# Automation and Control of Irrigation in the Monti Berici Hills in Northern Italy

USCID Water Management Conference

Irrigated Agriculture Responds to Water Use Challenges — Strategies for Success

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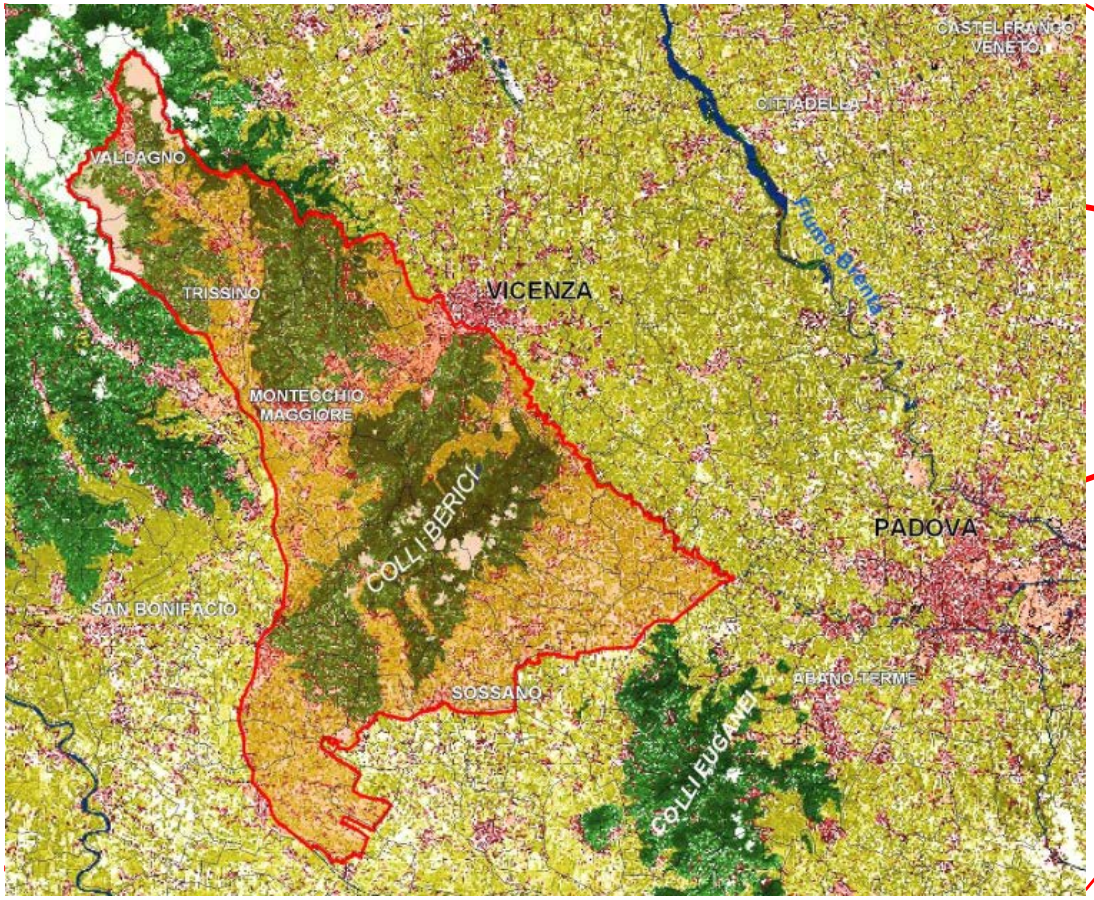
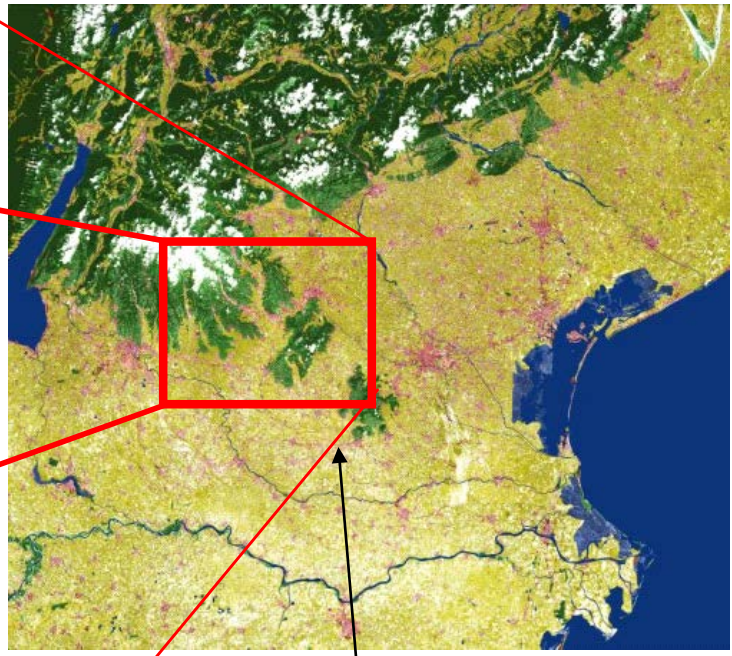
# “Riviera Berica” Drainage and Irrigation District



- Total area 57,000 ha
- Total irrigated area: 13,000 ha (12,000 sprinkler, 600 flood irrigation, 400 micro-irrigation)
- Total water right flow rate: 5 m3/s

# INTRODUCTION

The irrigation of the North Italian flood plain is carried out with low efficiency systems

Two new irrigation plants were set up, 1) in 2004 on 57 ha, and 2) in 2005 on 150 ha, in the Vicenza Province.

The areas are within the perimeter of the Irrigation and Drainage District Alta Pianura Veneta and extends on the Monti Berici hills, where the viticulture flourishes

Beforehand, irrigation was present only in few farms which used water from wells or civil aqueducts to fill tanks situated in an upper site, and distribute it by gravity in a pipe distribution network equipped with a drip irrigation system

Such a highly technological irrigation plants are justified to encourage further investments in an area with high agricultural and social potential, and implementation of best practices to obtain products of even better quality.

In this paper we will focus on design and maintenance, irrigation scheduling, and effects on the on-farm distribution systems.

# COMMON FEATURES

- The mission of the District is to improve local agriculture, and **funds** were obtained from European Union and the Region Veneto

- From a main subsurface **pipe network** under pressure, secondary pipes with farm outlet reach the owners that applied for it and allowed the District to pass by their land with the pipes

- From then, owner are **committed** to use only that water, and invited to use high efficiency irrigation systems

- **Production** is cherries (mostly in the 2004 project), wine (mostly in the 2005 project), olives

# SITE

- Sub-humid climate
- Annual rainfall:  900-1000 mm
- Annual hydrological deficit: 100-150 mm
- Long term average daily temperature: –1 ÷ +23°C (2006: -8.4 ÷ +36.9°C)
- Orientation: mostly South-East
- Elevation: 20÷315 m.a.s.l.
- Slope: 0÷15%
- The higher the elevations the shallower the soil
- Haplic Luvisols, with loam, silty loam and clay loam textures
- Rocks up to 50%
- Ph 7.62÷7.90
- Calcareous rocks

Site 2 features
(2005, 150 ha)

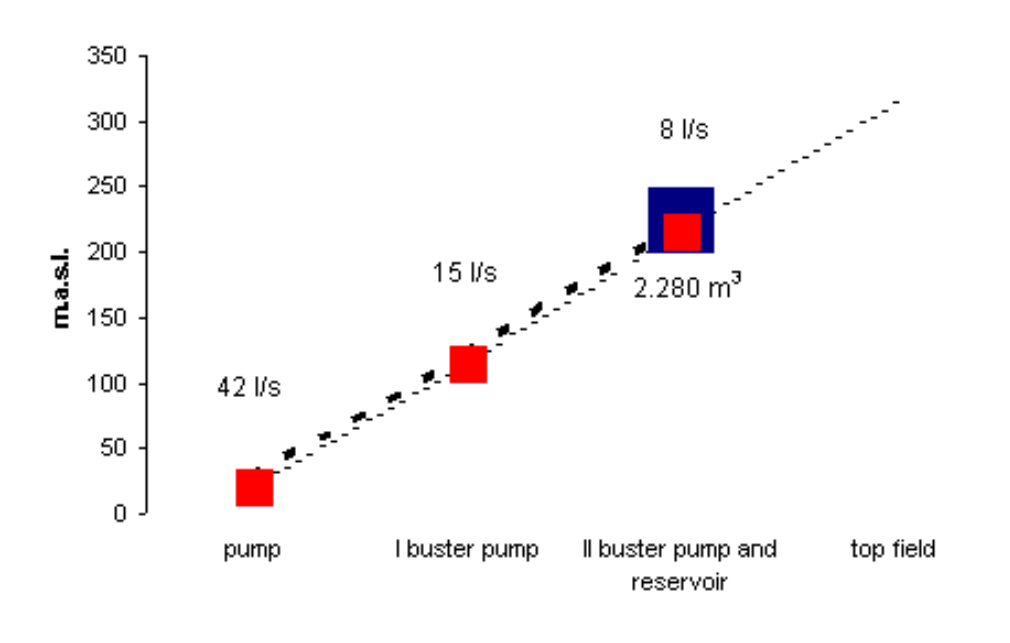
# Pre existing condition

- 1.100÷5.000 plants/ha (Guyot and “Tendone” trellis system, harvest mechanization beginning)

- Existing on-farm irrigation system (wells or civil aqueducts, tanks up-hill, drip irrigation)

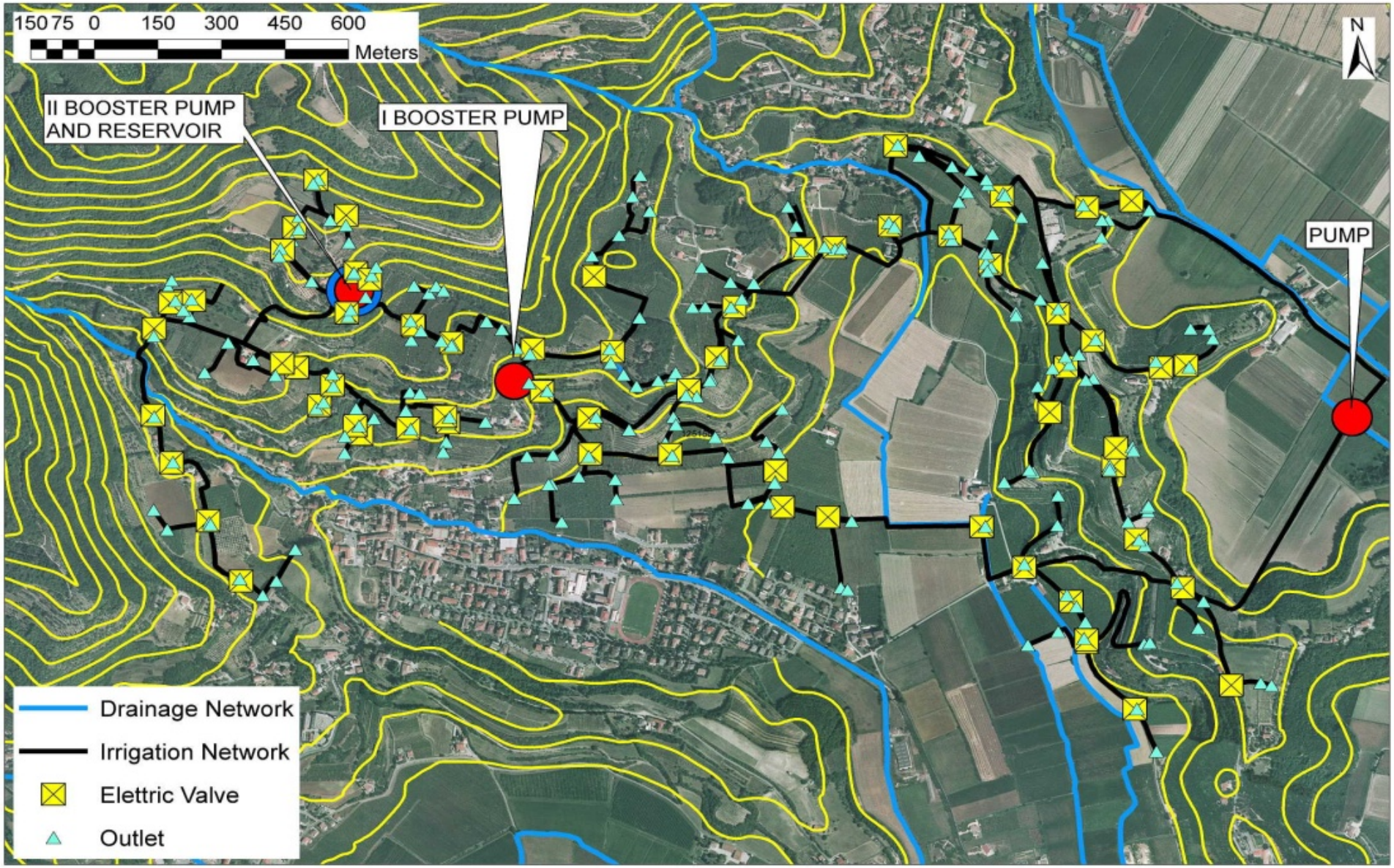
- Problems: dropping water table, energy and maintenance costs, poor performances, no technical support

# Project




- Main station, 20 m.a.s.l., total installed power 74 KW, 105 m of head
- 1st booster pump, 110 m.a.s.l., total installed power 25 KW, 110 m of head
- 2nd booster pump, 215 m.a.s.l., total installed power 15 KW, 118 m of head
- Reservoir of 2.280 m3
- Fields 20÷315 m.a.s.l.
- To minimize the loss of pressure on the pipes, the distribution system can contemporarily pump water into the pipes and into a reservoir

- 23-km distribution network of 23 km (polyethylene pipes 90÷140 mm diameters, and 90÷110 mm diameters)
- 67 electric valves 2÷3 in (on-off, impulse flow meter)
- 217 field outlets 1÷2 in (gate valve, disk filter <100M, flow controller)
- Total cost: € 1.600.000


150 75 0 150 300 450 600
Meters
N
II BOOSTER PUMP
AND RESERVOIR
I BOOSTER PUMP
PUMP
Drainage Network
Irrigation Network
Elettric Valve
Outlet

# Control system

- 2.3 ha/electric valve, 0.7 ha/outlet
- Motorola Irrinet control system on electric valves
- Remote desktop (radio/GSM modem connection to the District offices)
- Parameters:
  - Diversion canal (water level)
  - Pumps (volume, pressure, hours of operation, energetic consumption)
  - Electric valve (volume, on/off)
  - Reservoir (level of water)

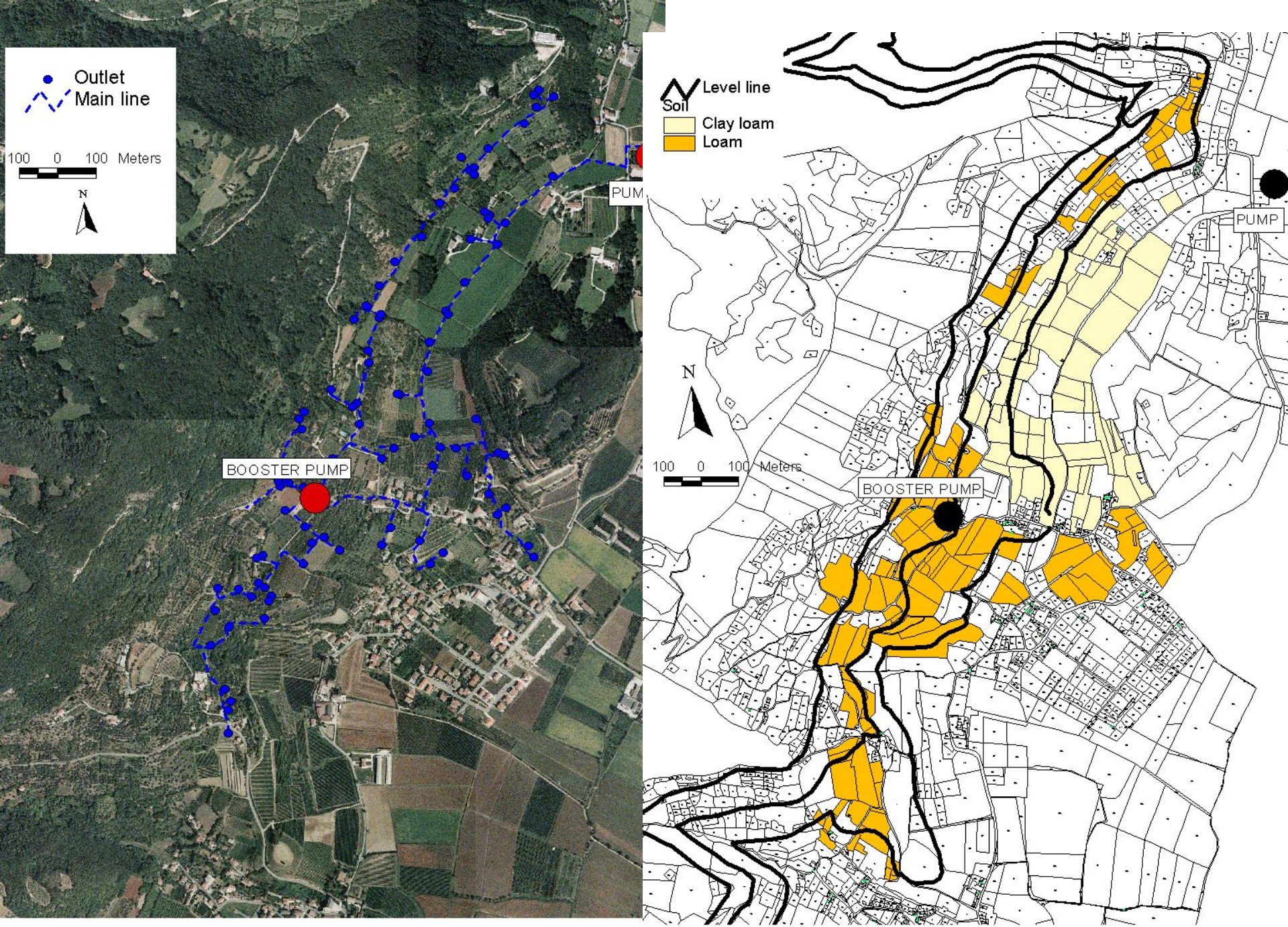
# Water scheduling implemented through SCADA

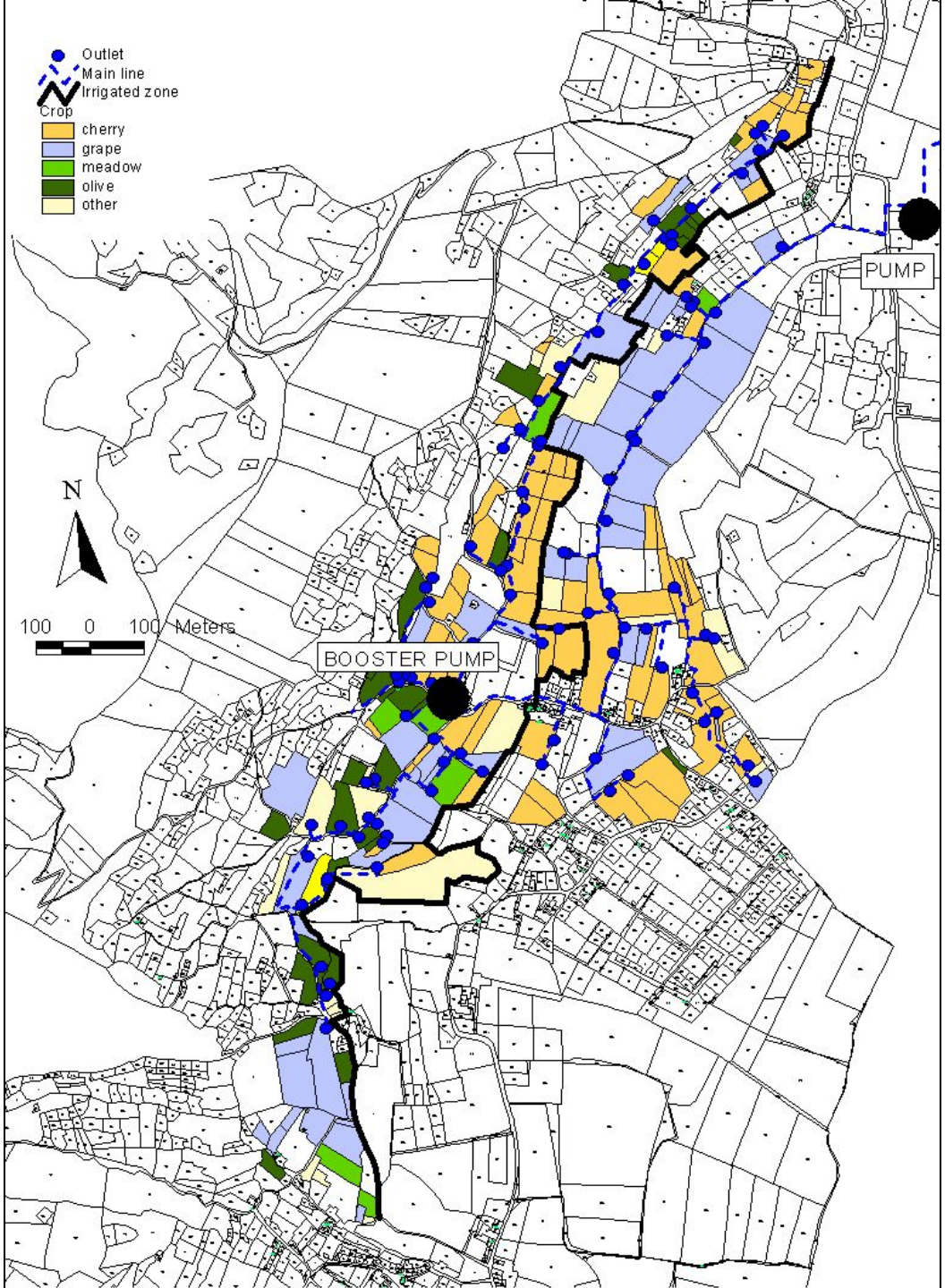
- Estimated irrigation water need: 0.25 l/s/ha
- Drip irrigation method recommended
- Pressure at the farm outlet: 3 atm
- Flow rate at the farm outlet independent from the irrigation method: 3.66 l/s/ha
- Rotational delivery of 3÷7 days
- Few hours left for maintenance at the end of each turn
- Water volumes 9.7÷15.1 mm/irrigation
- 72 sub-areas, average surface 2.15 ha
- Sub-areas having similar elevation receive water at the same moment

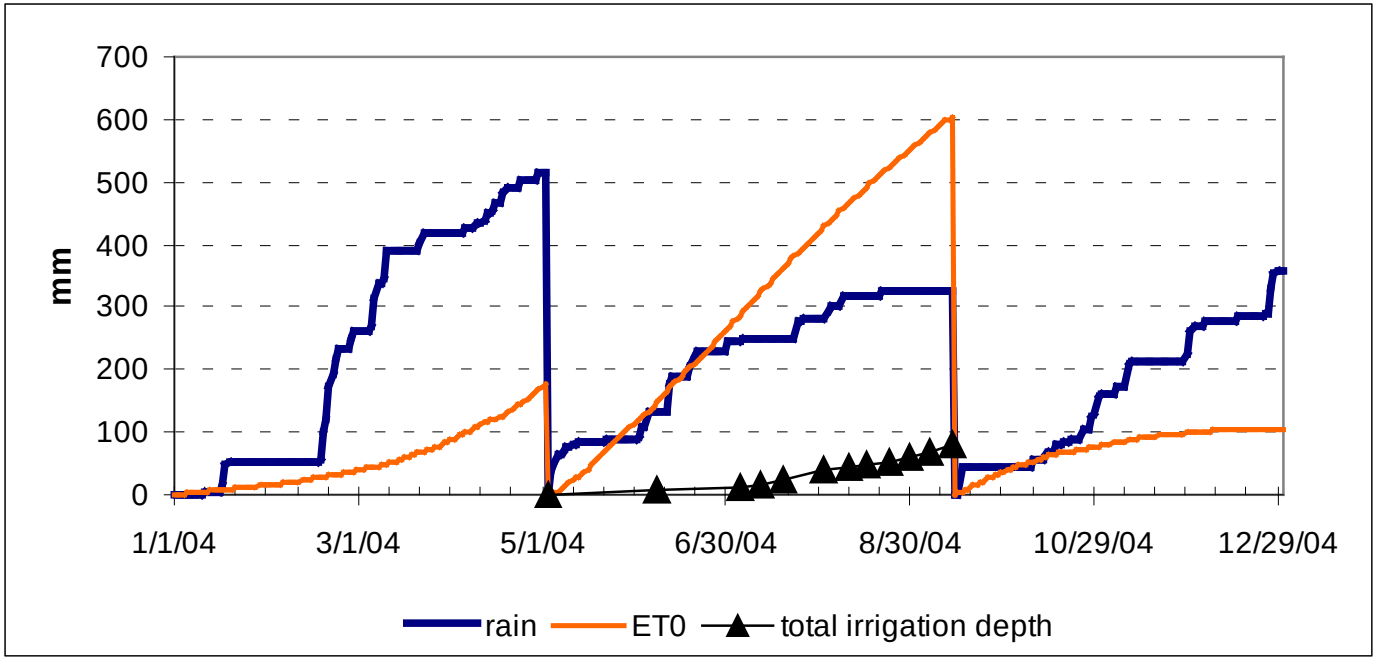
# Site 1
# (2004, 57 ha)

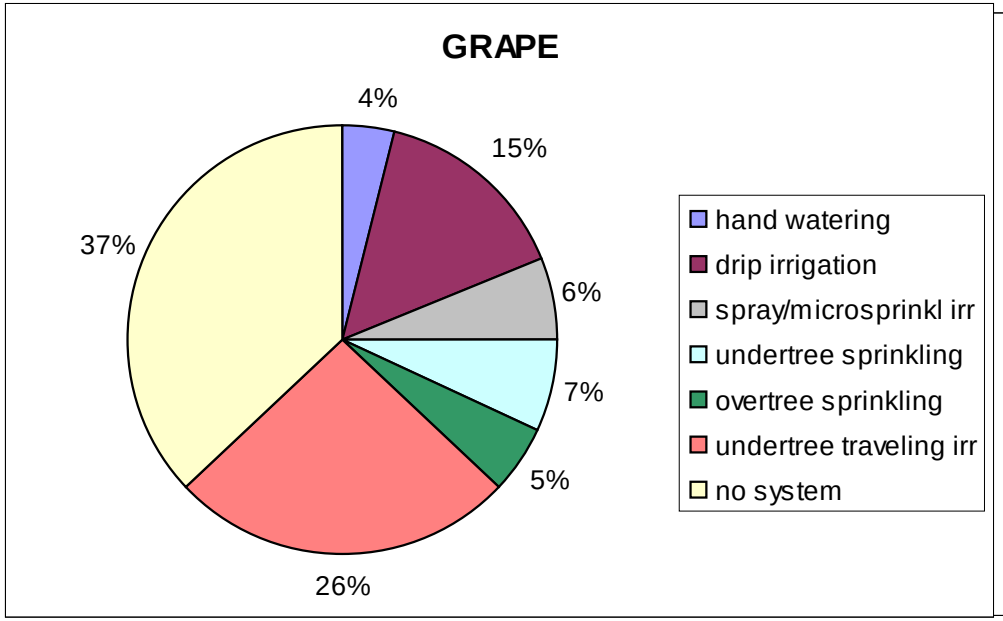
## Preliminary evaluation
## in collaboration with the University of Padova

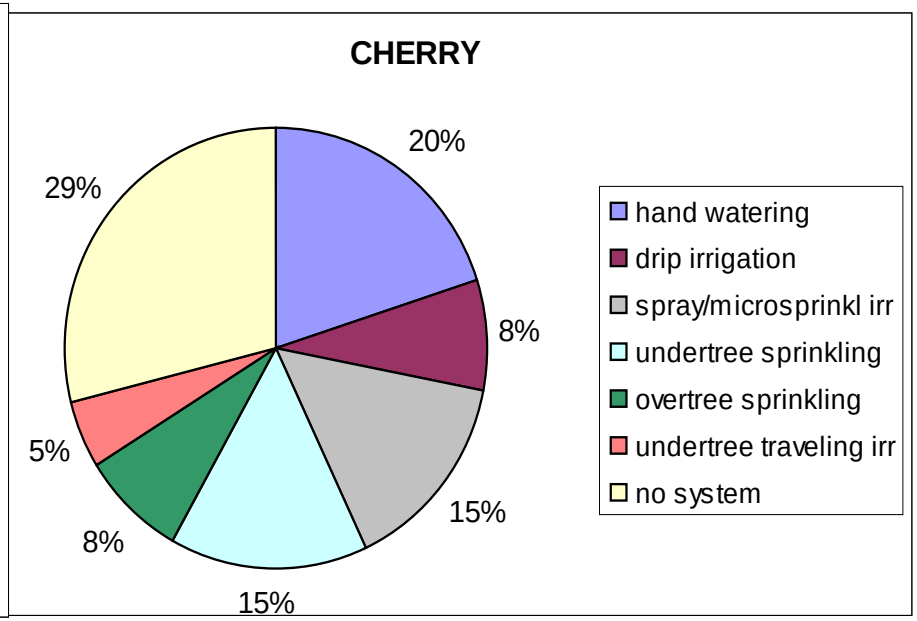
(Proceedings of the 2005 World Water and Environmental Resources Congress, ASCE/EWRI, Anchorage, Alaska, May 15-19)


Outlet
Main line
100 0 100 Meters
N
PUM
BOOSTER PUMP
Level line
Soil
Clay loam
Loam
N
100 0 100 Meters
PUMP
BOOSTER PUMP


Outlet
Main line
Irrigated zone
Crop
cherry
grape
meadow
olive
other
N
100 0 100 Meters
BOOSTER PUMP
PUMP


700
600
500
400
300
200
100
0
mm
1/1/04
3/1/04
5/1/04
6/30/04
8/30/04
10/29/04
12/29/04
rain
ET0
total irrigation depth


GRAPE
4%
15%
6%
7%
5%
26%
37%
hand watering
drip irrigation
spray/microsprinkl irr
undertree sprinkling
overtree sprinkling
undertree traveling irr
no system


CHERRY
20%
8%
15%
15%
8%
5%
29%
hand watering
drip irrigation
spray/microsprinkl irr
undertree sprinkling
overtree sprinkling
undertree traveling irr
no system

# OUTCOMES

There is potential for enhancing the overall water use efficiency and the economic income of irrigation

There is a need to keep disseminating the benefits of using water balance to determine timing and depth of irrigation

Current irrigation methods have to be modernized to fully take advantage of the potential of the automated distribution system (i.e. hand watering and under tree travelling irrigation)

It would be beneficial start a detailed monitoring program that evaluates irrigation performance parameters (ex. distribution uniformity, soil moisture)

Information gathered with this programme (and a possible new monitoring programme) can be useful also to orientate developments in the entire District

# EFFECTS

- A service was introduced in an area were irrigation was done very little and in a expensive way

- Improvements in crop production became evident pretty soon in quantity and quality of product

- The District had to learn a new service. This was supported by new tax income (higher rates, new rates for owners which used to pay only drainage service)

- The new duties (opening and closing season operations, continuous control, higher risks of damages to farms) have been very time consuming at begin, and still sometime are seen as extra work

- The positive start of the first project pushed the second project owners to participate

- The consume of water increased in the area

- Now farmers (and regulators!) believe that also cherry and wine trees benefit from efficient water distribution in some moments of the their cycle and the season

- Project 2 didn’t have the same success as project 1 (less people actually is using water, therefore is paying less). May be because of the smaller proportion of cherry trees, highest income crop in the area

- Nevertheless, just out of the project 2 area big farms owners begun to ask the District to extend the service to their land

- This can be read as a social benefits, where young people is kept in remote areas, which otherwise can incur in hydro geological issues; furthermore, young people tens to conduct bigger and more modern farms

- Thanks to the SCADA implementation in the project we were able to attract funds from the University of Padua, which helped to evaluate the project, identify its potential, and give recommendations for further development

- The 2004 project (EU funds) was evaluated by an independent contractor after 1 year of operation. In the report it is stated that the project have potential for enhancing yield and quality of products

Thank you for your attention