Presentation prepared for the 4th AIEAA Conference

"Innovation, productivity and growth:
towards sustainable agri-food production"

AIEAA
ASSOCIAZIONE ITALIANA DI ECONOMIA AGRARIA E APPLICATA

Toward the adaptation to new regulation on water pricing in the agricultural sector: a case study from northern Italy

Ancona, 11-12 June, 2015

Elisa Guerra[1*], Francesco Galioto[1], Meri Raggi[2] and Davide Viaggi[1]

[1] Department of Agricultural Sciences, University of Bologna, Bologna, Italy
[2] Department of Statistical Sciences, University of Bologna, Bologna, Italy
*elisa.guerra10@unibo.it

Outline

1. INTRODUCTION
- the question
- theoretical background

2. STUDY AREA

3. METHODOLOGY
- water-crop production function
- economic analysis

4. RESULTS

5. SUMMARY AND CONCLUSION

6. FURTHER CONSIDERATIONS

1. INTRODUCTION

- THE QUESTION:

How should local reclamation and irrigation boards (R.I.B) allocate their water supply costs amongst users to meet Emilia-Romagna regional guidelines?

- Do volumetric tariffs affect irrigation water consumption?

1. INTRODUCTION

- THEORETICAL BACKGROUND

L.R. 7/2012 – “Disposizioni per la Bonifica. Modifica alla L.R. 42/1984.”

60/200/EC – Water Framework Directive

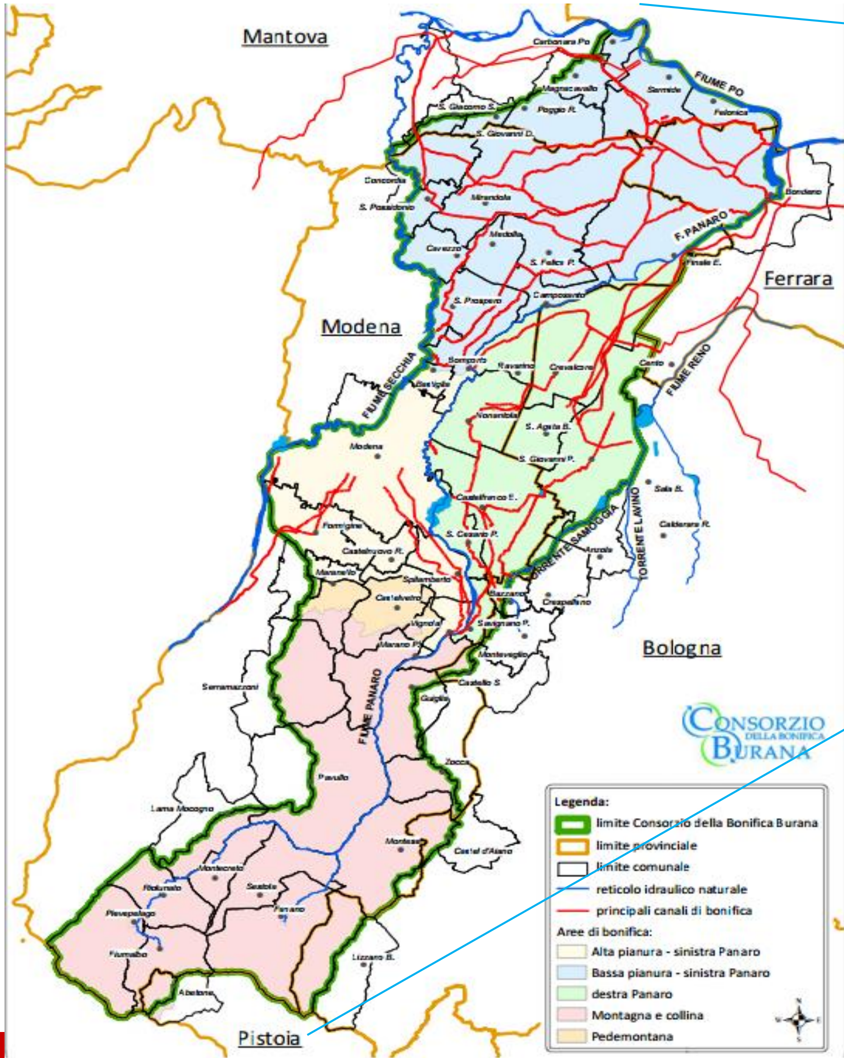
Polluter pays

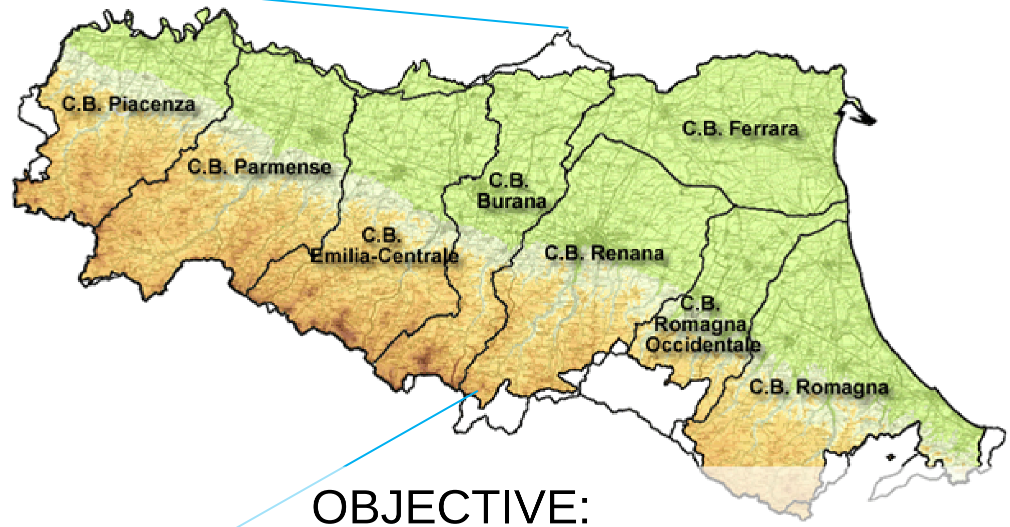
Full-cost recovery (flat rate + variable charge)

Incentive pricing

2. STUDY AREA

- THE BURANA RIB BASIN: 17.000 km^2





OBJECTIVE:

✓ THE STUDY ASSESSES THE ECONOMIC IMPACTS OF TWO PRICING CRITERIA (NEW AND CURRENT), IN RELATION TO:

(A) APPLIED WATER VOLUMES,

(B) LAND ALLOCATION,

(C) IRRIGATION TECHNOLOGY ADOPTION.

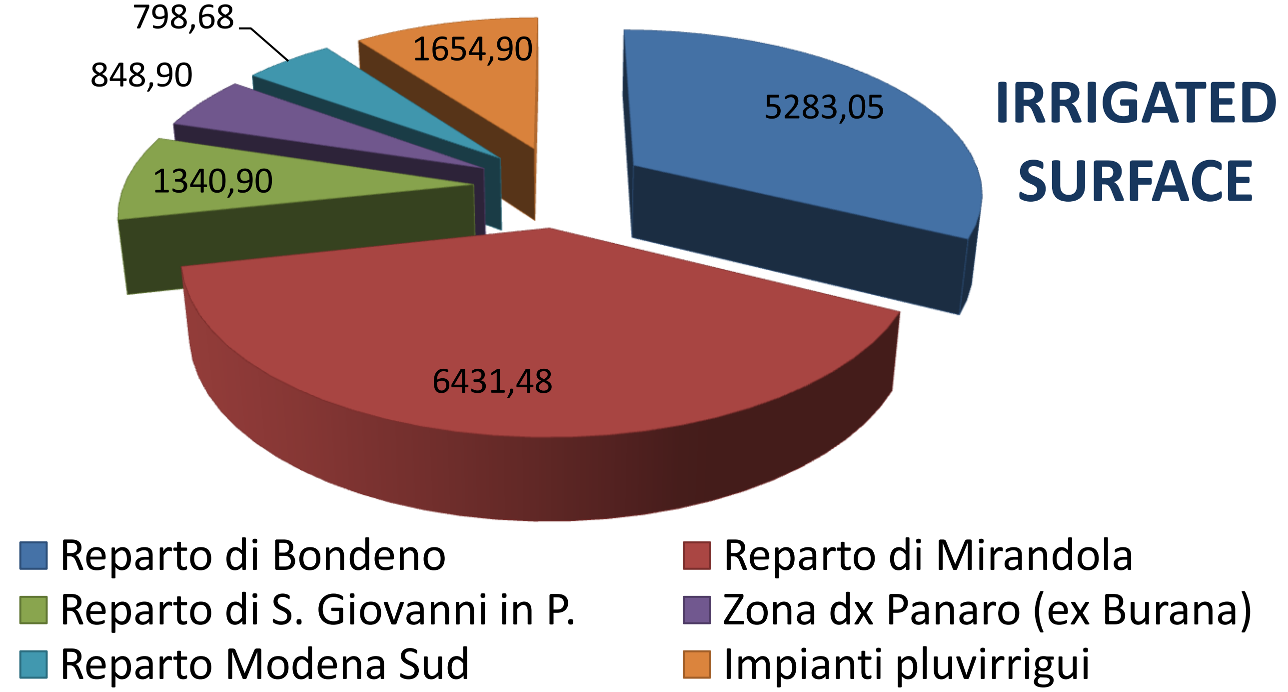
2. STUDY AREA

MEAN CARACTERISTICS OF INTERVIEWD FARMS	**DISTRICTS**				
(June 2014)	BASSA PIANURA	MO SUD	NONANTOLA / RAVARINO	EX RENOPALATA	PRESSURE-PIPES
N. FARMS	12	7	2	8	3
AGE OF THE OWNER	46	54	55	49	55
EDUCATION (2 - DEGREE; 1 - DIPLOMA; 0 - NO DIPLOMA)	1,3	0,7	1,0	0,9	1,3
WATER RESERVOIR (FARM WITH N. / TOTAL FARM N.)	-	0,1	-	0,4	-
SINK (FARM WITH N. / TOTAL FARM N.)	0,3	0,3	-	0,3	0,3
MEAN UAA (ha)	115	18	16	46	39
UAA IRRIGATED (%)	56	71	83	39	72
ORCHARD (%)	6	29	60	20	28
FIELD CROPS (%)	78	56	20	62	48
HORTICULTURAL (%)	16	0	16	18	3
VINEYARD (%)	0	15	4	1	21
DRIP IRRIGATION	42	55	70	38	55
FURROW IRRIGATION	0	31	0	16	0
SPRINKLER IRRIGATION	25	0	20	8	28
T - WATER CHARGE LEVEL (€/ha)	17	39	13	13	127
ML - GROSS INCOME (€/ha)	599	503	853	777	514
CURRENT TYPE OF TARIFF(1)	D	WL	W	C	F

(1) D – BASED ON THE DISTANCE FROM THE MAIN ABDUCTION SOURCE; W – TWO PART TARIFF: FLAT AND BASED ON WATER CONSUMPTION; WL – TWO PART TARIFF: PER IRRIGATED SURFACE AND BASED ON WATER CONSUMPTION; C – TWO PART TARIFF: FLAT AND BASED ON CROP TYPE; F – FLAT TARIFF

2. STUDY AREA

- THE BURANA R.I.B.



NEW TARIFF SCENARIOS:

(A) ONE TARIFF FOR SECTORS SERVED BY OPEN CANALS;

(B) ONE FOR SECTORS SERVED BY PRESSURE PIPES.

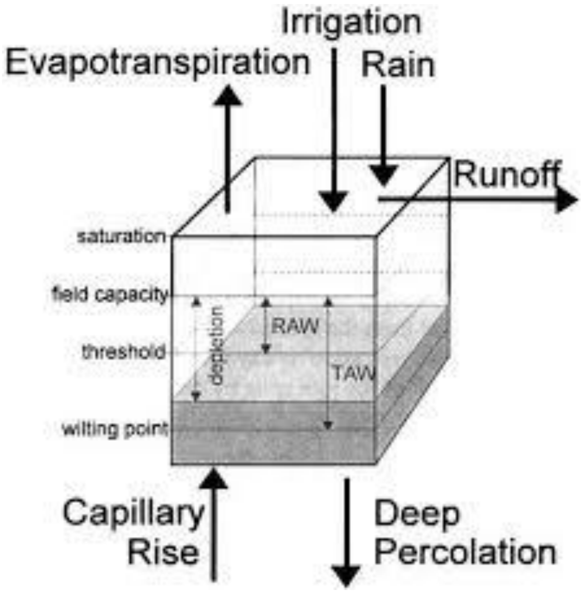
3. METHODOLOGY

- Water-crop production function

CROP-YIELDS ESTIMATION AS A FUNCTION OF THE IRRIGATION WATER VOLUMES, THROUGH MATHEMATICAL MODELS, SIMULATING:

A - LOCAL CROP EVAPOTRANSPIRATION, ASSUMING WELL-WATERED CONDITIONS (GUERRA ET AL, 2014).

B - WATER REDUCTION EFFECT ON CROP YIELDS (STEDUTO ET AL, 2012) FOR DIFFERENT WATER DISTRIBUTION SYSTEMS.



3. METHODOLOGY

- Economic analysis

max

$$\prod_a = \sum_{z,i,t} [p_i y_{i,t}(w_{i,t}) - c_{z,i,t}(x_{a,z,i,t}, w_{i,t}) - (t_{d,i,t} + tw_{i,t})] x_{a,z,i,t} \quad \forall a$$ EQ. 1

s.t.

$$\sum_{i,t} x_{a,z,i,t} \leq land_{a,z} \qquad \forall a \in Z$$ EQ. 2

$$\sum_{z,i,t} x_{a,z,i,t} w_{i,t} \leq Wat_a \qquad \forall a$$ EQ. 3

$$\sum_{z,i,t} x_{a,z,i,t} l_{i,t} \leq lab_a \qquad \forall a$$ EQ. 4

$$\sum_{z,i,t} [(t_{a,z,i,t} + t_a w_{i,t})] x_{a,z,i,t} \geq F^{sc} + \sum_{z,i,t} [V_a^{sc}(w_{i,t}) x_{a,z,i,t}]$$ EQ. 5

$$x_{a,z,i,t} \geq 0, w_{i,t} \geq 0, (tf, tv^a{}_{d,i,t}, tv^b{}_{d,i,t}) \geq 0$$ EQ. 6

PMP APPROACH (HOWITT, 1995; QUIRINO, 2015)

- ASSUMPTION: FARMER= PROFIT MAXIMIZER;
- THE OBSERVED CROP DESIGN AND WATER USES ARE OPTIMAL;
- THE REGULATOR ACTS ON BEHALF OF USERS.

3. METHODOLOGY

- Scenario analysis

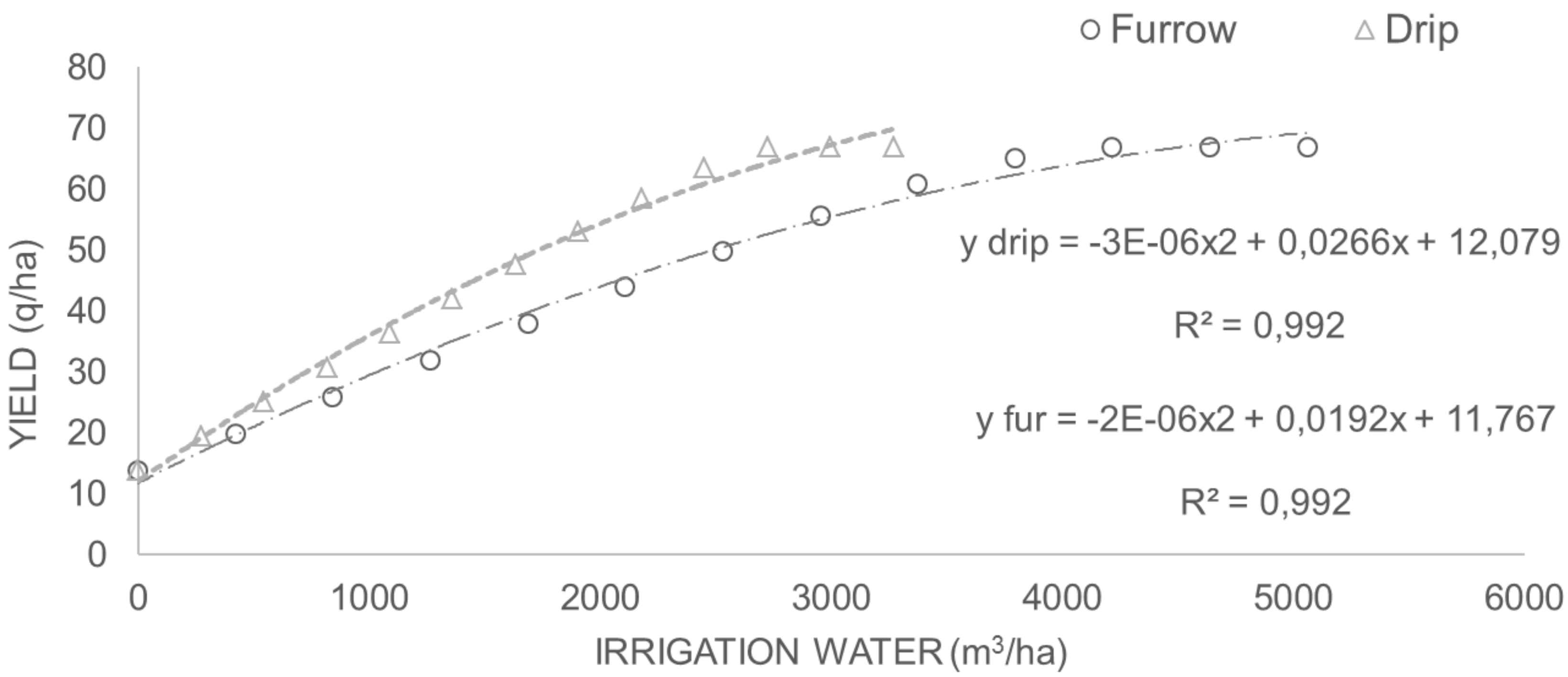
WATER CHARGE CRITERIA VARY FROM FLAT TO DIFFERENCIATED BY CONSIDERING DIFFERENT LAND USES, WATER DELIVERY SYSTEMS, AND IRRIGATION TECHNOLGOGYIES

- Sensitivity analysis

BASED ON NEW WATER CHARGE CRITERIA,THE RATIO BETWEEN FLAT AND VARIABLE PART OF TARIFF IS DIFFERENCIATED ACCORDING TO DIFFERENT WATER DELIVERY SYSTEMS.

4. RESULTS

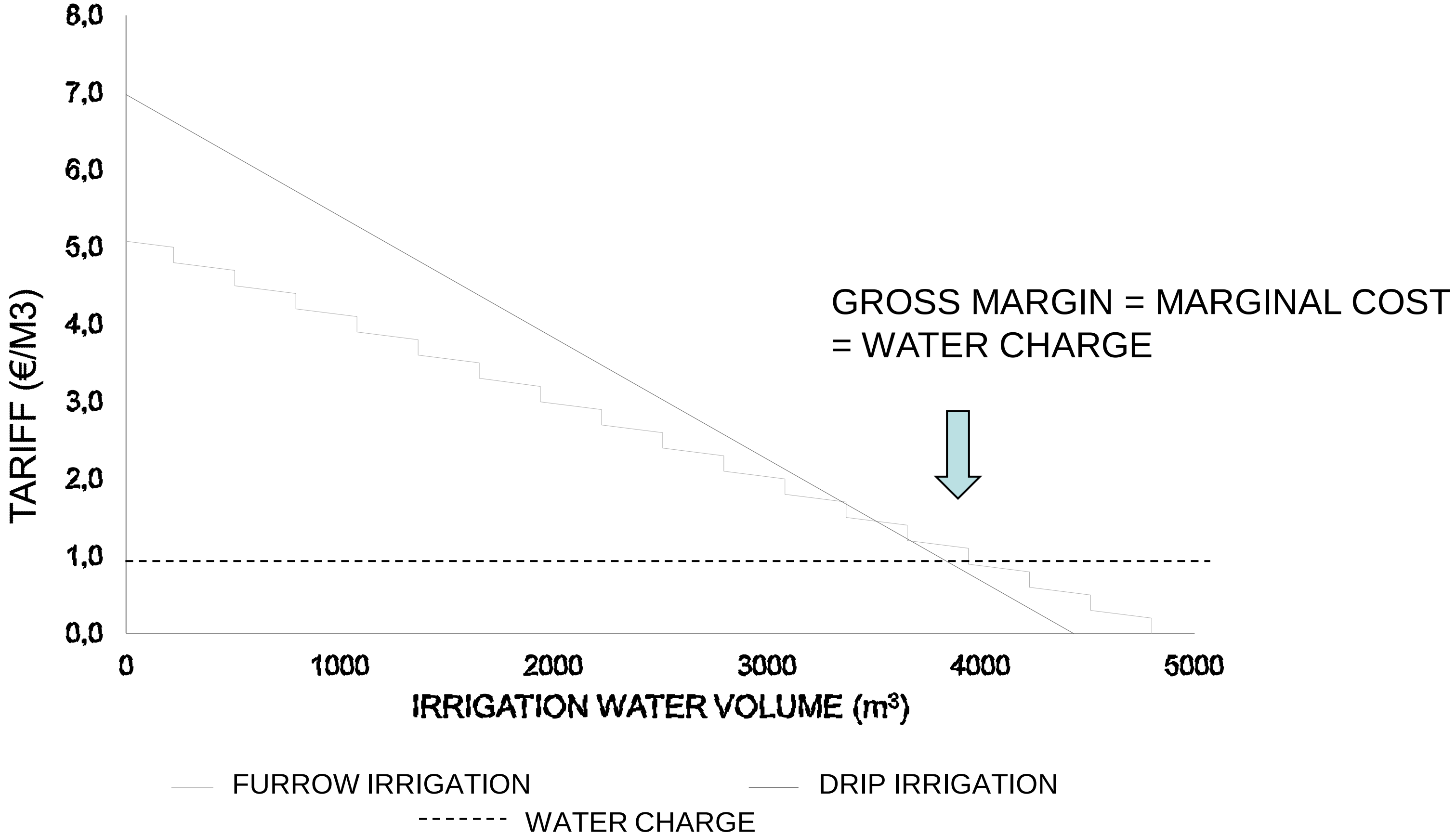
- Water-crop production function



Source: own elaboration

4. RESULTS OF ECONOMIC ANALYSIS

- Crop-Water demand function



Source: own elaboration

4. RESULTS OF SCENARIO ANALYSIS

TABLE 1 - IMPACT OF DIFFERENT WATER CHARGE SCENARIOS ON LAND AND WATER USE FOR DIFFERENT GROWING CATEGORIES, FOR BOTH WATER DELIVERY SYSTEMS (UNIT: DIFFERENCES IN PERCENTAGE, COMPARED TO THE CURRENT SCENARIO, %).

GROWING CATEGORIES	LAND USE		WATER USE	
	OPEN CANALS	PRESSURE PIPES	OPEN CANALS	PRESSURE PIPES
NON IRRIGATED CROPS	0%	2%	-	-
VINEYARDS	0%	-2%	**-3%**	**-3%**
ORCHARDS	0%	-1%	0%	-1%
ARABLE CROPS	0%	-2%	0%	-2%
HORTICULTURAL CROPS	0%	**-5%**	0%	**-7%**

Source: own elaboration

4. RESULTS OF SCENARIO ANALYSIS

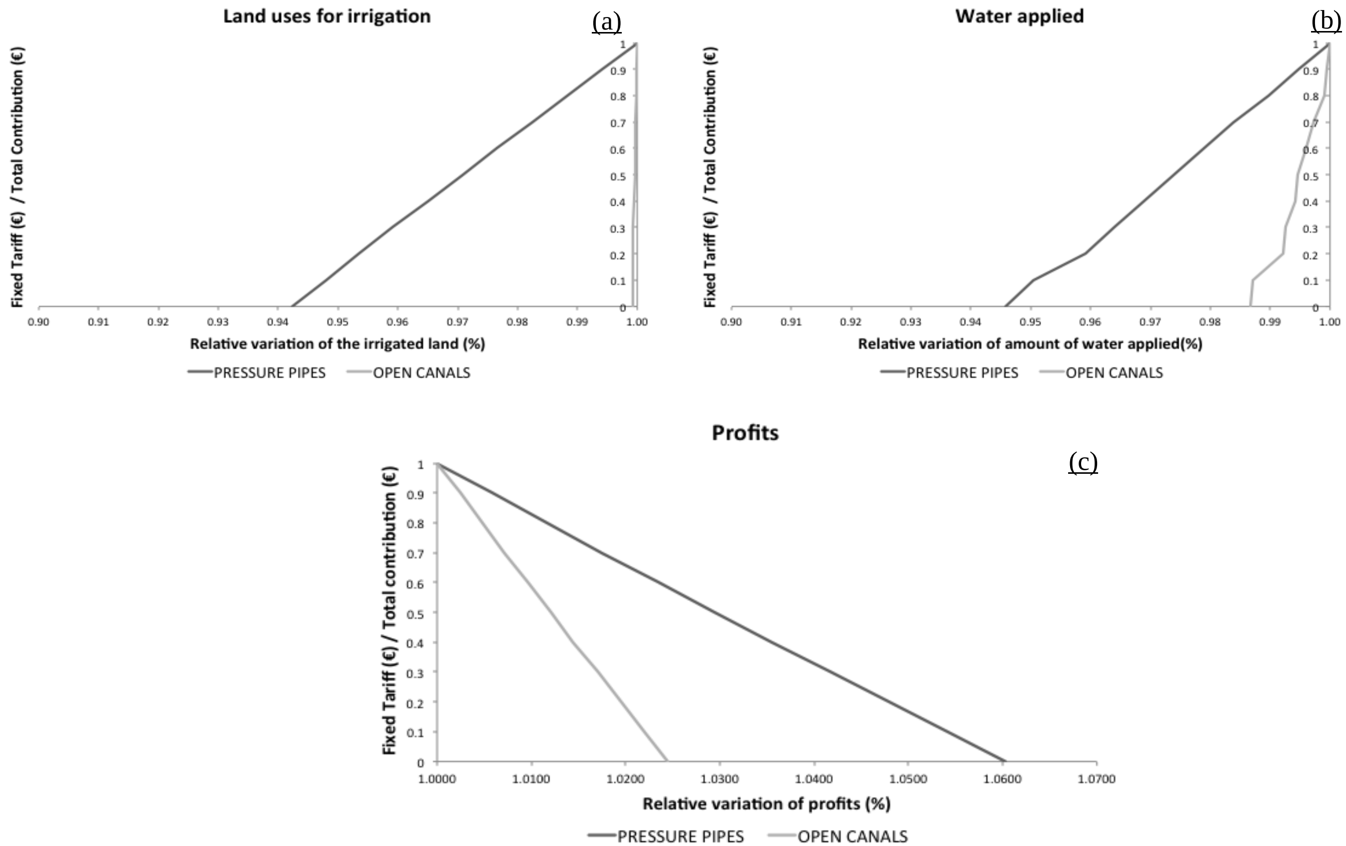
TABLE 2 - IMPACT OF DIFFERENT WATER CHARGE SCENARIOS ON INCOME OF DIFFERENT GROWING CATEGORIES FOR OPEN CANAL AND PRESSURE PIPE WATER DELIVERY SYSTEMS (UNIT: PER HECTARE CONTRIBUTION/PER HECTARE INCOME, %).

GROWING CATEGORIES	SCENARIO 1		SCENARIO 2	
	OPEN CANALS	PRESSURE PIPES	OPEN CANALS	PRESSURE PIPES
NON IRRIGATED CROPS	5%	**59**%	0%	**39**%
VINEYARDS	1%	8%	1%	7%
ORCHARDS	0%	2%	0%	2%
ARABLE CROPS	4%	**24**%	3%	**17**%
HORTICULTURAL CROPS	1%	6%	2%	8%

Source: own elaboration

4. RESULTS OF SENSITIVITY ANALYSIS

FIGURE 3 – RELATIVE VARIATION OF IRRIGATED FARMLAND (A), OF WATER APPLIED (B) AND OF FARM PROFITS (C) IN RELATION TO THE VARIATION IN THE ‘FIXED AND VARIABLE’ RATIO, OF THE TWO-PART TARIFF IN THE ALTERNATIVE SCENARIO



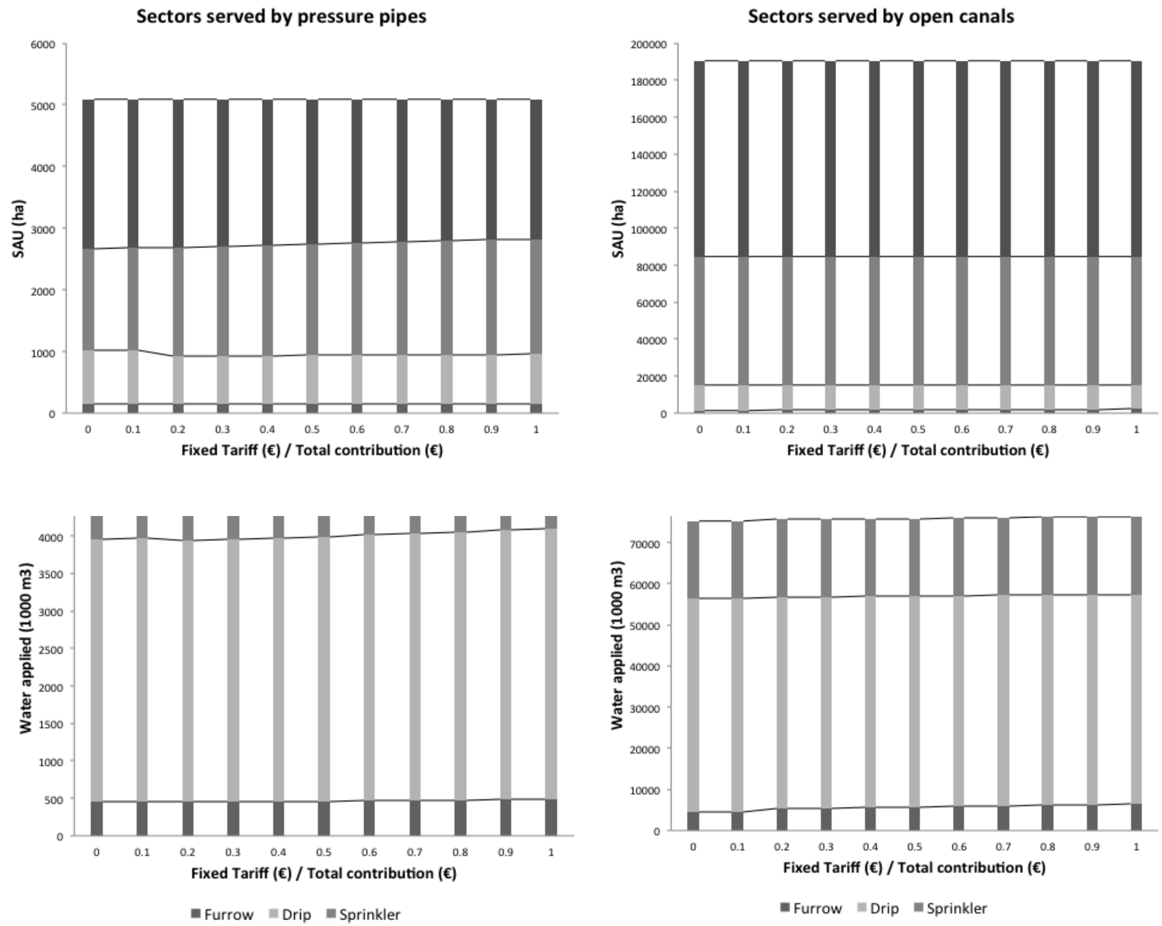
4. RESULTS OF SENSITIVITY ANALYSIS

ABSOLUTE VARIATION IN THE ALTERNATIVE SCENARIO FOR:
Furrow (dark), Sprinkler (medium), Drip (light).

TOP - IRRIGATED FARMLAND

ACCORDING TO THE RATIO BETWEEN 'FIXED/VARIABLE' COMPONENTS OF TARIFFS, THE EFFECT IS MORE EVIDENT FOR PRESSURE PIPES, THAN OPEN CANALS-CROSSED SECTORS, ESPECIALLY FOR IRRIGATED LAND.

BOTTOM - APPLIED WATER



5. SUMMARY AND CONCLUSION

- HYPOTHETICAL AND ACTUAL PRICING POLICIES SCENARIOS WERE ANALYSED, BASING ON CURRENT ORGANIZATIONAL RULES OF THE BURANA IRRIGATION NETWORK, IN NORTHERN ITALY.

- THE IMPLEMENTATION OF WATER TARIFFS WAS FOUND NOT TO SIGNIFICANTLY AFFECT IRRIGATION WATER USES, IN MOST OF THE DISTRICTS, MAINLY BECAUSE OF:

1. STRUCTURAL CONSTRAINTS, LIMITING THE NUMBER OF AVAILABLE PRICING OPTIONS.
2. THE VARIABLE COMPONENT AMOUNT IS TOO LOW.
3. WATER-DEMAND FUNCTION FOR MAIN IRRIGATED CROPS IS STRONGLY INELASTIC.

6. FURTHER CONSIDERATIONS

- FIRST RESULTS CONFIRMED THAT THERE IS NO MUCH EVIDENCE THAT WATER PRICING HAS A SIGNIFICANT IMPACT ON CONDITIONING IRRIGATION WATER USES (MOLLE, 2008).

- WATER PRICING, COULD DESERVE TO CO-FINANCE SUBSIDIES ON INVESTMENTS, FURTHER PROMOTING THE ADOPTION OF PRECISE IRRIGATION TECHNOLOGIES (LOPEZ-MORALES, 2011).

- CROSS-COMPLIANCE BETWEEN THE WFD AND THE CAP-REFORM COULD PROMOTE A SET OF COMPLEMENTARY MEASURES, AMONG WHICH THE DIFFUSION OF WATER SAVING TECHNOLOGIES (VIAGGI, 2015).

- THE NEW CAP-REFORM IS ADDRESSING THIS ISSUE, EITHER BY FINANCING ADVISORY WEATHER SERVICES, AND BY TRAINING FOR SUPPORTING INVESTMENTS (EC, 2013).

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Elisa Guerra
Research fellow
Department of Agricultural Sciences - DipSA - UniBo
e-mail: elisa.guerra10@unibo.it

AKNOWLEDGEMENT: CONSORZIO DELLA BONIFICA BURANA