were developed to predict the effects of artificial recharge using the hydraulic properties of aquifers, groundwater levels, and meteorological data.

Time series changes of water balance after artificial recharge were analyzed, and residence time of the recharged water was also predicted with a certain degree of uncertainty.

Source:

[https://www.researchgate.net/publication/252464872 Artificial Recharge Coupled with Flood Mitigation in Jeju Korea](https://www.researchgate.net/publication/252464872_Artificial_Recharge_Coupled_with_Flood_Mitigation_in_Jeju_Korea)

Economy: Malaysia

Case N°: 57

Region / State / Province:

Kuala Lumpur

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 47 N ; East 790372 ; North 334496

Objectives:

Create a system of gates in the industrial computer link platform, in order to achieve measurable improvements in the accuracy of water levels.

Summary / description / main characteristics:

Previously, authorised farming personnel were required to drive considerable distances between water sluice gates. This was time consuming, costly and dependent on manpower being available at the right time. With the IoT approach farmers could take immediate action using their smartphones for remotely opening or closing water gates at the optimum times. The solution also triggered early warning alerts to enable preventive action should water levels become too high or low.

Through the depth of real-time data available from the multiple sensors attached to the water sluice gates, MOA personnel and farmers could also do trend analysis comparisons based on historical rainfall, water and temperature levels to more accurately determine the minimum level of irrigation required for producing maximum rice crop yields.

Photographs / schemes:



Results obtained:

Kontron PC Gateway's ability to connect a multitude of devices with the addition of I/O modules from other vendors, and support of ModBus and industry standard MQTT messaging, have ensured an optimal TCO for the overall solution.

What's more, the water irrigation system's architecture has demonstrated potential for deployment in other field-based agricultural and industrial IoT applications such as water recycling, flood management, factory automation and buildings energy management.

Source:

<https://www.kontron.com/blog/embedded/iot-in-agriculture-efficient-water-management-helps-farmers-grow-more-rice>

Economy: Russia

Case N°: 58

Region / State / Province:

Samara

General Information:

Water conduction systems

Coordinates (UTM):

Zone s/i ; East s/i ; North s/i (Nationalwide)

Objectives:

To implement an irrigation system based on open canals and frontal sprayers for irrigation of approximately one thousand hectares.

Summary / description / main characteristics:

It was in the Volga region that the Spasskaya Irrigation System (SOS), which is still considered one of the largest in Russia, was launched. When commissioned, it included the head pumping station and 26 pumping stations. 102 km of irrigation-bypass canals were laid. This made it possible to irrigate 42.5 thousand hectares of land. In addition, the irrigation system on an area of 910 hectares was restored at the capacities of NSP No. 14 and 15. with a total length of irrigation network of 13.5 km. About 220 million rubles were invested in the modernization, half of the amount was reimbursed as part of state support to farmers.

The farm purchased the most modern equipment for irrigation - five Bauer frontal sprinkler machines with water intake from SOS open canals entered the fields. Frontal sprinkler is the only type of irrigation equipment that can irrigate the entire area of the field. On square pieces of land, each span moves parallel to the ground, leaving no unspilled corners. The degree of irrigation reaches 99%.

Photographs / schemes:



Results obtained:

When it was put into service, the main pumping station and 26 pumping stations were included. 102 km of irrigation channels were installed. This means that it is 42.5 thousand hectares of land. To obtain consistently high yields, the farm only rebuilt two pumping stations (NSP) with a total coverage of more than 1.1 thousand hectares of land with its own funds only last year.

Source:

<http://mcx.ru/press-service/regions/v-samarskoy-oblasti-zapushchena-v-ekspluatatsiyu-orositelnaya-sistema-na-baze-otkrytykh-kanalov-i-fr/>

Economy: Chile

Case Nº: 59

Region / State / Province:

Coquimbo

General Information:

New water sources

Coordinates (UTM):

Zone 19J ; East 277486,64 ; South 6674291,08

Objectives:

Implement fog catchers for irrigation of olive trees and vines.

Summary / description / main characteristics:

In the framework of the project "Fog, an alternative source of water resources", a demonstration plot of 0.25 hectares was established in 2013 in the Sugar Loaf, sector of Coquimbo. In this place, three fog catchers of 153 m² each were established, which have had an average daily collection of 2.5 liters per m² of mesh, where an average of 1,150 liters per day or 420,000 liters per year is obtained. The captured water is stored in a 12,000-liter pond and it is used to irrigate a demonstration plot with *Acacia saligna*, olive trees and vines.

Photographs / schemes:





Results obtained:

The current structures have 150 m² of mesh, with galvanized steel pillars and high wind resistance cables, which can exceed 100 kilometers per hour in these sectors. In the Coquimbo Region, there is a condition in which there is always fog, "which is formed by small microscopic droplets that do not have the capacity to fall like rain, so what this mesh does is catch those drops to form a larger one, which is the one that falls and goes to a gutter and then collects in a tank with a capacity of 7 thousand liters ". In general, the average water collected in the region is 3 liters per square meter of mesh per day. That is to say, in a trap of fogs of 150 m², it is possible to harvest 450 liters daily, while in the year it will accumulate between 160 to 200 thousand liters.

Source:

<http://www.cda.uc.cl/wp-content/uploads/2015/12/Libro-Agua-de-Niebla-1.pdf>

Case N°: 60

Region / State / Province:

Coquimbo /Choapa

General Information:

Irrigation channel networks.

Coordinates (UTM):

Zone 19 J; East 314121; South 6481036

Objectives:

Administer and distribute the surface waters of the Choapa River and its tributaries, according to the rights of use of each user, ensuring the quantity and quality of the

resources, representing the irrigators before the State and the private sectors, supporting the management of the Water Communities and the development of the basin of the same river.

Summary / description / main characteristics:

A control and telemetry system is installed in the Choapa River, constructing 34 gates that allow the monitoring of the movement of the water flow to the irrigators based on their water rights with a minimum error margin. Three antennas are installed in a parallel way that allows the transfer of information between the monitoring points in the irrigation canals with the control room. Each of the gates measures the flow that the water canal has, plus its accumulated volume.

Photographs / schemes:



Results obtained:

Improved water management in the Choapa River, strengthening the commitment to the care of the water resources in the area, improving water availability for each of the irrigators of the community in an equitable manner, based on the rights that each one of them owns. it was possible to obtain instinctual information about the state in which each of the water canals, that make up the Choapa River, are located.

Source:

<https://www.iagua.es/noticias/chile/rubicon-water/16/04/14/solucion-gestion-remota-rio-choapa-chile>

<http://www.jvriochoapa.cl>

Case Nº: 61

Region / State / Province:

Coquimbo

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 19 J; East 285204.67; South 6666416.71

Objectives:

The main objective is to increase production and improve with it the ratio of kilogram of fruit per cubic meter of water consumed, which also translates into better investment returns

Summary / description / main characteristics:

In the IV Region, a farmer of 70 ha of lemons that presented a production of 60-70 Ton / ha. In 2014, the first investment was made in IoT (DropControl Telemetry) to automate Irrigation Equipment with the opening of wireless valves through the CNR Irrigation Law, with a subsidy of 60%. The following year changes are implemented in the productive management and implement soil moisture sensors in 4 irrigation sectors and a meteorological station, thus allowing to have the complete management of Climate, Irrigation, Soil.

Photographs / schemes:



Results obtained:

It has been able to increase consecutively its productions around 10-15% per year, reaching in some quarters the 120 tons per hectare. Additionally understand and inform your buyers that your water footprint is 12 liters per lemon produced. The Return on Investment (ROI) was achieved in the 2nd season.

Source:

Wiseconn Company

Case Nº: 62**Region / State / Province:**

Valparaiso / San Felipe

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 19 H; East 320826.54; North 6358304.35

Objectives:

The main objective is to increase production and improve with it the ratio of kilogram of fruit per cubic meter of water consumed, which also translates into better investment returns. The energy cost of increasing water in this area is key.

Summary / description / main characteristics:

Project has 200 ha of different crops among which avocados, grapes and citrus. The project was subsidized through the CNR in its contest 22-2012, subsidized with Intrapredial Telemetry around 40 points of soil moisture. Subsequently, the client expanded its network to more than 60 points, incorporating monitoring of time and volume of irrigation, weather stations and new points of soil moisture; with own investments and contribution of private capital of telecommunications companies and Corfo.

Photographs / schemes:



Results obtained:

The project has managed to reduce the consumption of water in the avocado from 14,000 m³ to 9,500 m³ while maintaining production and improving the quality of the fruit. In electrical terms there is clearly a saving product that the entire project is irrigated with water driven. It is estimated that energy savings are around 30%.

Source:

Wiseconn Company

Case N°: 63

Region / State / Province:

Valparaiso / Los Andes

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 19 H; East 354735.21; South 6364618.67

Objectives:

The main objective is to increase production and improve with it the ratio of kilogram of fruit per cubic meter of water consumed, which also translates into better investment returns. The energy cost of increasing water in this area is key.

Summary / description / main characteristics:

Producer of Nogales in the Andes, V region, with 100 ha of Chandler, Howard and Sunland varieties. They have allowed adjusting the frequency and time of irrigation by phenological status (postharvest sprouting, fruit growth and maturation), achieving increases in productivity and profitability during the three years of study. The productive average in the first years in which it started with the sensors (2007-2010), before the study was 4,480 tons / ha, during the years of the study (2011, 2012 and 2013).

Photographs / schemes:



Results obtained:

Yields increased 25%, 12% and 46%, respectively, with an average of 6,533 tons / ha, which implies 108,530 tons of higher production in the 3 years of the study for 29.1 ha of the three irrigation sectors . The ROI was in the first year.

Source:

Wiseconn Company

Case Nº: 64

Region / State / Province:

Biobío / Mulchén

General Information:

Water conduction systems

Coordinates (UTM):

Zone s/i ; East s/i ; North s/i

Objectives:

Covering an agricultural irrigation channel 550 meters long with a transversal profile of 1 meter of slope by 1.2 meters of base and that carries a constant 1000 to 1200 liters per second.

Summary / description / main characteristics:

BIOMEMBRANAS AQUARUBBER FOR WATERPROOFING OF AGRICULTURAL IRRIGATION. Acuarubber is an impermeable biomembrane made of recycled rubber, developed for the coating of channels and dams in order to eliminate the losses by infiltration in the conduction and containment of the resource.

Some of its main characteristics: 1.- Durability and resistance to perforations caused by animal traffic and irregular soil conditions. 2.- Elasticity, adjustment and ease of installation. 3.- Rapid implementation. 4.- Harmless for flora and fauna. 5.- It does not need qualified personnel for its installation 6.- It does not need heavy machinery for the installation 7.- 100% recycled and recyclable.

Some advantages of coating with Acuarubber: 1.- Elimination of water losses through infiltration 2.- Increase in flow capacity 3.- Minimize maintenance costs 4.- Eliminate plant proliferation in the channels corporate video: <https://youtu.be/5NSOnVVrCzg>

Photographs / schemes:





Results obtained:

Irrigation canal built in June 2016, is currently in perfect condition. Main results: 1.- Excellent water transit due to its minimum noise; 2.- It does not generate sediment in its base. - It does not generate vegetation.; 3.- The material is very resistant since cattle have accidentally entered and have not affected or cracked the Biomembrane.

Source:

ACUARUBBER SPA – ACUAOBRA SPA

Case Nº: 65

Region / State / Province:

Valparaíso / Cabildo / Bartolillo

General Information:

Accumulation systems, Technology for irrigation management.

Coordinates (UTM):

Zone 19H ; East 323807.8 ; North 6417618.2

Objectives:

Algae Growth & Evaporation Reduction

Summary / description / main characteristics:

The problem of this avocado producer was the amount of algae blooms in the 2,400 m² irrigation pond that forces him to clean the pump filters up to two or three times per day and replace them every 2 months in summer season. Besides the labor work implied, the collapse of filters resulted in intromission of algae in the drippers with consequences in the irrigation quality and crop quality. After trying with chemicals, raschel mesh and other ideas to fight algae growth with no good results, he contacted us to install Barrier Ball® floating cover. Also, this particular zone faces, since 2009, a critical water scarcity situation (declared by the government as Scarcity Hydric Zone)

Photographs / schemes:



Results obtained:

After the installation of Barrier Ball® floating cover the frequency of filter cleaning went down to once a month, the filters now last the whole year, the chemical usage to fight algae went down to zero (from 50 kg of copper sulfate consumption per month), the irrigation efficiency increased around 50%, the pressure of the drippers located in the upper zone of the hills was recovered and crop quality was stabilized. Also, the energy consumed by the pumps decreased significantly because of the evaporation reduction (80% efficiency - less water replacement) and saving 3,854 m³ of water per year only in this irrigation pond. Barrier Ball® generated a virtuoso circle in the irrigation process, allowing the owner to produce better quality avocados, with less maintenance and chemical consumption in the irrigation pond and saving 80% of the water that used to evaporates.

Source:

EXMA - BARRIER BALL

Case Nº: 66

Region / State / Province:

Valparaíso / Cabildo / El Ingenio

General Information:

Accumulation systems, Technology for irrigation management.

Coordinates (UTM):

Zone 19H ; East 298111.9; North 6403101.4

Objectives:

Algae Growth & Evaporation Reduction

Summary / description / main characteristics:

The problem of this producer was the amount of algae blooms in the 665 m² irrigation pond that forces him to clean the pump filters once a day. Besides the labor work implied, the collapse of filters resulted in intromission of algae in the drippers with consequences in the irrigation quality and crop quality. After trying with chemicals, raschel mesh and other ideas to fight algae growth with no good results, he contacted us to install Barrier Ball® floating cover. Also, this particular zone faces, since 2009, a critical water scarcity situation (declared by the government as Scarcity Hydric Zone)

Photographs / schemes:



Results obtained:

After the installation of Barrier Ball® floating cover the frequency of filter cleaning went down to once a month, the filters now lasts the whole year, the chemical usage to fight algae went down to zero (from 14 kg of copper sulfate consumption per month), the irrigation efficiency increased around 50%, the pressure of the drippers located in the upper zone of the hills was recovered and crop quality was stabilized. Also, the

energy consumed by the pumps decreased significantly because of the evaporation reduction (80% efficiency - less water replacement) and saving 1,068 m³ of water per year only in this irrigation pond. Barrier Ball® generated a virtuoso circle in the irrigation process, allowing the owner to produce better quality fruits, with less maintenance and chemical consumption in the irrigation pond and saving 80% of the water that used to evaporates.

Source:

EXMA - BARRIER BALL

Case Nº: 67

Region / State / Province:

Valparaíso / San Felipe / Llay-Llay

General Information:

Accumulation systems, Technology for irrigation management.

Coordinates (UTM):

Zone 19H; East 320808.4 ; North 6358302.2

Objectives:

Algae Growth & Evaporation Reduction

Summary / description / main characteristics:

The problem of this producer was the amount of algae blooms in the 3,000 m² irrigation pond that forces him to clean the pump filters once a day in summer season. Besides the labor work implied, the collapse of filters resulted in intromission of algae in the drippers with consequences in the irrigation quality and crop quality. After trying with chemicals, raschel mesh and other ideas to fight algae growth with no good results, he contacted us to install Barrier Ball® floating cover in the pump suction area to reduce the prescence of algae. (300 m²)

Photographs / schemes:



Results obtained:

After the installation of Barrier Ball® floating cover the frequency of filter cleaning went down to once a month, the filters now lasts the whole year. The irrigation efficiency increased around 50%, the pressure of the drippers was recovered and crop quality was stabilized. Also, the energy consumed by the pumps decreased significantly because of the evaporation reduction and less load loss (80% efficiency - less water replacement). Barrier Ball® generated a virtuous circle in the irrigation process, allowing the owner to produce better quality fruits, with less maintenance and chemical consumption in the irrigation pond.

Source:

EXMA - BARRIER BALL

Case Nº: 68

Region / State / Province:

Valparaíso / Quillota, Reg Los Caleos, in Nogales.

General Information:

Water conduction systems

Coordinates (UTM):

Zone 19H ; East 294427; North 6385458

Objectives:

- Efficient distribution of irrigation water, zero loss.
- Accurate control and generation of detailed records about irrigation water consumption.

Summary / description / main characteristics:

In Chile, 82% of water consumption corresponds to agriculture. And agriculture loses between 30% and 50% of the water available in the distribution stage to agricultural land, and there is no record of water consumption by each user.

Under these conditions: without exact control, without recording the consumption and with large losses, it is impossible to manage the water resource.

The PRESSURIZED DISTRIBUTION NETWORKS FOR IRRIGATION are systems that incorporate pipes, automatic valves and telemetry, allow a controlled and efficient distribution of irrigation water, generating records of irrigation water consumption per user, with exact real-time flow rates of delivery .

With controlled flows, an efficient technical-economic sizing of pipes is generated, which compared to enabling a pressurized network system is up to 30% cheaper than simply applying concrete to a channel.

In addition, since it is a pressurized system, it can deliver water with enough pressure to directly irrigate drippings, generating great savings in energy consumption.

Under a scenario of flood events, the system is totally resilient.

Under drought scenarios, it allows a truly efficient water management.

Empower Water Users Organizations eliminate uncertainty and reduce conflicts associated with water consumption.

Photographs / schemes:



Results obtained:

The Los Caleos Water Community plans the distribution of water, executes it in an exact way, and also with the real records of water consumption per user, analyzes and optimizes even more the use of water.

They program weekly the distribution of water efficiently.

The operation of the system is carried out with a minimum of man hours per day, including some days with zero man hours.

The community now has control over water delivery at a click.

The community eliminated the uncertainty about the volumes and volumes of water delivered.

Maintenance is minimal, so maintenance costs too.

Source:
Hidroamb

Case Nº: 69

Region / State / Province:

Metropolitana Region

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 19H ; East 280901.9; North 6225096.7

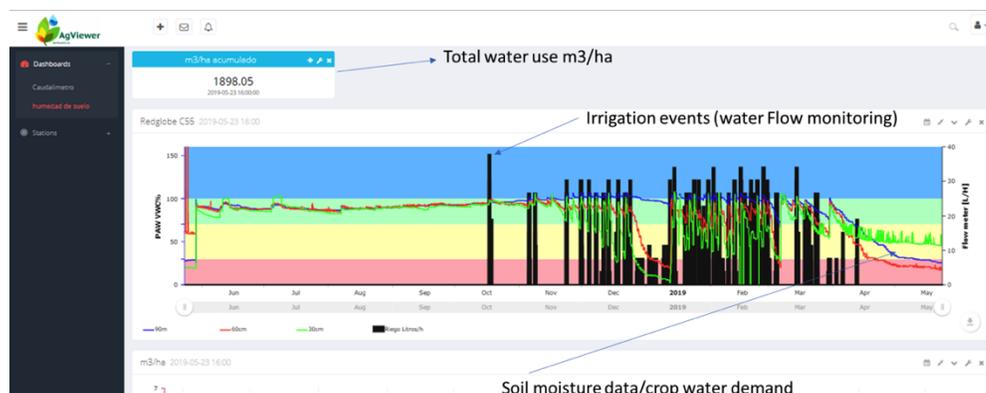
Objectives:

Optimize water use with IoT soil sensor technologies

Summary / description / main characteristics:

Using soil sensors at different depth we could optimize water use following exactly crop water demand, avoiding deep drainage losses

Photographs / schemes:



Results obtained:

It was used around 1900 m³/ha of water compared with the average water use of 7000m³/ha demand for table grape, sustaining a good production of 4000 boxes per hectare on table grape production.

Source:

Morph2o LA

Case Nº: 70**Region / State / Province:**

Atacama Region / Vallenar Province

General Information:

Water conduction systems

Coordinates (UTM):

Zone s/i ; East s/i ; North s/i

Objectives:

The main objective of the tubing is related to avoiding water losses due to infiltration and evaporation. The pipeline offers these guarantees for its speed of installation reaching more than 200 m per day

Summary / description / main characteristics:

HDPE internal 1200 mm corrugated tubing Tiger ADS. The installed amount was 900 m in the city of Vallenar, located in the North of the economy.

Photographs / schemes:



Results obtained:

Tubing is achieved in 2 months of installation. It avoids losses of water by infiltration and evaporation, improving by 100%

Source:

TUBOS Y PALSTICOS TIGRE -ADS DE CHILE LTDA

Case Nº: 71

Region / State / Province:

Atacama / Vallenar - San Jose Canal

General Information:

Water conduction systems

Coordinates (UTM):

Zone s/i ; East s/i ; North s/i

Objectives:

Avoid loss of water by infiltration and evaporation generated in a complicated access area.

Summary / description / main characteristics:

The construction company SANTA ANY installed ADS-TIGRE pipeline, benefiting around 100 irrigators from the Vallenar area

Photographs / schemes:



Results obtained:

Installation of 2000 m in 3 months - It avoids losses due to infiltration and evaporation. It is possible to cover a channel with very difficult access. The benefits in the reduction of loss are around 40%, which allowed to compensate the lack of water in the nearby communities.

Source:

TUBOS Y PLASTICOS TIGRE ADS DE CHILE LTDA

Case Nº: 72

Region / State / Province:

Coquimbo / La Serena - Elqui River Area - San Pedro Nolzco

General Information:

Water conduction systems

Coordinates (UTM):

Zone s/i ; East s/i ; North s/i

Objectives:

Avoid water loss and improve channel efficiency

Summary / description / main characteristics:

CHANNEL SAN PEDRO NOLAZCO. A tubing of more than 2000 m of 1500 mm is made in a complicated area of tubing. These tubes, in its vast majority, were moved by helicopter in order to reach the complicated areas of access.

Photographs / schemes:



Results obtained:

Installation of 2000 mm in three months - It avoids losses due to infiltration and evaporation. It is possible to cover a channel with very difficult access.

Source:

TUBOS Y PALSTICOS TIGRE -ADS DE CHILE LTDA

Case Nº: 73**Region / State / Province:**

Metropolitana Region

General Information:

Water treatment and reuse

Coordinates (UTM):

Zone 19H ; East 324071.68 ; North 6328454.65

Objectives:

System of secondary or tertiary treatment following a primary treatment (conventional primary sedimentation or an anaerobic lagoon) applicable to waters of domestic, industrial, food, among others.

Summary / description / main characteristics:

Fixed film treatment system consists of a shallow lagoon or tank where a monoculture or polyculture of macrophyte plants is developed, capable of receiving the passage of an effluent (previous pre-treatment) at the root level through a bed of sand or gravel used as a support for the vegetation. Considering a retention time in it, it allows carrying out several physical-chemical and bacteriological processes necessary for water purification. The oxygen needed to carry out these processes are supplied by the own plants, which through photosynthesis, allow to supply the oxygen necessary for the purification in the root zone, degrading the organic matter, granting the possibility of growth of nitrifying bacteria to carry out the denitrification and achieving that the heavy metals are retained at a ground level. The finished product can be collected in an exit channel.

The technical characteristics of the system describe that it has a typical slope of less than 2% and a depth between 0.3 to 1.0 meters, capable of supporting a flow of up to 13,000 m³ / day.

The selection of macrophyte plants is mainly based on the characteristics of the local climate, their oxygen transport capacity (from the leaves to the root), their tolerance to high concentrations of contamination, their resistance to diseases and their ease of handling , among others.

(For more information see: MORE Water Security Portfolio of Measures Actions and Solutions for the Water Gap, Water Scenarios 2030. Available at URL: <https://www.escenarioshidricos.cl/multimedia/>)

Photographs / schemes:



Results obtained:

Fundación Chile has implemented more than five systems for the treatment of agro-industrial RILES and wastewater for the degradation of organic matter, and has also carried out pilot applications in mining for the treatment of clear water.

Experiences show that it has great potential for domestic water treatment. High efficiency in the removal of BOD5 and SST (about 95%). It allows a 75% removal of nitrogen. It has an efficiency over 90% in the removal of pathogenic bacteria. It has a waterproof coating to prevent infiltration and ensure control over the water level. Unlike the surface lagoon, when water circulates below the surface, no odors or proliferation of mosquitoes are generated. Create and restore suitable wetlands to enhance biodiversity, the development of habitats and the landscape value of the place.

It complies with water discharge regulations in Chile DS90, DS 609, NCh 1333. They are simple to operate, therefore ideal for rural community systems. They are highly flexible to changes in flow rates and sudden pollutant loads.

Source:
Fundación Chile

Case N°: 74**Region / State / Province:**

Coquimbo

General Information:

Water treatment and reuse

Coordinates (UTM):

Zone 19 J; East 268396,26 ; North 6611688,79

Objectives:

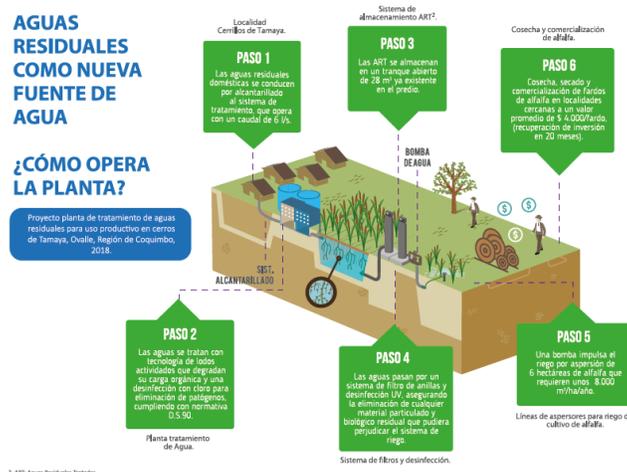
Use treated wastewater discharged by rural treatment systems in the agricultural sector.

Summary / description / main characteristics:

The Reuse of Wastewater Treatment Project in the Coquimbo Region, is an initiative financed by the Innovation Fund for Competitiveness (FIC-R) of the Regional Government of the Coquimbo region and executed by Fundación Chile during the years 2016 and 2018. The project is born in response to the water shortage in the area, manifested by a deficit of rainfall and snow, with semi-empty reservoirs and scarce snow accumulation in the mountain range. Under this problem, the project seeks to promote technology transfer to encourage the reuse of treated wastewater discharged by rural WWTPs. For this purpose, methodologies that generate quality water, without risks to human health or the environment, and that are possible to incorporate the various productive sectors of the Coquimbo region as required. Thus, allowing the same volume of water to be reused several times, generating productive linkages at the local level. The system built in the town of Cerrillos de Tamaya, in Ovalle (Coquimbo Region), was a project implemented by Fundación Chile to take advantage of the wastewater discharged by the PTAS of Cerrillos de Tamaya. The project contemplated the use of the 6 l / s of treated wastewater discharged by the PTAS for the irrigation of 5.5 hectares of alfalfa. The APR Committee undertook to operate and maintain the rural WWTP in such a way that the quality of the reuse water could be used by the agricultural productive sector that reused this new source of water. In this case, the farmer takes care of the work of cultivation, harvesting and commercialization of the agricultural product (alfalfa), agreeing with the APR committee an economic retribution for the use of treated wastewater delivered. In this way, a strategic alliance was created between the APR Committee of Cerrillos de Tamaya and the farmer, generating a reuse model of treated wastewater at a rural

level that was of high interest and is currently being implemented as the first case referring to the domestic level, with high probability of replication in the economy. In this way, the earnings from commercialization of the product were estimated at 50 thousand dollars per year, with a recovery of the investment in 1 year and 4 months, approximately. The model considers sharing the profits between the farmer (60%) and the APR Committee (40%), which would mean an additional income for the committee, which could be used in the operation and optimal maintenance of the PTAS, an eventual reduction of user fee and improvement of the operating standards of the rural PTAS. (For more information see: MORE Water Security Portfolio of Measures Actions and Solutions for the Water Gap, Water Scenarios 2030. Available at URL: <https://www.esenarioshidricos.cl/multimedia/>)

Photographs / schemes:



Results obtained:

The treatment plant for treated wastewater from Cerrillos de Tamaya cost 50 million pesos, only the investment in the irrigation system was considered, since the PTAS was built (a PTAS in good condition was selected for the operation and administration), managing to reuse 6 L / s of treated wastewater discharged by the rural PTAS of the locality to irrigate 6 hectares of alfalfa. This resulted in the generation of 50 thousand dollars a year, which are shared between the APR Committee that administers the rural PTAS and the farmer in charge of the irrigation system and agricultural production, through a profit distribution model with a contract for collaboration by means, which delivers 40% of the profits to the Committee and the remaining 60% to the farmer.

The resources delivered to the Committee are reinvested in the PTAS of the locality, to improve the operation and maintenance of the system, hire new personnel and / or purchase of necessary supplies, without impacting the user's rate and improving the water treatment conditions that the PTAS receives.

Source:

Fundación Chile

Case N°: 75**Region / State / Province:**

Los Ríos / Valdivia

General Information:

Innovative water conduction systems; Water efficiency.

Coordinates (UTM):

Zone 18H ; East 659080,3 ; North 5600062,3

Objectives:

To supply the market of potato producers, seeds of healthy and sustainable potato minitubers.

Summary / description / main characteristics:

The project consists on potato crops, in an aeroponic way. That is to say, instead of cultivating them on earth, this initiative allows the growth of seeds (or minitubers in

this case) in the air. The roots are suspended in the air, in special greenhouses. The seeds are not submerged on a water flow or on earth, as the traditional method. The minitubers or potato seeds are produced in a closed space, where the water with nutrients is nebulized. In other words, with a sprayer the water is divided in very small drops that form a cloud that allows the nutrition of the plant. In that way, the roots grow in the air, being exposed to oxygen and to this marvelous "fog" that "feeds" them and enables them to grow healthy.

Photographs / schemes:



Results obtained:

One of the most recognized aeroponic farms is in Chicago, the Green Sense Farm. The use of this system has enabled them to reuse the greatest part of their water and it is 10 times more efficient than a traditional farm, because it produces 26 lettuce harvests more, instead of the two or three regular crops. In Nutraterra CHILE, during 2004, they generated its first pilot production that had 30 thousand minitubers. These were acquired for the ones, as explained in FIA, who supported the initiative: seed producers and potato farmers.

Furthermore, this system allows a 70% saving of water, which is an essential benefit and means that potatoes can be grown in areas where the resource is increasingly scarce. Nutraterra is already developing some projects in other places, which they consider not only saving water, but also the use of fertilizers, because everything is circulating again in the system. This allows maximum utilization of water and nutrients. This is a closed and sterile system (free of microorganisms), so fertilizer applications are minimal. In addition, technologies have been incorporated to save energy in the control of temperature in greenhouses, through aerothermal systems that use heat pumps to provide cooling or heating. Today, Nutraterra is conducting research with different varieties of potatoes, such as Desiree, Pukará and Yagana,

among others; all in order to produce a sustainable potato or a potato that can be healthy and be produced efficiently at a reasonable cost.

Source:

<https://www.eldefinido.cl/actualidad/pais/10243/Papas-voladoras-El-nuevo-sistema-de-cultivo-de-la-NASA-que-ya-llego-a-Chile/>

Process of consulting the APEC economies on experiences and projects in the efficient and sustainable use of water in agriculture.

In the framework of the consultation activity of the APEC economies on successful and replicable cases in the efficient use of water from agricultura, a summary file was developed for each case or experience, which was sent on June 4 to the delegates of the APEC economies.

The responses were received until June 28 to be included in the preliminary report. Cases that are received at later dates will be reviewed and included in the brochure and final report.

The cases sent by the APEC economies are below.

Economy: United States

Case Nº: 76

Region / State / Province:

California

General Information:

Accumulation Systems; Irrigation channel networks

Coordinates (UTM):

Zone 10S ; East 601436.86 ; North 4318752.65

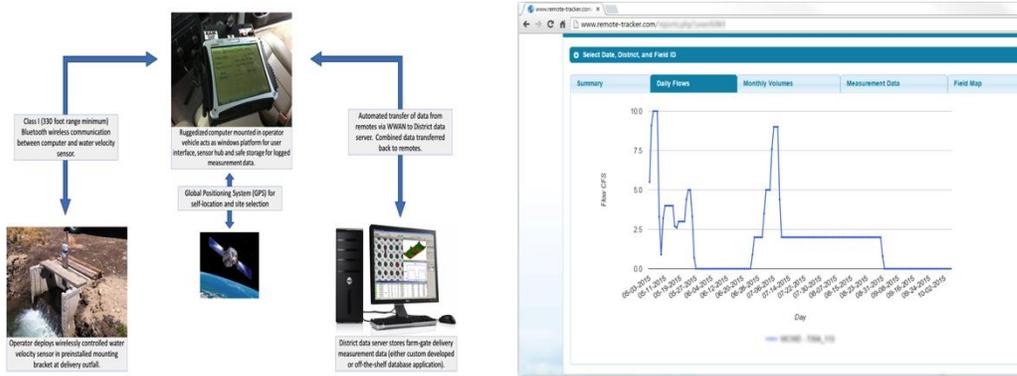
Objectives:

The California Water Conservation Act of 2009 requires agriculture water suppliers to implement critical efficient management practices, which include measuring the volume of water delivered to customers, report aggregated farm-gate delivery data to the California Department of Water Resources (DWR), and bill customers based in part by the volume of water delivered. DWR developed the measurement regulation and the Office of Administrative Law made the final regulation in July 2012.

Summary / description / main characteristics:

RD 108's flow measurement program included installing concrete weir boxes on the discharge end of turnouts as shown in the attached photo. The box isolates changes in field water levels, ensures a full water delivery pipe, and provides a location to mount a portable flow meter. Each water operator has a portable flow meter that can be temporarily installed to record the flow rate into a field at the start, completion, or any time there is a change in the flow rate delivered to a field. The flow multiplied by the duration of the flow event is used to calculate the total volume of water delivered: 450 Turnout boxes - 10 Acoustic Doppler Sensors - 10 Panasonic Toughbooks

Photographs / schemes:



Results obtained:

The user interface on the operator PC enables them to view real time flow data from a wireless water velocity sensor while adjusting flows at the turnout gate. The data is automatically transferred to a server at the District headquarters and develops daily the volumes for each turnout within the district. The software also generates water use reports for each field and invoices based on water delivered to each customer.

Source:

Reclamation District 108.

Case N°: 77

Region / State / Province:

California

General Information:

Renewable energy

Coordinates (UTM):

Zone 10S; East 604724.76 ; North 4300473.02

Objectives:

To Generate power to supply the Sycamore Recycle Pumping Plant - drainwater reuse plant. The Sycamore Recycle Pumping Plant uses a combined 775 horsepower to lift stormwater and field runoff to supply a maximum flow of 268 cfs to approximately 6,000 acres planted primarily with Rice.

Summary / description / main characteristics:

The Sycamore Solar Plant, a solar photovoltaic (PV) electric generating system comprises 30 each MECA MS Tracker 10 dual-axis trackers. Each tracker has 56 Trina TSM POS polycrystalline high efficiency PV modules, for a total of 1,680 PV modules. The system is rated at 386.4 kW DC at Standard Test Conditions. The DC output from the trackers is converted to 480V, three phase AC power by an Advanced Energy Industries Solaron 333 kW bipolar inverter, with a system CEC rating of 330.876 kW AC.

All PV system output that is not consumed by the RD-108 pumps are fed into the grid via a bi-directional meter which allows net metering credit to RD-108 for excessed generation.

Photographs / schemes:



Results obtained:

The PV Generating system successfully supplies 90% of power to the Sycamore Recycle Pumping Plant. In an average year, the plant generates approximately 800,000 Kwh AC Energy

Source:

Reclamation District 108.

Economy: Thailand

Case N°: 78

Region / State / Province:

Central Region / 11 Provinces

General Information:

Watershed management; Water conduction systems; Irrigation channel networks; Accumulation Systems.

Coordinates (UTM):

Zone 47N ; East 542838-726241 ; North 1492200-1782877

Objectives:

Water management in Chao Phraya Basin: 1. To develop water resources and to increase the irrigated area. 2. To prevent and mitigate water hazards. 3. To Preserve the ecosystem.

Summary / description / main characteristics:

The Chao Phraya Basin is considered the most important basin in Thailand for several reasons. The basin covers an area of 160,400 km², corresponding to 30% of Thailand's land surface area. It stretches from the slightly elevated northern plains to the low alluvial plains where the river flows into the Gulf of Thailand. The basin hosts 40% of the economy's population and generates 66% of the Gross Domestic Product (GDP); moreover, it includes the capital and largest city of Bangkok, which is Thailand's political, commercial, industrial, and cultural hub and it is located at the delta of the Chao Phraya River. The Chao Phraya Basin can be divided into 8 sub-basins: Ping, Wang, Yom, Nan, Sakae Krang, Pasak, Tha Chin, Chao Phraya main stream. The headwaters of the Chao Phraya River originate in the Northern part of the economy and consist of four tributaries: Ping, Wang, Yom and Nan rivers (four rivers combined at Nakhon Sawan province). In the downstream part, the Chao Phraya passes through Bangkok until the Gulf of Thailand.

Economy: Indonesia

Case N^o: 79

Region / State / Province:

Malangbong/Garut/Jawa Barat

General Information:

Accumulation Systems

Coordinates (UTM):

Zone 49M ; East 179962 ; North 9204941

Objectives:

1. To accumulate water and/or raise the water level from many sources, such as springs, rainfall/run off, rivers and/or other water sources to supply irrigation water.
2. To conserve water on agricultural land.

Summary / description / main characteristics:

The agricultural sector is the most vulnerable sector against climate change. Climate change causes season shifts and changes in rainfall patterns. The rainfall duration becomes longer and its intensity becomes higher. This situation causes a high frequency of flood events. Climate change also causes a longer dry season than usual which is causing a drought, decreasing agricultural productivity, and narrowing the planting area. Therefore, certain efforts are needed so that the abundant rain water during the rainy season can be used to prevent a drought during the dry season.

The Directorate General of Agricultural Infrastructure and Facilities, Ministry of Agriculture, introduces water conservation projects through rainfall and runoff water harvesting techniques to address this issue. We introduce the development of farming pond in all parts of Indonesia. In the past four years, we have built 23,174 farming ponds. These farming ponds must be close to the agricultural area, effective, cheap, location specific, as well as being able to supply a sufficient amount of water at the farm level throughout the year.

Photographs / schemes:



Results obtained:

The farm pond in Malangbong, Garut, Jawa Barat is chosen as an example of the project. This farm pond was built by the Gema Tani farmers group. It can accumulate water up to 4800 m³ to irrigate 25 hectares of rice fields. This farm pond is founded through government and community voluntary contributions. Its main water resources are rainfall, springs and creeks that are collected by pipes to the pond.

Source:

Directorate General of Infrastructure and Facilities/Ministry of Agriculture.

Economy: Phillippines

Case N°: 80

Region / State / Province:

Western Visayas Region/ Province of Negros Occidental

General Information:

Technology for irrigation management.

Coordinates (UTM):

Zone 32P ; East 643501,86 ; North 1140040,22

Objectives:

The Installation of Canacungan Ram Pump Irrigation System (RPIS) aims to generate new service areas of Small-Scale Irrigation Projects (SSIPs) that will result in improved productivity and an increased income of farmers in rural areas. It also aims to provide a sustainable irrigation system that is cost-effective, efficient, and environment-friendly to rural farmers.

Summary / description / main characteristics:

The Canacungan RPIS, installed in Barangay Canacungan, La Castellana, Negros Occidental, is a government project founded under the Department of Agriculture - High Value Crops Development Program (DA-HVCDP) through the Bureau of Soils and Water Management (BSWM). The project was installed on the year 2014 and the total project cost is PhP 500,000 pesos (about US\$ 9,615). The project consists of an intake structure, catchment tank, ram pump foundation, ram pump assembly, storage tank and pipes and accesories. The primary source of water for the system is the river within the Barangay. The components of the ram pump assembly are locally made, which is relatively cheaper and spare parts for repair are readily available. The ram pump uses an intake pipe with 3.0 inches diameter to operate and a delivery pipe with 1.5 inches diameter to deliver water to the 30-cubic meter ferrocement storage tank. The irrigation from the storage tank is done through gravity, since the tank is located at a higher elevation level than the production area.

Ram Pump Irrigation System is best suited on far flung areas where farms are at a higher elevation level than the source of water and use a fuel water pump to lift water which is too costly. The Canacungan RPIS is being operated and maintained by the

"Dama Farm Workers Agrarian Reform Beneficiaries Association" which is a farmer association in the barangay. Currently, the project irrigates 3.0 hectares of sugar cane plantations.

Photographs / schemes:



Results obtained:

The installation of the Canacungan RPIS increased the irrigated service area by 3 hectares. Sugar cane production also increased due to the provision of irrigation in the area. High sugar cane production resulted to increased farmers' income. Aside from irrigation, the project is also used as a source of water for domestic use.

Through the project, the delivery of irrigation water to the elevated barangay was achieved, not only helping the farmers but the community as a whole. Additionally, the installation of RPIS requires low operation and maintenance cost which is beneficial to the farmers. The system runs automatically and continuously for 24 hours and there is no need for an operator to watch the system. Basic maintenance includes regularly checking for air and leakages in the ram pump system, gaskets, check valve and door hinges.

Source:

Bureau of Soils and Water Management.

Case N^o: 81

Region / State / Province:

Aisa/Philippines/Bohol

General Information:

Small Water Impounding System (SWIS)

Coordinates (UTM):

Zone 51P ; East 643560,59 ; North 1113808,35

Objectives:

The Small Water Impounding System (SWIS) aims to harvest rainfall and runoff during rainy/wet seasons and store the harvested rainfall and runoff for immediate or future use. The main use of the stored water is for irrigation of crops, such as rice and other high value crops. Other uses include fish and livestock production and for domestic use. There are also inherent environmental functions such as flood prevention, groundwater recharge and micro climate enhancement/moderation.

Summary / description / main characteristics:

Currently, there are more than 600 SWIS in the economy being implemented by the Department of Agriculture through the leadership of Bureau of Soils and Water Management (BSWM). One of these is the **San Roque SWIS** which is operating since 1980 (about 39 years). The SWIS has six major physical components, namely: watershed area, earth embankment, reservoir, spillway, outlet works and service area with a distribution system (canals). The earth dam is about 25 meters in height with a length of 110 meters, the reservoir surface area is 14.40 hectares and a total length of canal is 6,860 meters. The Philippine government funded the implementation of the project with a total cost of PhP 18 Million pesos (about US\$ 350,000) including its rehabilitation in 2011.

The San Roque SWIS is primarily being utilized for irrigation of 110 hectares of rice field, both for wet and dry season. The system is being managed by SARISA Small Water Irrigators Association (SWISA) with 115 members. This association is registered at the Security and Exchange Commission of the economy to have legal personality to transact business with the government and other related agencies. Moreover, the association was capacitated by the BSWM through various training programs and related activities to effectively and sustainably operate and maintain their system.

Photographs / schemes:



Results obtained:

The following benefits were obtained from San Roque SWIS: 1) Increased cropping intensity from 100% to 200% due to irrigation; 2) increased palay production from an average of 3.0 metric tons to an average of 4.4 metric tons per hectare per cropping season; 3) possibility to acquire properties (e.g. office), farm machineries (e.g. hand tractor, mud turtle, mehcanical rice thresher, shredder, lawn mower) and post harvest facilities such as mechanical dryer, solar dryer and palay shed; 4) able to provide services to their members and non-members with corresponding minimal fees for the use of their equipment; and 5) awarded as one of the Outstanding Irrigators Association in 2018 where they received a cash prize of Php500,000.00 (about US\$ 10,000.00) which they can use to further improvement of their system.

Source:

Department of Agriculture-Bureau of Soils and Water Management.

Economy: Mexico

Case Nº: 82

Region / State / Province:

Sinaloa

General Information:

Technology for irrigation management

Coordinates (UTM):

Zone 12R ; East 701965 ; North 2854106

Objectives:

Tecnification of surface irrigation, in order to save 10% of water used in the irrigation of crops.

Summary / description / main characteristics:

The Mexican government has in operation an ambitious program for Technical improvement of Gravity Irrigation (RIGRAT for its Spanish acronym) in main irrigation districts paid by government and Water User Associations. This low-cost program is based on a personalized irrigation assistance to farmers during a water year through irrigation extension workers. RIGRAT considers that farming is a risky activity and only the producer takes on the risk. Therefore, the program's objective is to help the producer to best meet crop water needs with irrigation delivery with as much flexibility as possible. This allows to increase water use efficiency and yields using modern on-farm irrigation management practices, considering the irrigation scheme constrain. The RIGRAT Project has the following components:

- 1.- Irrigation extension. Professional extension support in on-farm irrigation management is the core of this program. Irrigation professionals were hired, one technician per 1,000 ha, to offer irrigation extension services as a link among local water authorities, WUA, producers and irrigators.
- 2.- Irrigation design. To achieve high efficiency and uniformity of irrigation using gravitywater application methods requires attentive field management after performing an optimal irrigation design.
- 3.- Irrigation scheduling. Each WUA participating in the RIGRAT program has compiled a database with information about crops, soils, weather, water distribution networks and water users, to estimate the irrigation water needs for each single plot.

Recommended irrigation schedules are adjusted by the IE according to the water delivery system capabilities and constraints. RIGRAT staff is responsible also for soil and crop sampling to obtain irrigation scheduling parameters. 4.- Land leveling. The RIGRAT project focuses to increase such uniformity through precision land-leveling in WUAs participating in the project. Land-leveling information is compiled by the IE and financed through federal programs with restrictions in field slopes and soil depth. 5.- Volumetric delivery. Volume is estimated at turnout level through flume or weirs where WUA distribute water to several plots or farms. It is more difficult to determine amounts of water applied at plot level when using surface irrigation than when using pressurized methods. Water applied to each furrow is estimated using a siphon tube measuring with head-discharge curve. 6.- Irrigation monitoring. Each IE is equipped with a TDR-type sensor and used during farms visits to monitor soil moisture. 7.- Program follow-up. As a program that uses public funds, RIGRAT has to measure and publicize quantitative assessment not only of overall project performance, but also of contributions to performance from each WUA in terms of water use efficiency and yields.

Photographs / schemes:



Results obtained:

The producers expected from the RIGRAT in order by priority: to increase yields, reduce inputs, and decrease irrigation volumes. Results from the survey gave a diagnosis about the producer before the project's implementation. With the

implantation of RIGRAT, now it is possible to follow each irrigation and its accumulation at the end of a water year at farm level. Total net and gross depths at plot level during the water year 2013-2014 are indicated in the Figure 1 and estimated application efficiencies are indicated in Figure 2. Both figures show high variability of delivered irrigation depths and the consequences in the application efficiencies at farm level.

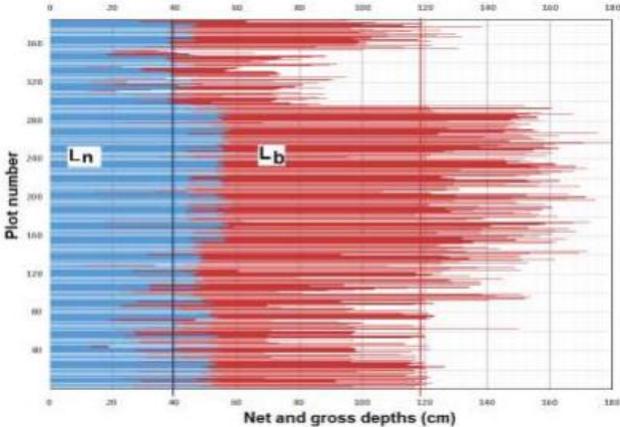


Figure 1. Total net (L_n) and gross (L_b) depths at plot level during the water year (2013-2014). As reference, the average net and gross depths are indicated as vertical lines.

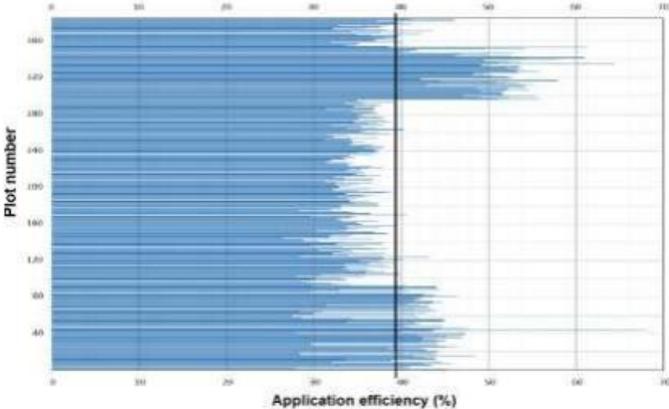


Figure 2. Application efficiencies at plot level during the water year (2013-2014). As reference, the average application efficiency is indicated as vertical line.

Figure 3 compares the required volume at farm level and the volume at WUA level for an irrigation district 075. In spite of large investments in hydraulic investment in the irrigation district, efficiencies are low and highly variable among WUA's for the same irrigation district. Figure 4 indicates the average application and global efficiencies for water year 2014-15 for WUA's participating in the RIGRAT project at ID075. Results indicate that global efficiencies at water source level are very low since the main reservoirs are far away from the agriculture zone with low conduction efficiencies.

One of the performance indicators of the RIGRAT project is water productivity. Figure 5 indicates contrasting differences in water productivity values among participating WUAs, which depend on efficiencies from field, turnout, WUA and ID.

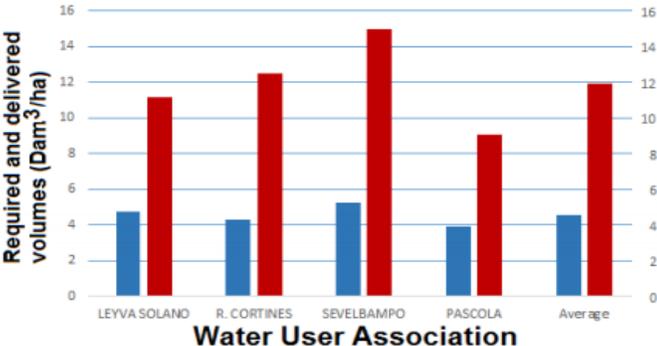


Figure 3. Comparison of required at farm and delivered at turnout per WUA in Dam³/ha for water year 2014-2015.

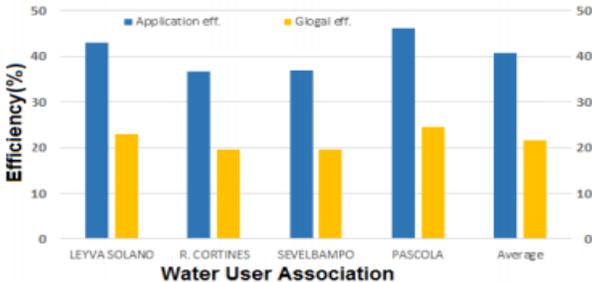


Figure 4. Application and global efficiency per WUA at irrigation district 075 - water year 2014-2015.

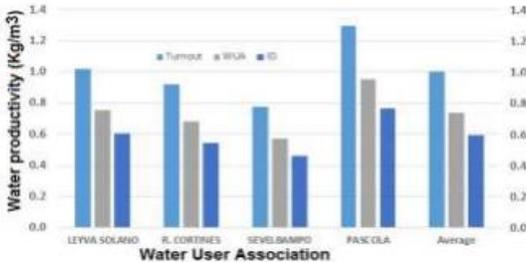


Figure 5. Average water productivity ((Kg/m³) estimated for WUAs participating in the RIGRAT at ID075 for water year 2014-2015.

Source:
 Instituto Mexicano de Tecnología del Agua.

Conclusion

From the search of successful and replicable cases in the economies of interest APEC, with a main focus on food safety and water use efficiency, it can be concluded that their results were satisfactory and of great interest, which is reflected in the summaries and cards filled out by the consultant, in addition to the information received from first source by companies, organizations and the economies themselves.

It is important to mention that the biggest challenge is the investigation of the relevant information. When it comes to initiatives of public interest and mainly with large-scale government financial contributions, some type of information regarding the projects is available on the web pages, media and / or academic publications. However, when these initiatives involve individuals and private companies on a small, medium or large scale, the information is not widely disseminated or available to be quantified and referred to.

In general, the information contained in this report is based on the work of the consulting firm's team, who compiled as much data as possible to disseminate the initiatives, which were attractive to be replicated and which met the criteria set forth in this background compilation.

In reference to the topics discussed, it is important to highlight that the transversal innovations of the APEC economies are related to the new technologies that have been developed in recent years regarding sensing, monitoring and follow-up, this last component being a fundamental pillar for making future decisions and which will allow a better use of water resources.