



# ***Sustainable Agriculture in Costa Rica***

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**XI WORKSHOP INTERNACIONAL  
BRASIL/JAPÃO  
ENERGIA, BIOCOMBUSTÍVEIS E  
DESENVOLVIMENTO SUSTENTÁVEL**

**IFSP, Campus Caraguatatuba  
11 September, 2013**





# Sustainable Agriculture Problems

- ❖ Climate change
- ❖ 2020 - 2080 Central America will increase temperature (1.1°C to 5°C)
- ❖ Precipitations reduce 50% in Central Pacific, Costa Rica
- ❖ Increase sediments loads not use BMP 's
- ❖ 85% of available water is used for agriculture.
- ❖ 45% decrease soil productivity.





# State Policy for Agricultural Sector



Competitiveness



Innovation and  
Technological  
development



Management of  
rural agriculture



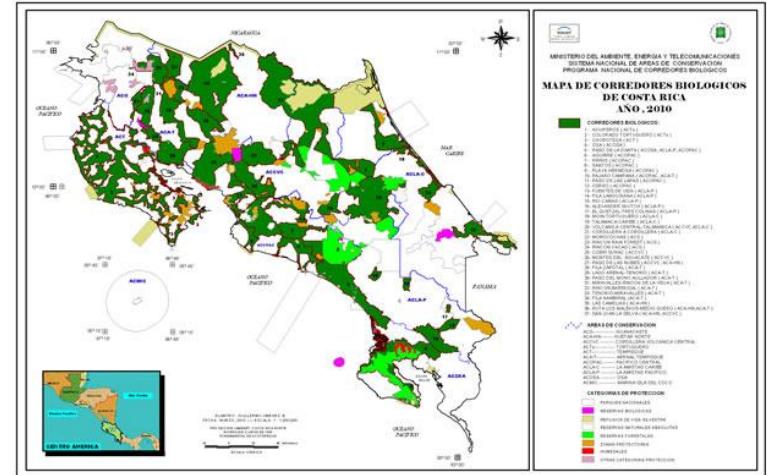
Climate Change  
and Agro-  
Environmental  
Management





# Steps to Sustainability

- ❖ 25.1% territory is preserved and establish of biological corridors. (goal 45%)
- ❖ 5% world biodiversity
- ❖ Environmental Services payment
- ❖ Ecological labels: preserve and increase incomes-
- ❖ Goal 2020: Carbon Neutral
- ❖ 98% Energy: Renewable: Hydropower, Eolic and geothermal





# University of Costa Rica

**SOILS AND WATER  
RESOURCES**

**MACHINERY AND  
MECHANIZATION**

**BIOSYSTEMS  
ENGINEERING**

**BIOPROCESSING**

**PROJECTS  
DEVELOPMENT**

- UCR change and upgrade its curriculum to integrate the concepts of competitiveness and production to sustainable agriculture to achieve our goal to be an ecological country

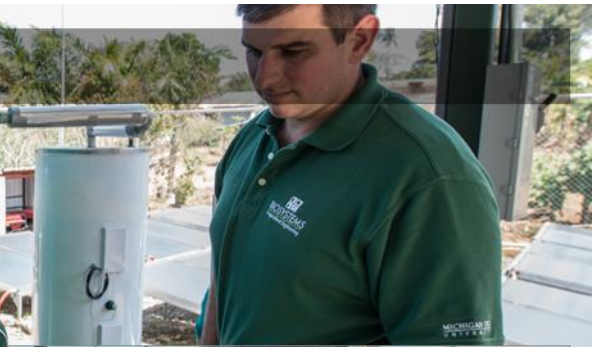




# Bioenergy Engineering



ENVIRONMENT



Published: May 10, 2013

## COSTA RICAN AND MSU OFFICIALS HELP DEDICATE **NEW ANAEROBIC DIGESTER**

Contact(s) [Layne Cameron](#)

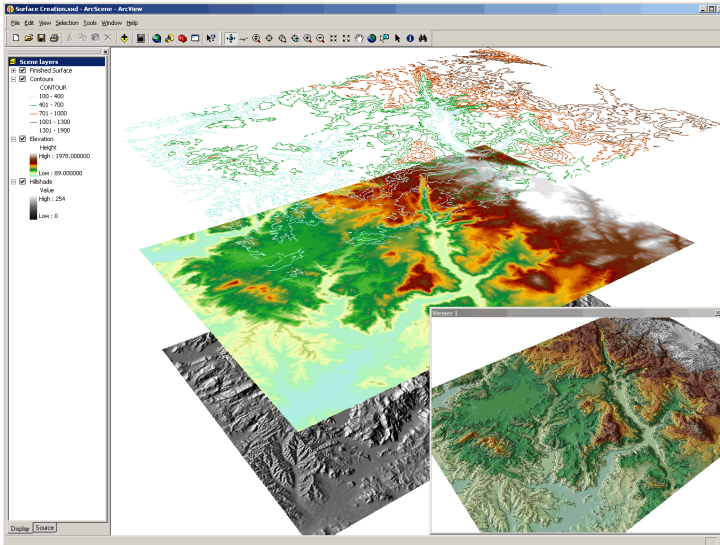


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# Ecosystems Engineering





# Technology applied production







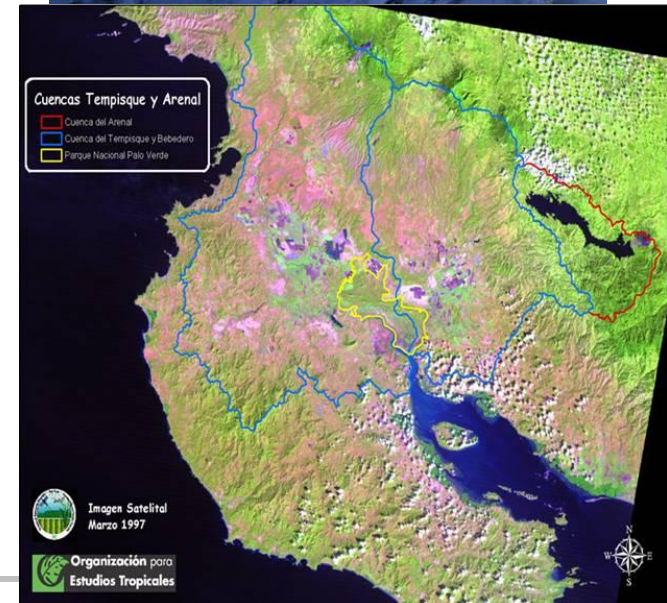
# Water Resources Management





# Arenal Tempisque Irrigation Project

- ❖ Located in Guanacaste, Costa Rica.
- ❖ Created in 1984
- ❖ Total Area: 60,000 ha:
  - 40,000 ha from Arenal Basin
  - 20,000 ha from Tempisque River
- ❖ 280 km<sup>2</sup> and 995 recipients
  - 257 km<sup>2</sup> surface irrigation
  - 16 km<sup>2</sup> pumping irrigation
  - 7 km<sup>2</sup> fishing activity (tilapia)





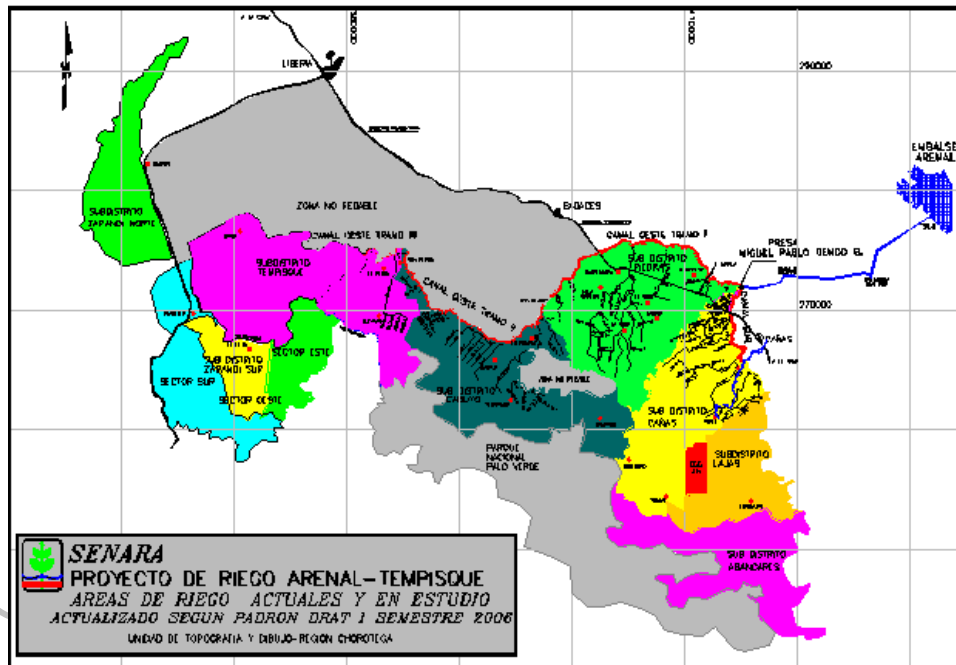
# Principal Crops in the Irrigation Project

Crop	Area (ha)	% national
Sugarcane	14,800	45.8%
Rice	9,230	
Pasture	2,790	
Tilapia	700	
Cotton	315	
Others:	100	
Pineapple		
Cantaloupe		71%
Papaya		
Onions		



# Hydraulic Resources

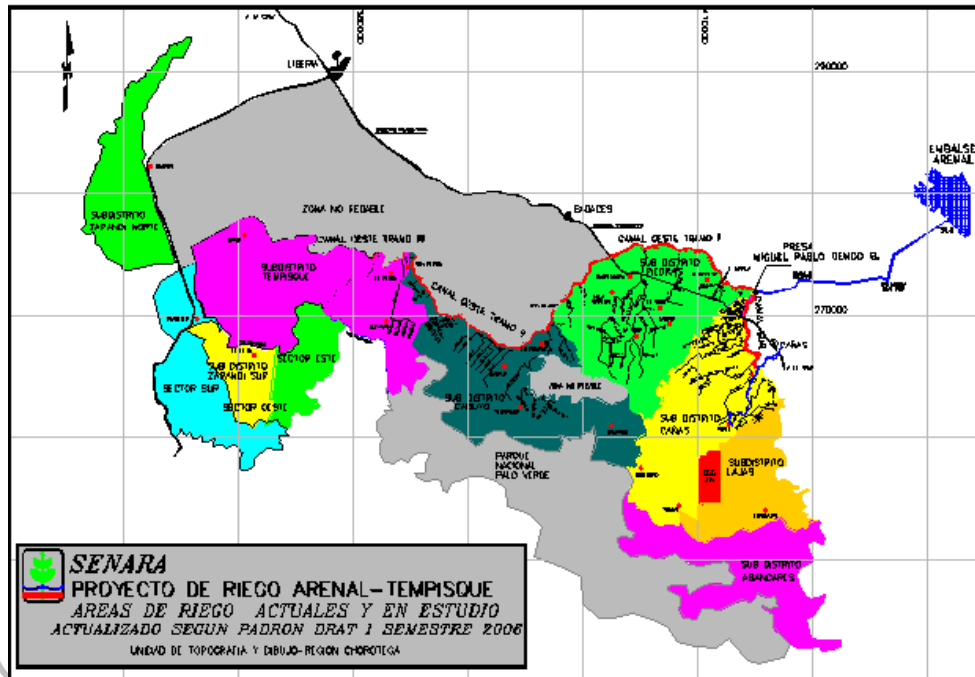
- ❖ Hydric dependence of Electricity Costa Rican Institute (ICE)
- ❖ Diversion discharge from Arenal Basin: 80 cms
- ❖ 3 powerhouses to generate electricity in the dry season (1/3 national consume)





# Hydraulic Resources

- ❖ Miguel Pablo Dengo Reservoir:
- ❖ South Channel: 8.5 km length and 30 cms, max capacity
- ❖ West Channel: 42 km length and 55 cms max capacity
- ❖ Secondary and tertiary channels





# Necessities in the Irrigation Project

- ❖ **Modernize the geospatial data base**
- ❖ **Preservation of water resources**
  - Discharged flows return to system to coastal areas and wetlands
    - Palo Verde National Park
- ❖ **Implement a volumetric rate for the farmers**
  - Water Rate is based on field size \$100/ha /year
- ❖ **Treatment of effluents and reuse**



# Necessities in the Irrigation Project

❖ Irrigation Project for water sustainability considering climate changes and critical operation in dry season.

❖ Expand the project to Guanacaste Municipality for water supply

PROYECTO AYA-SENARA

## Agua viajará por canal hasta zona costera

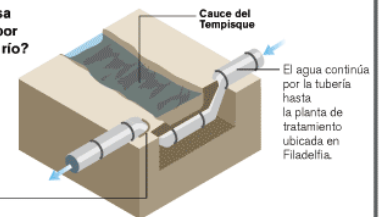


### El tubo de cañería



Los 31,5 km van desde El Pelón de la Bajura hasta Filadelfia, donde se potabiliza y distribuye hacia las zonas costeras.

### ¿Cómo pasa la tubería por debajo del río?



FUENTE: BERNAL SOTO, GERENTE GENERAL DE SENARA

naCIÓN

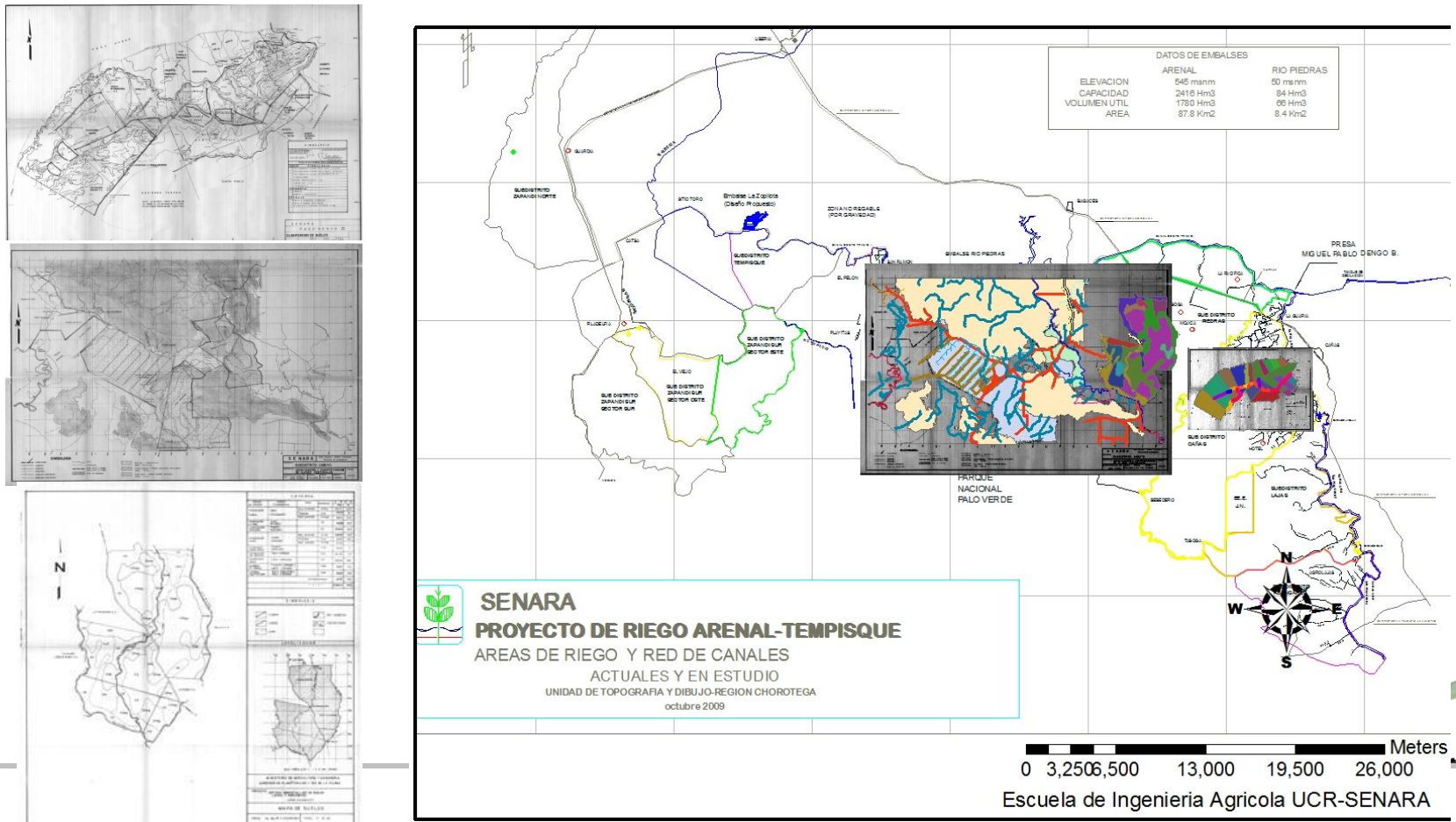
FREDDY SOLÍS B./LA NACIÓN





# Progress

## ❖ Generation of Geospatial data in the Irrigation Project





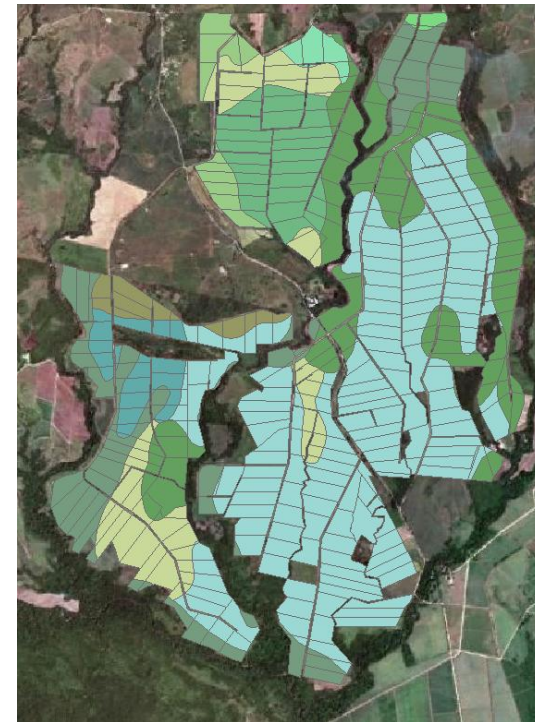
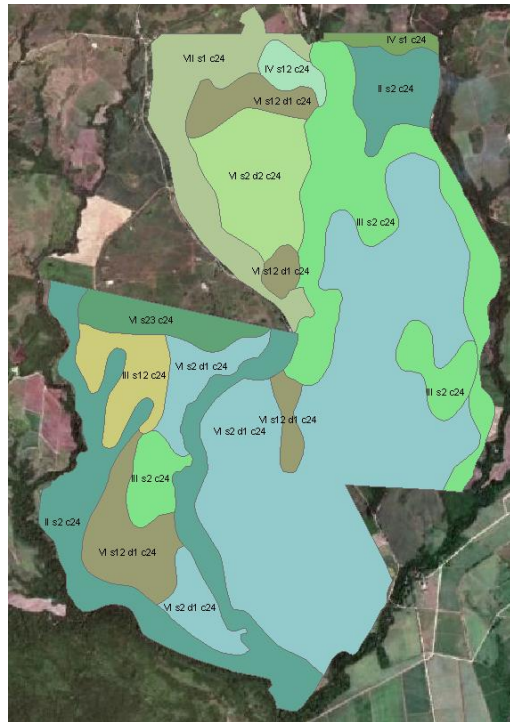
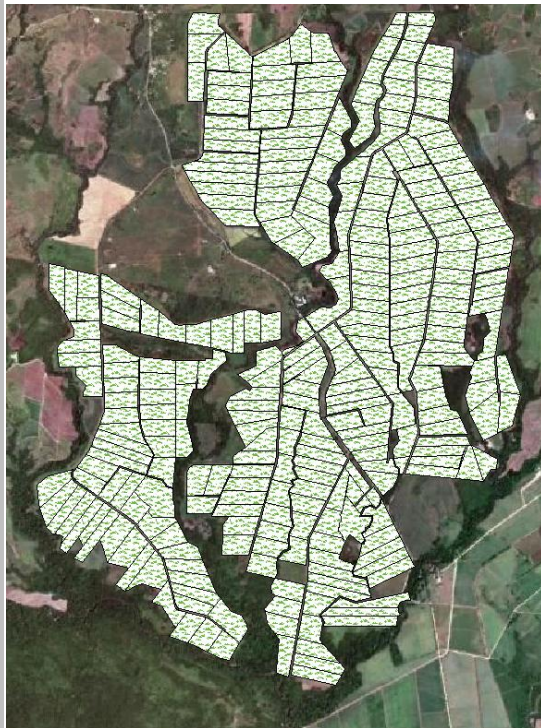
# Cartographic model for land use capacity

LA\_SOGA\_CRTM05

INTERSECT

Capacidad de uso por Finca

CAPACIDAD\_DE\_USO\_CRTM05

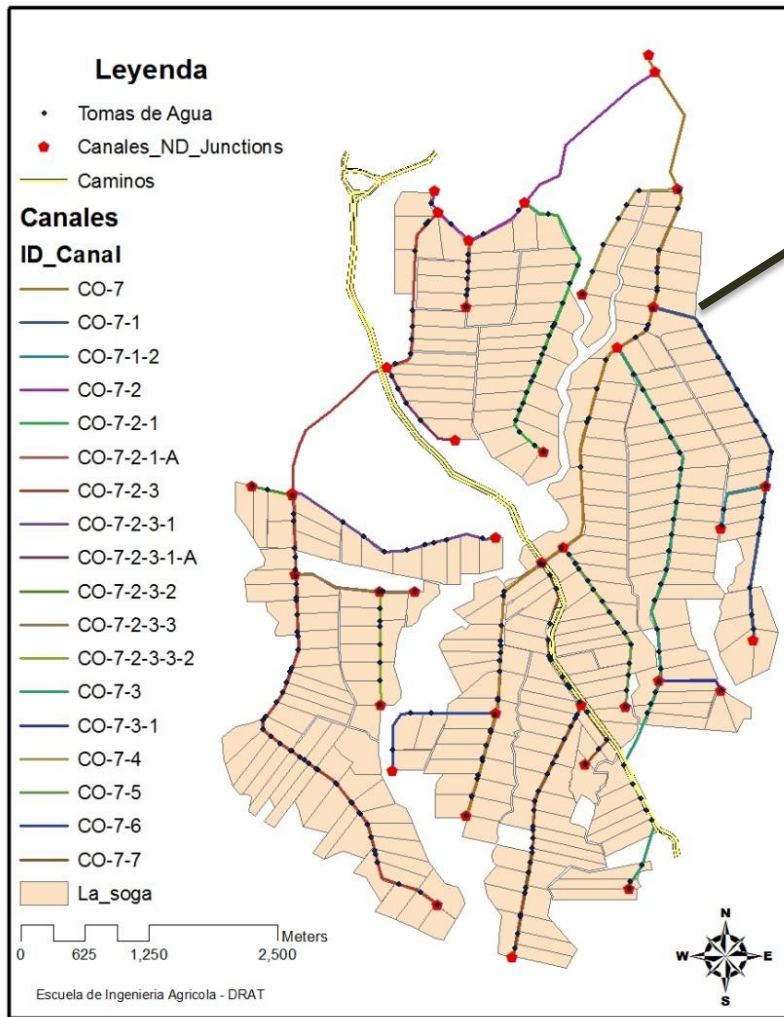


C\_USO

- II s2 c24
- III s12 c24
- III s2 c24
- IV s1 c24
- IV s12 c24
- VI s12 d1 c24
- VI s2 d1 c24
- VI s2 d2 c24
- VI s23 c24
- VII s1 c24



# Irrigation Channel network and water intakes location



**Identify**

Identify from: <Top-most layer>

Tabla\_de\_informacion\_de\_L

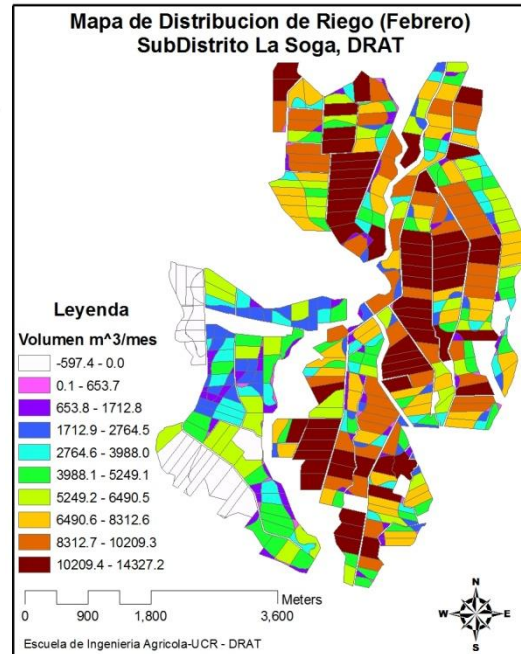
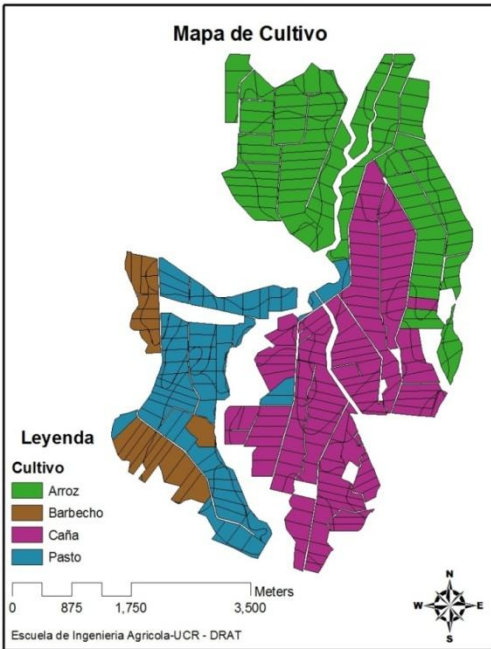
Location: 405,131.165 267,7

Field	Value
FID	104
Shape	Point
ID_Parcela	104
ID_Canal	CO-7-3
Name	
Name_1	
ID_Canal_1	CO-7-3
TIPO	R
L	5770
Q	0.81
H	0.7
B	0.75
D	0.53
Z	1.5
N	0.014
A	0.81
BL	0.17
S	0.001
FID_12	104
FID_	0
Correo_Ele	
ID_Parce_1	104
ID_Prop	

Identified 1 feature

The screenshot shows the 'Identify' window in a GIS application. An arrow points from a red dot on the map to the 'Identify from' dropdown menu, which is set to '<Top-most layer>'. The 'Location' field displays the coordinates '405,131.165 267,7'. Below this, a table lists the attributes of the identified feature, including fields like FID, Shape, ID\_Parcela, ID\_Canal, and various numerical values.

# Water crop requirement by property



**Identify**

Identify from: <Top-most layer>

Áreaterenopoligonos\_Intersección  
Typic Ustropept  
Typic Ustropept

Location: 404,925.570 270,665.553

Field	Value
FID	84
Shape	Polygon
FID_Área_t	5
Id	6
Área	931085.396989
Perímetro	4478.882456
Tipo_suelo	Typic Ustropept
Consociaci	Consociación San ...
FID_La_sog	45
FID_	46
F_ÁREA	61240.668341
Cultivo	Arroz
Kc	0.7
Kc_Medio	1.07
Kc_Final	0.7
RO_enero	13.0152
RO_febrero	14.076
RO_m...	15.0000

**Identify**

Identify from: <Top-most layer>

Áreaterenopoligonos\_Intersección  
Typic Ustropept

Location: 404,925.570 270,665.553 Met

Field	Value
ET0_abril	5.388364
ETC_Enero	89.005389
ETC_Febrer	138.400062
ETC_marzo	173.063762
ETC_abril	113.155633
ETC_E_DIA	2.871142
ETC_F_DIA	4.942859
ETC_M_DIA	5.582702
ETC_A_DIA	3.771854
Preci_Ene	4.2
Preci_Febr	4.3
Preci_Mar	7.4
Preci_Abril	44.5
B_H_ENERO	-84.805389
B_H_FEBRER	-134.100062
B_H_MARZO	-165.663762
B_H_ABRIL	-68.655633

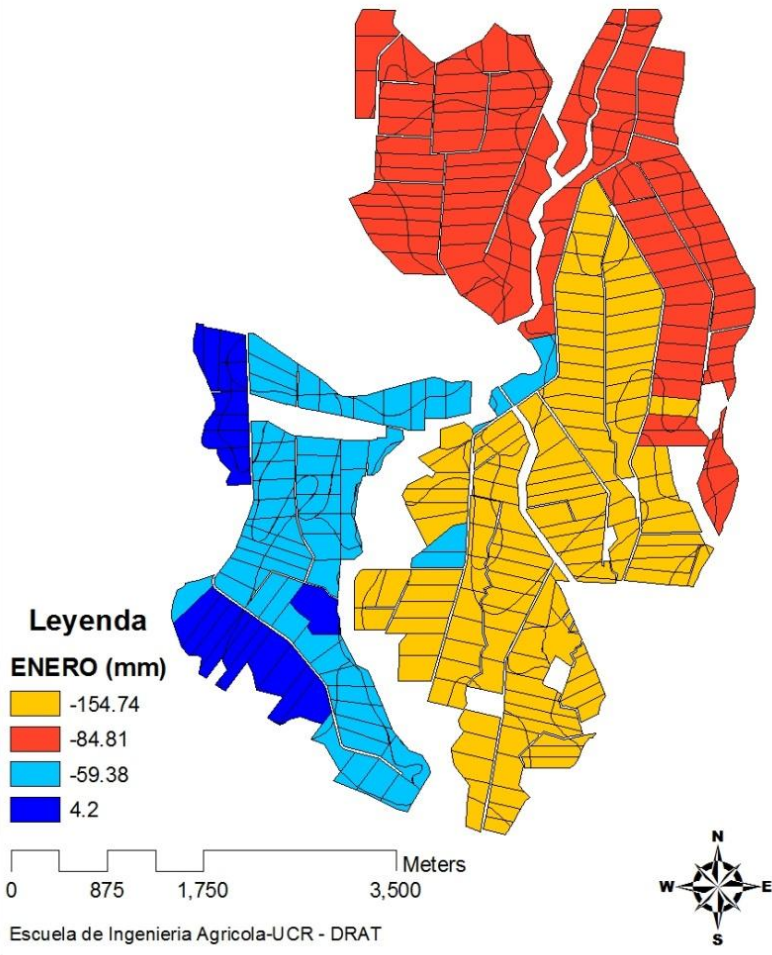
Month	Temp		Rain (mm)
	T min	T max	
Jan	22.5	31.8	4.2
Feb	22.9	32.7	4.3
March	23.2	33.8	7.4
April	24.0	34.4	44.5
May	23.7	33.5	174.9

Crop	day	Kco	Kc2	Kc3
Rice	150	1.05	1.2	1.05
Pasture	70	0.3	0.7	0.5
Sugarcane	365	0.4	1.25	0.75

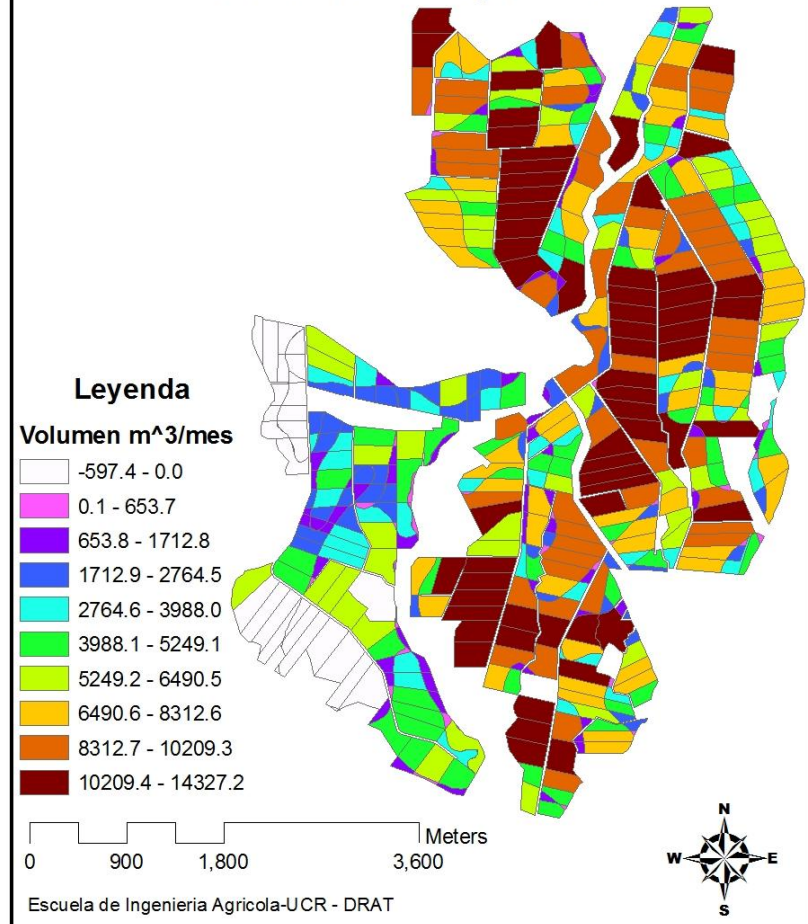
# Water crop requirement by property



## Gradiente de Demanda (Enero)

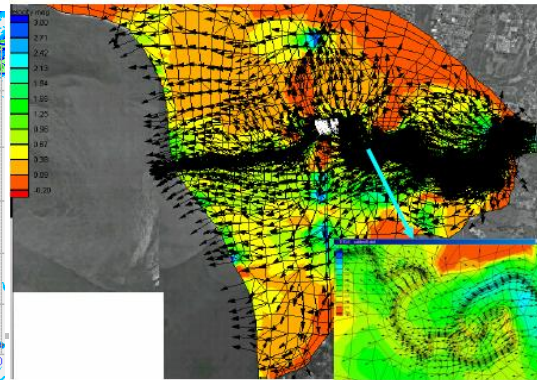
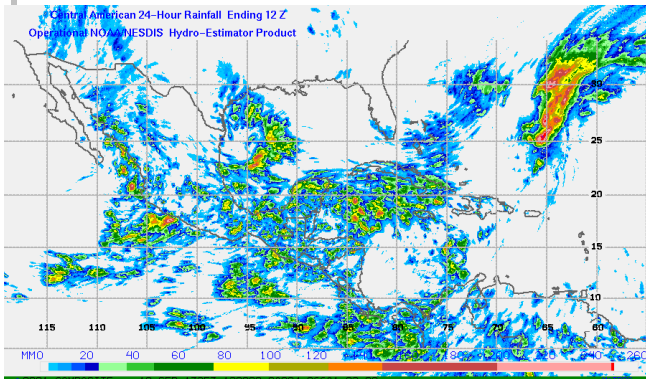
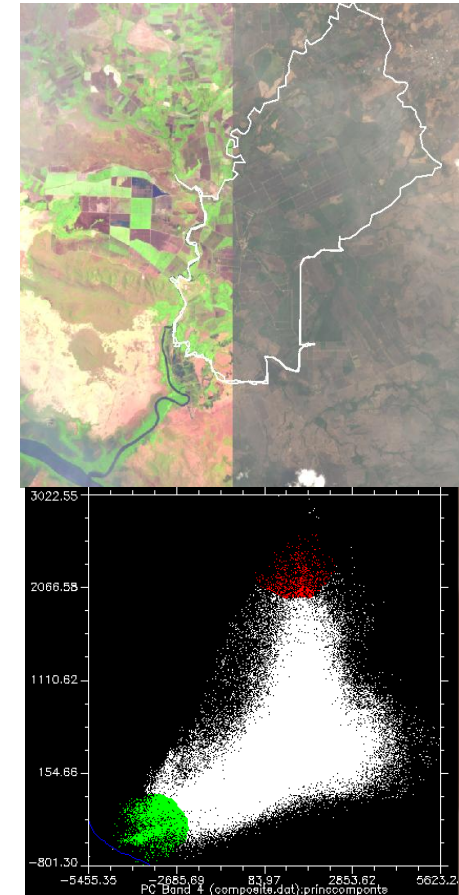


## Mapa de Distribucion de Riego (Febrero) SubDistrito La Soga, DRAT



# Working Process

- ❖ Water requirements for crops in the Irrigation District by crop/growing cycle/user.
- ❖ Analysis of LanSAT Images for crop parameters
- ❖ Aerial Evapotranspiration
- ❖ Aerial Rainfall from HydroEstimator (validated)
- ❖ Generate flood zone maps



$$k_C = 1.2246 NDVI + 0.2203$$

$$ET = ET_0 k_C$$



**Thank you**

