Análisis de la Demanda de Agua en la Agricultura (II)

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Menús del Día (1 y 2): 2027

- Bajo/Medio precio de agua, producto vendido/comprado
- Más riego, más cuestionado
- Natura 2000 mal pagada
- Naturaleza perdida
- Acuíferos/humedales y ríos/riberas desaparecidos
- Secano abandonado/regadíos inadecuados o excesivos
- Cultura de culpa y miedo
- Perdida de sabiduría, ´arte´ del agricultor
- Monocultivos, “pueblos dormitorios”
- Valor perdido del campo

- Alto precio de agua, como bien caro, prestado del ecosistema
- Menos riego, más aceptado
- Natura 2000 bien pagada
- Naturaleza valorada y cuidada
- Acuíferos/humedales y ríos/riberas recuperados
- Secano protegido/adaptado
- Más cultivos de alto valor/uso pero bajo consumo de agua
- Conocimiento/arte retenido
- Paisaje, economía y tejido social rural buenos y diversos
- Valor añadido y retenido en el campo

WADI PROJECT

I) WADI HYPOTHESIS RESULTS
II) SCENARIO DEVELOPMENT
III) WADI RESULTS (Guadalquivir)
IV) FUTURE RESEARCH NEEDS

I WADI HYPOTHESIS

Mathematical models and farmers' behaviour

- to build good 'descriptive' models based upon the multicriteria nature of decision-making, and the search for a compromise between the conflicting objectives of the farmer.
- our modelling approach is based on the estimation of particular farmers' multi-attribute utility functions (1)

Aggregation bias and cluster analysis

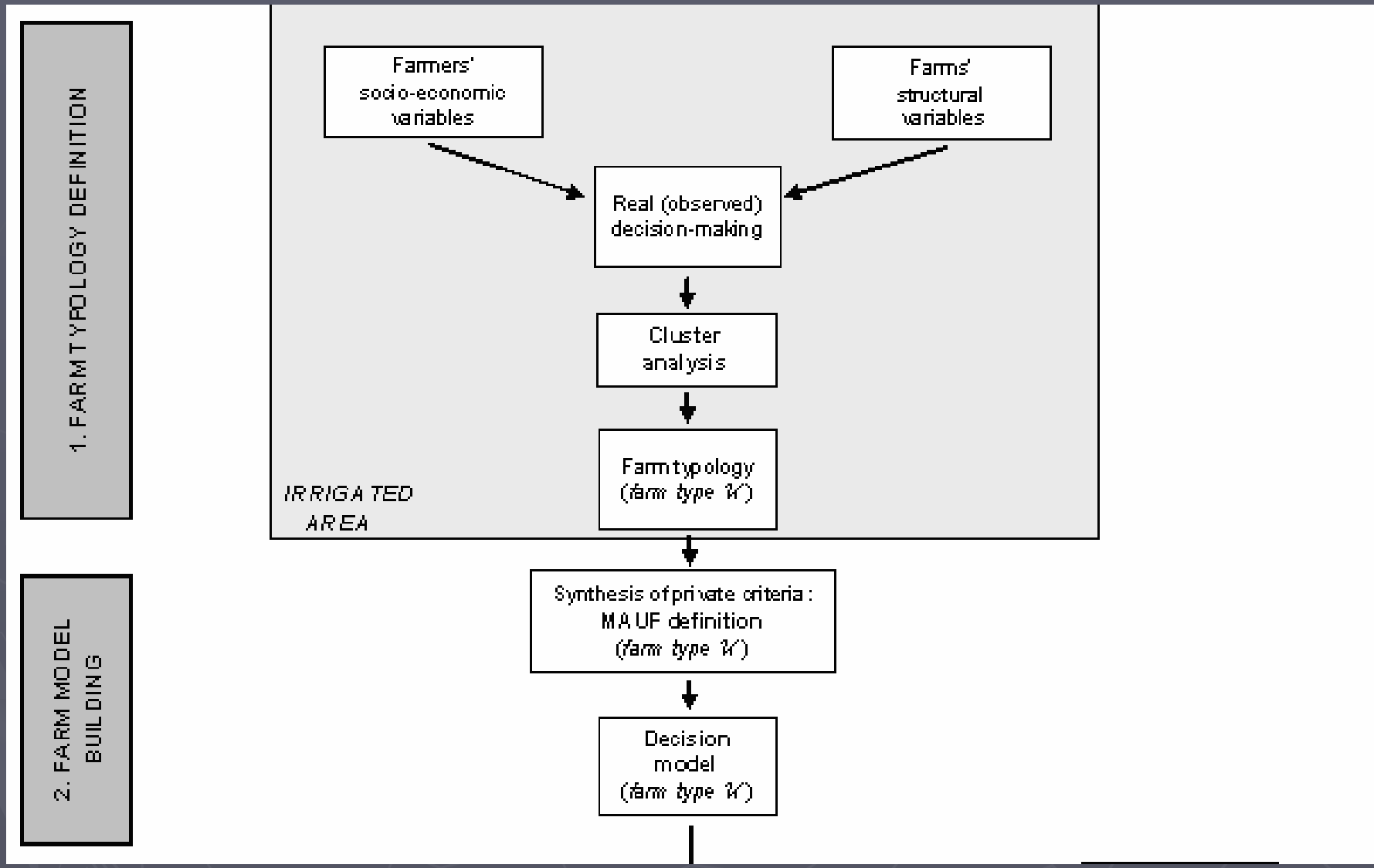
- the objective of the Wadi project is to obtain aggregated results in order to guide policy making
- This aggregation bias can only be avoided if the farms included in the models fulfil strict criteria regarding homogeneity (Day, 1963):
  - technological homogeneity (same possibilities of production, same type of resources, same technological level and same management capacity).
  - pecuniary proportionality (proportional profit expectations for each crop) and
  - institutional proportionality (availability of resources to the individual farm proportional to average availability).

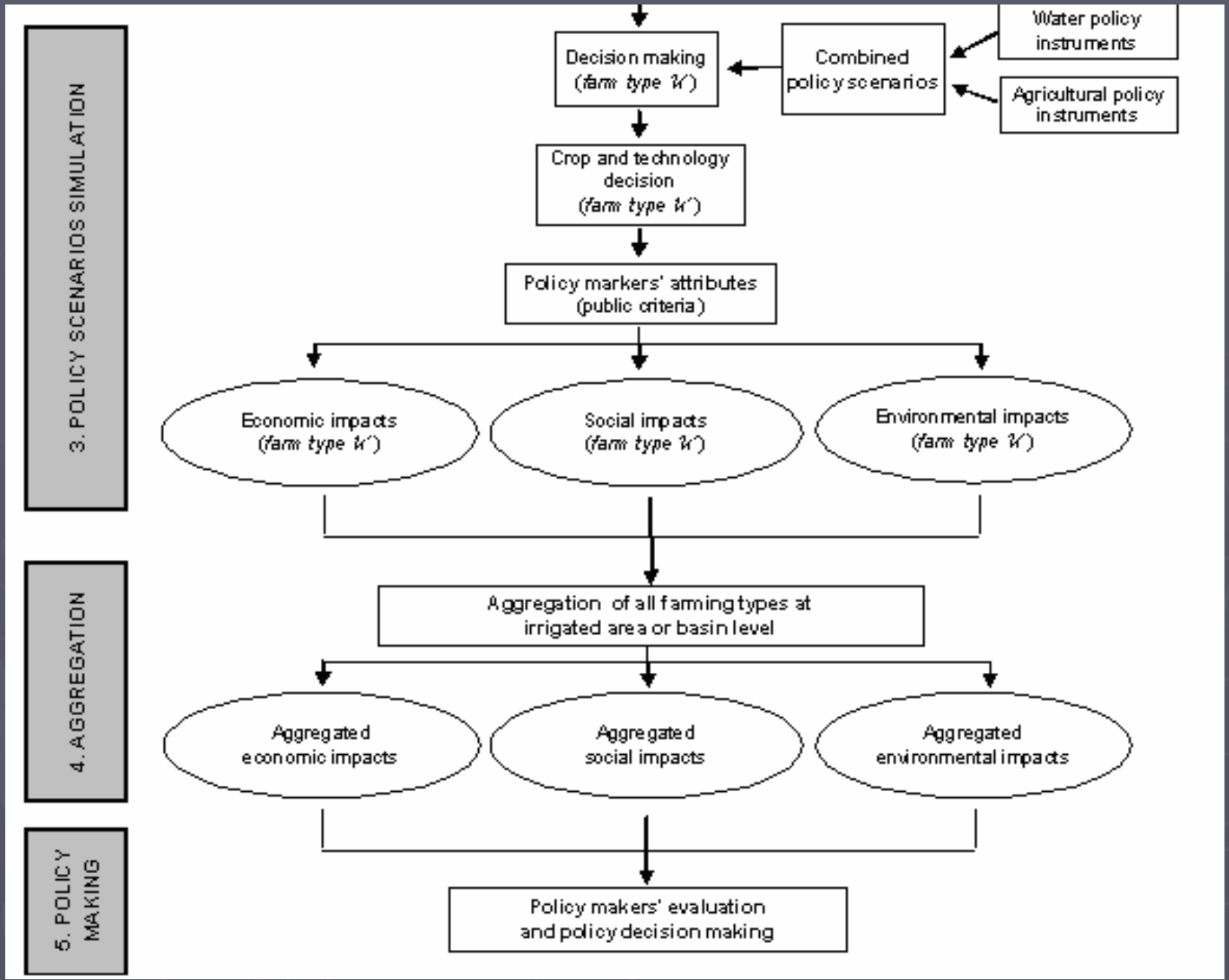
Cluster analysis

- Berbel and Rodríguez (1998) as a starting point. These authors noted that for this type of classification the most efficient method is cluster analysis, taking farmers' real decision-making vectors (actual crop mix) as the classification criterion.

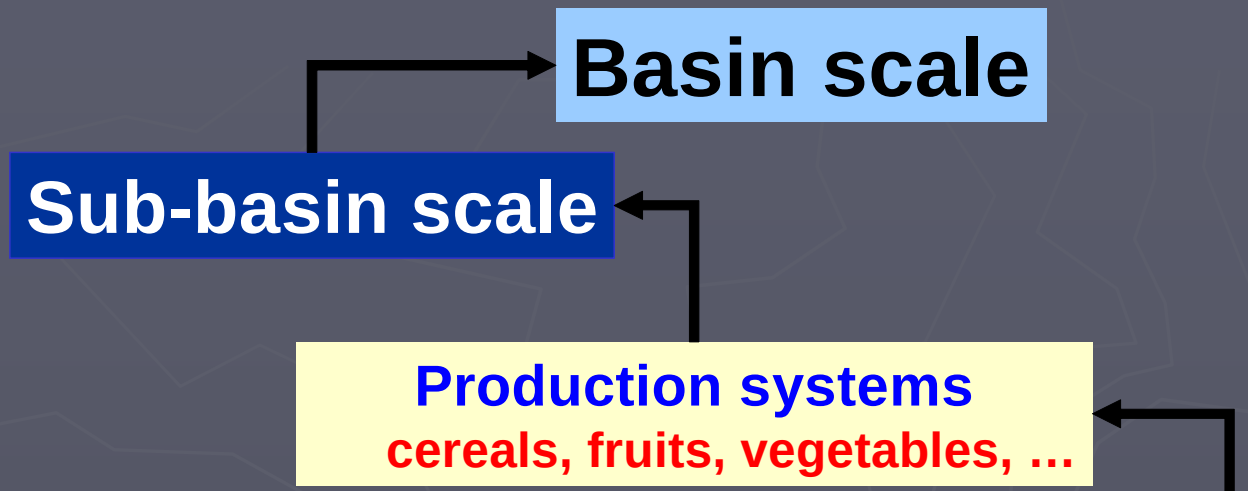
Characteristics of our methodology.

CLASSIC	OUR APPROACH
Profit maximizing	MCDM Utility
Homogeneous behaviour	Farmer type specification
Focus on farm	Focus on farmer
Macromodels	Micromodel aggregation
Economic activity	Indicators and multifunctionality
Short-run analysis	Long-run analysis based on scenarios


1. FARM TYPOLOGY DEFINITION
2. FARM MODEL BUILDING
Farmers' socio-economic variables
Farms' structural variables
Real (observed) decision-making
Cluster analysis
Farm typology (farm type 'k')
IRRIGATED AREA
Synthesis of private criteria : MAUF definition (farm type 'k')
Decision model (farm type 'k')


3. POLICY SCENARIOS SIMULATION
4. AGGREGATION
5. POLICY MAKING
Water policy instruments
Agricultural policy instruments
Combined policy scenarios
Decision making (farm type 'i')
Crop and technology decision (farm type 'i')
Policy markers' attributes (public criteria)
Economic impacts (farm type 'i')
Social impacts (farm type 'i')
Environmental impacts (farm type 'i')
Aggregation of all farming types at irrigated area or basin level
Aggregated economic impacts
Aggregated social impacts
Aggregated environmental impacts
Policy makers' evaluation and policy decision making

Detail of farms aggregation



Farms of different types:

- main production: cereals, fruits, vegetables, …
- management: family / industrial
- size: small /medium / large
- …

Selected indicators

Area	Selected indicators
Economic balance	Farm income Farm contribution to GDP Public support
Social impact	Farm employment Seasonality
Landscape and biodiversity	Genetic diversity Soil cover
Water use	Irrigation technology Water use Marginal value of water
Nutrients and pollutants	Nitrogen balance Pesticide risk Energy balance

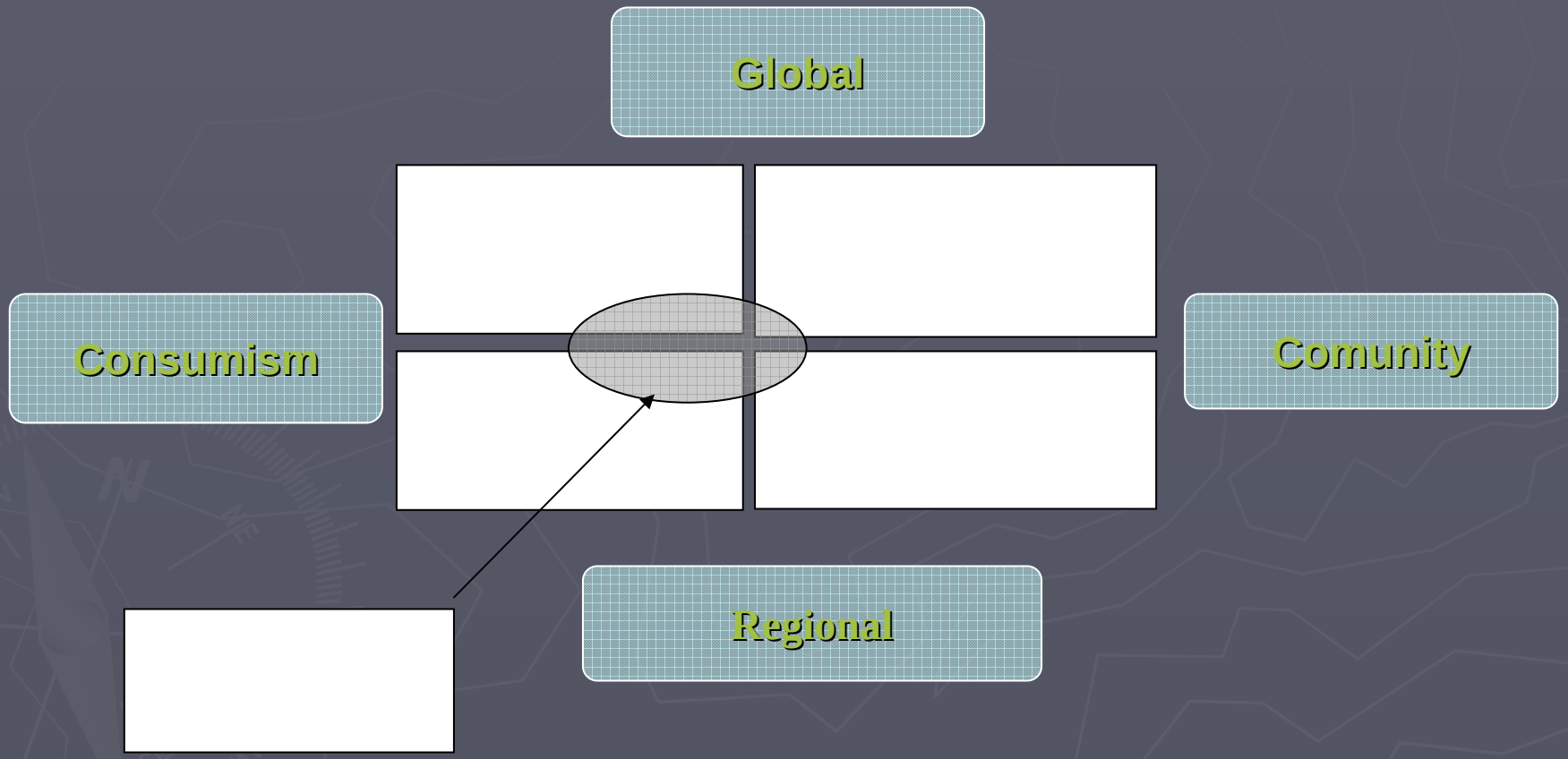
II SCENARIO DEVELOPMENT

ASSESS CURRENT TRENDS IN TREND VARIABLES

- Demography
- Rural discharges
  - individual
  - stormwater
- Urban discharges
  - collective
  - stormwater
- Agricultural USE & discharges
- Industrial discharges

- Do not rely too much on past projections: it may lead to false projections
- Disaggregated approach might be preferable. E.g. for demand forecasting

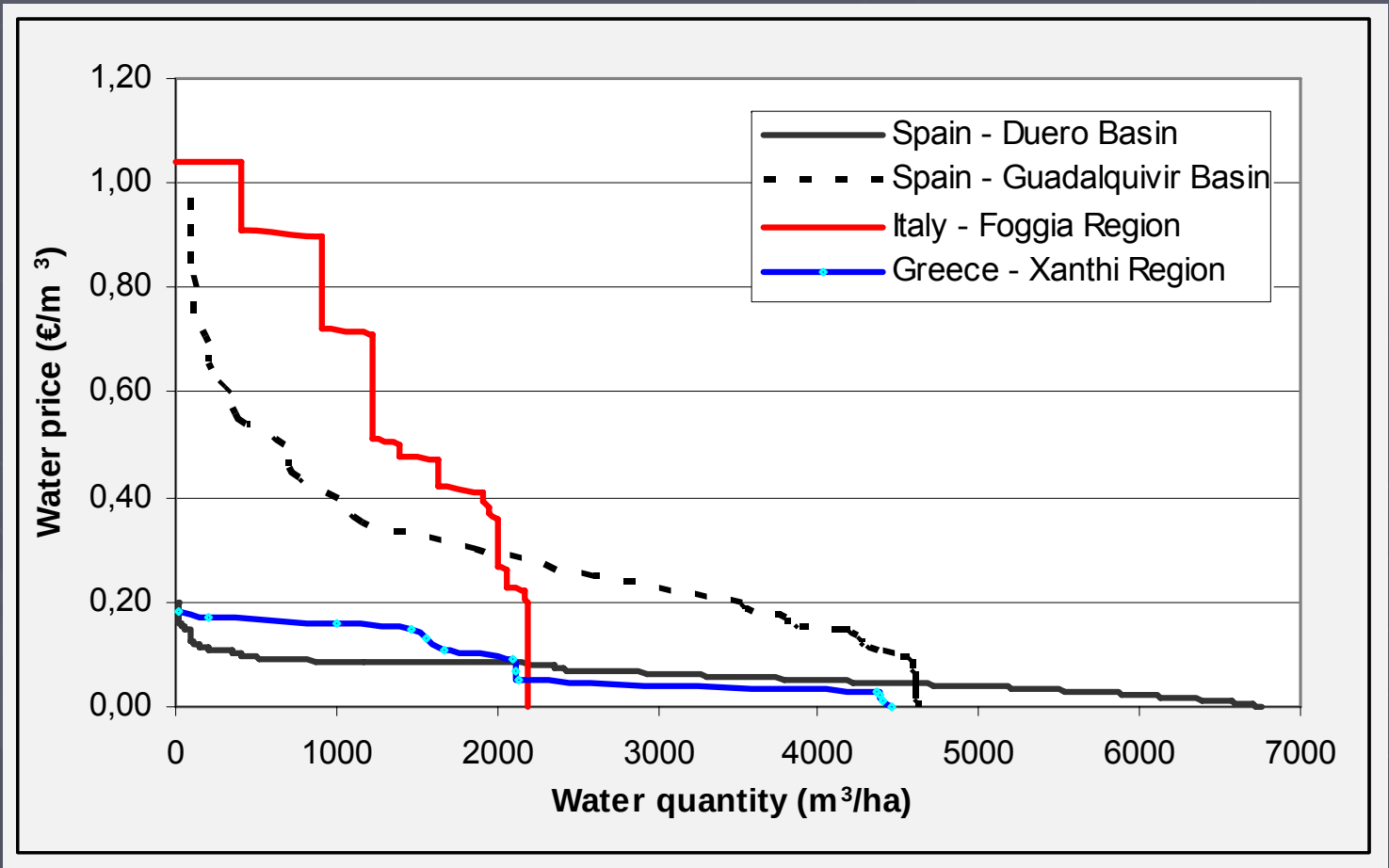
Four basic scenarios



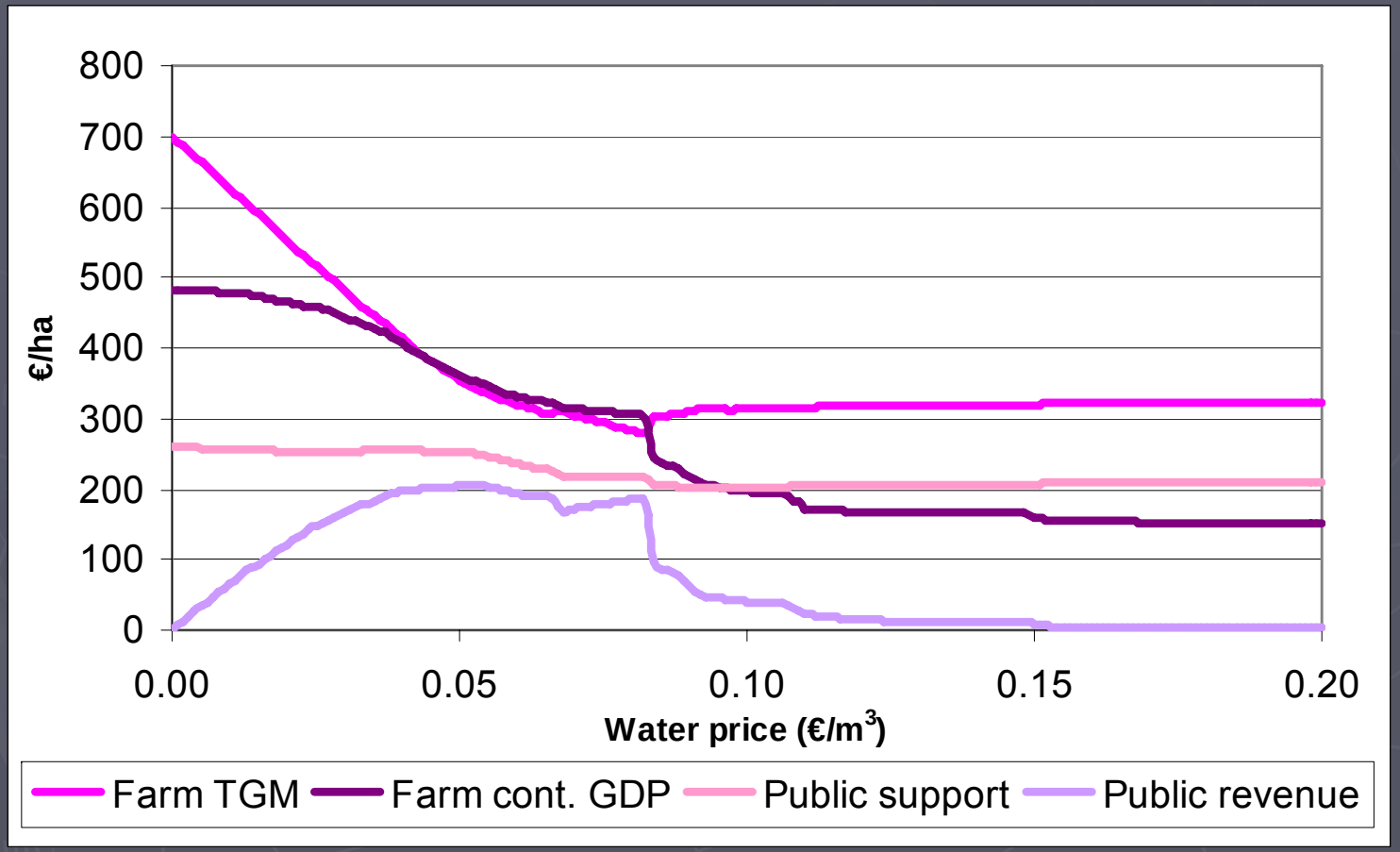
Scenarios Coherent

		WADI escenarios PAC			
		Present CAP	Reformed CAP	Local Management	World Market
WADI: escenarios DMA	Politica	■			
	DMA estrict		■		
	Super-DMA			■	
	DMA partial				■

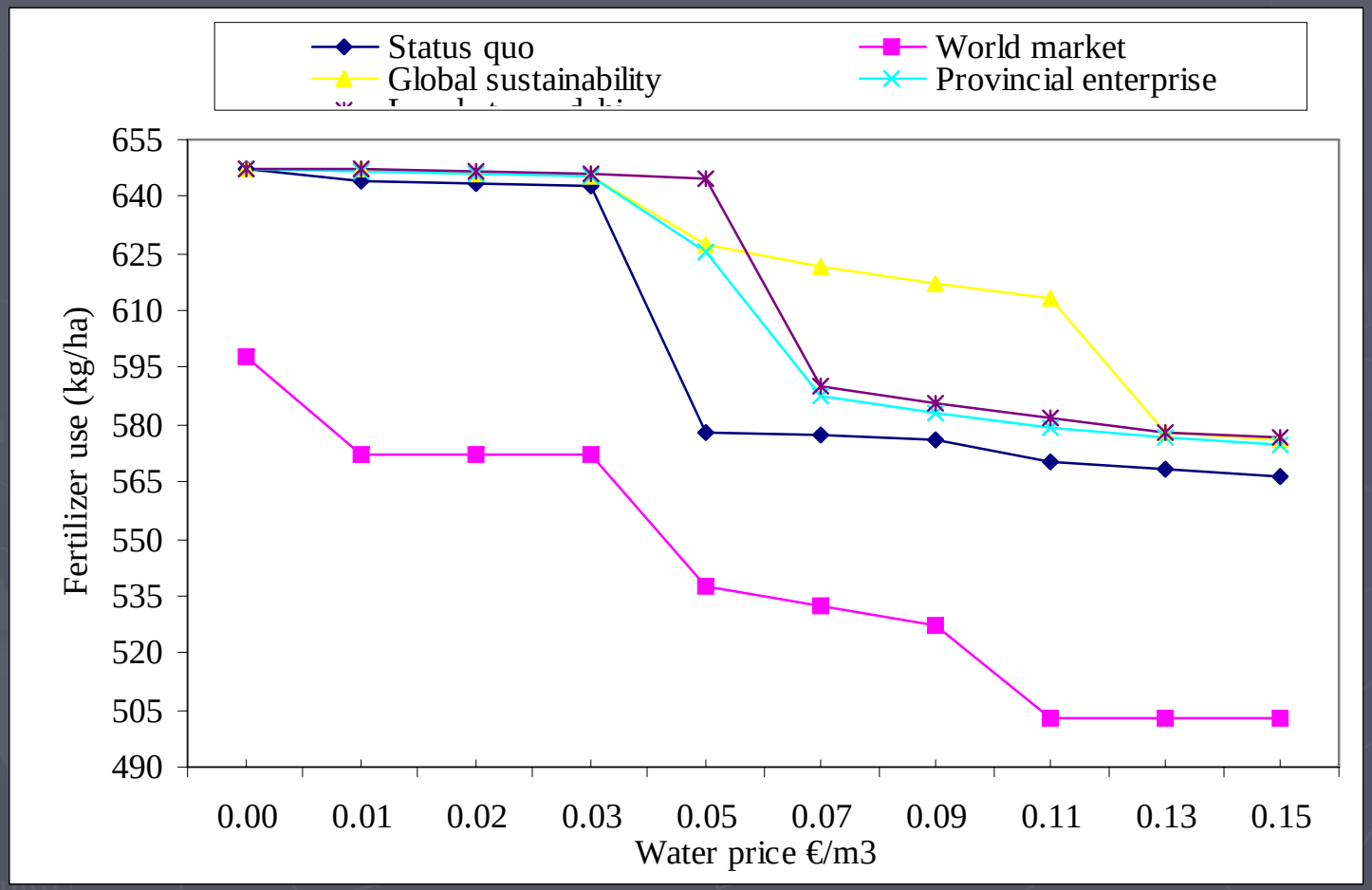
Demanda de agua comparada



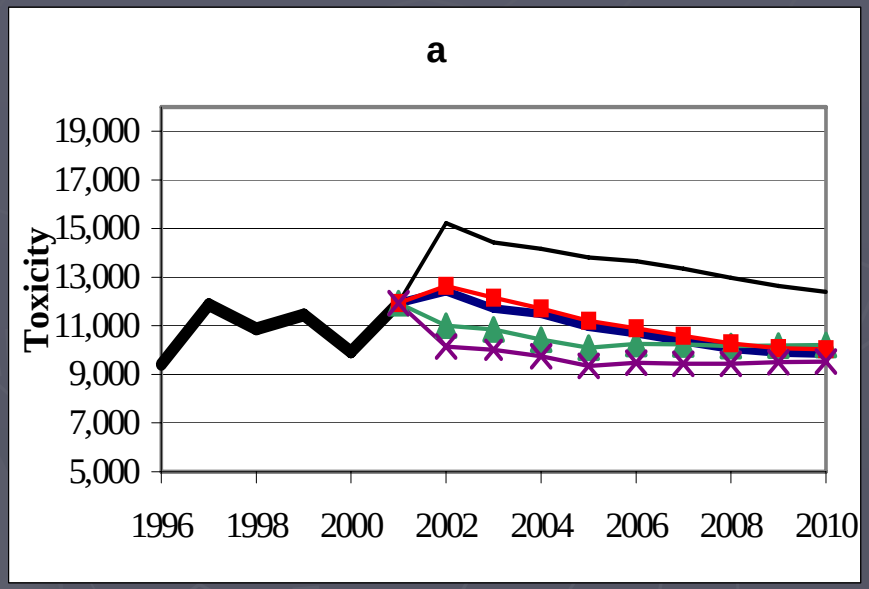
Impacto del precio de agua

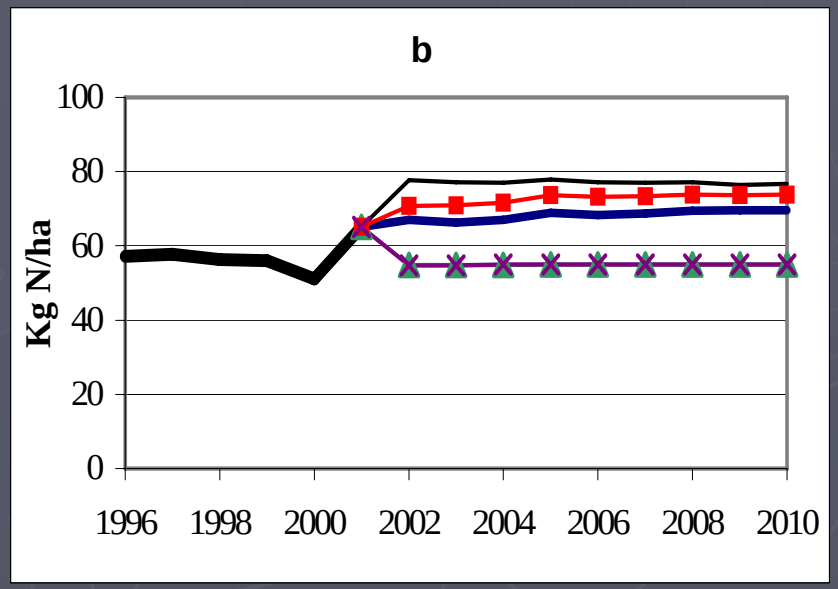


Impacto de precio y escenarios



Evolución prevista





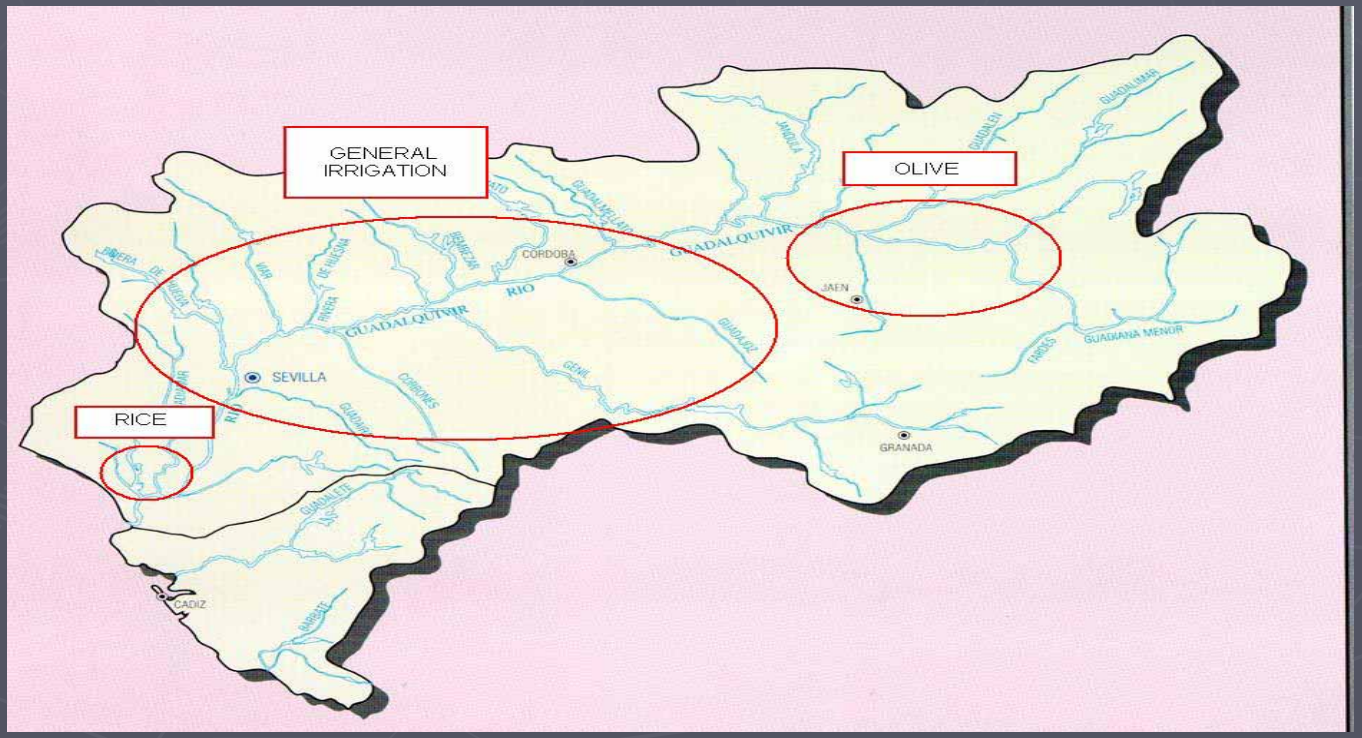
Parameters

	World Agricultural Markets	Global Sustainable Agriculture	Provincial Agriculture	Local Community Agriculture
Output prices				
Cereals	80-90	90-100	100-110	110-120
(Area payments)	0	90-100	95-105	105-115
Vegetables	85-95	110-120	100-110	120-130
Fruits	85-95	95-105	100-110	120-130
Livestock: Meat	85-95	90-100	95-110	110-120
Dairy: milk	85-95	90-100	100-110	115-125
Agric environmental	55-60	95-105	40-50	115-125
Input prices				
Fertiliser and pesticides	85-110	130-150	105-115	130-170
Water	115-130	130-150	105-120	140-160
Water infrastructure	130-140	120-130	105-120	110-120
Crop Yields	120-130	110-115	100-110	80-100

III WADI RESULTS (Guadalquivir)

MAIN AGRICULTURAL SYSTEMS IN A CATHCHMENT

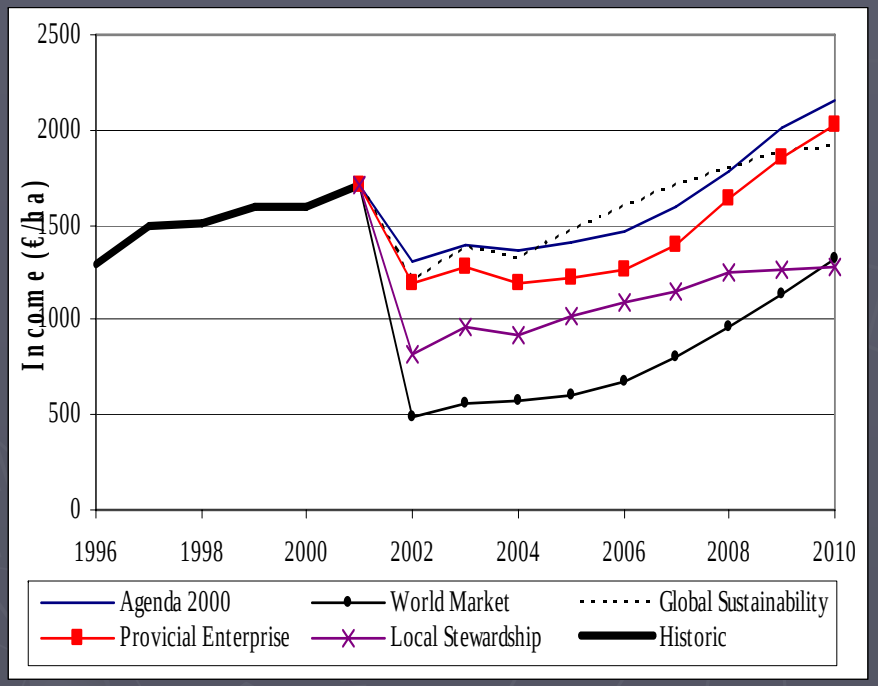
Critical uncertainties AGRICULTURE	- new CAP - new technology/prices - water price polcy

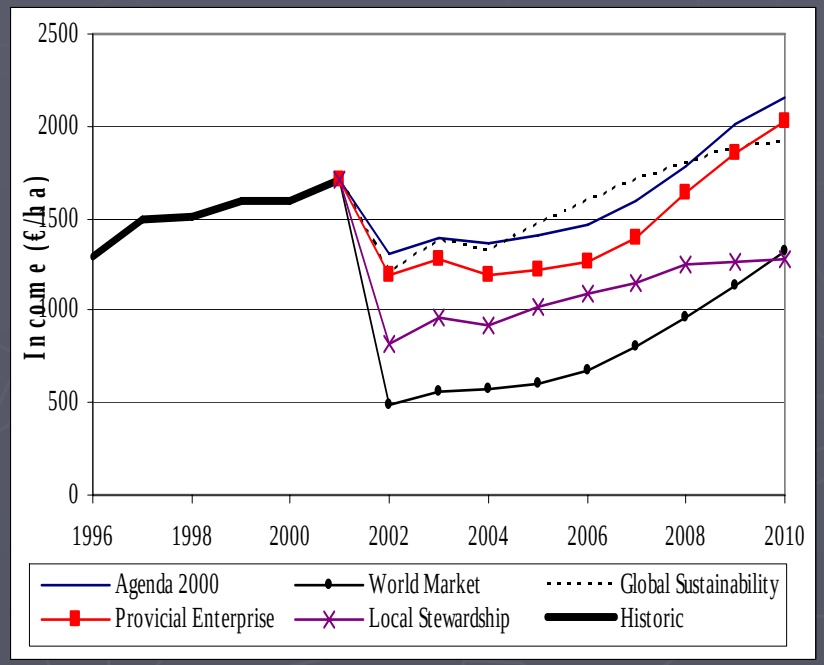


Criteria Weightings by cluster in General Irrigation System

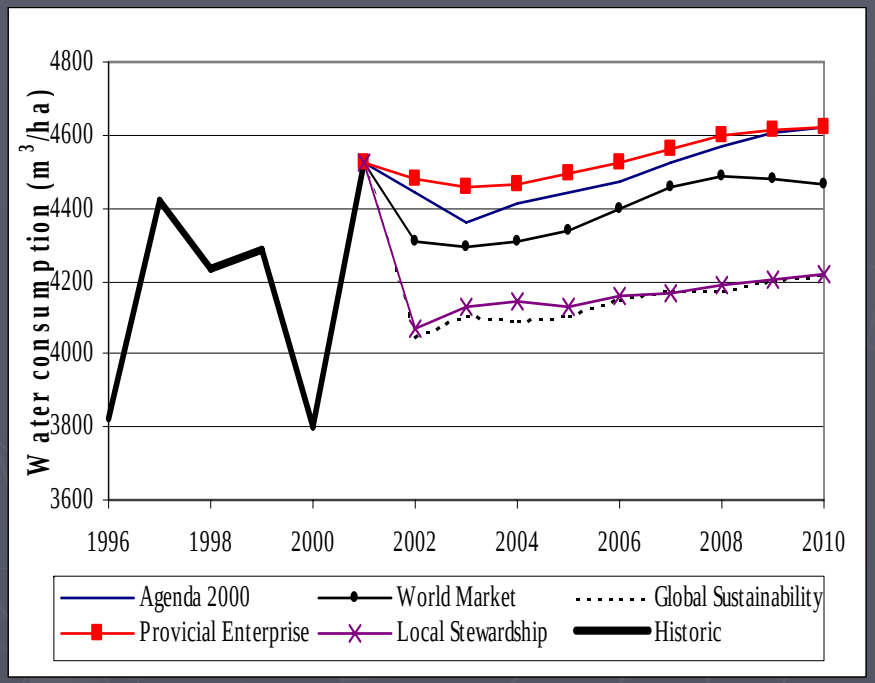
Fuente Palmera			
Cluster A: Cotton	Cluster B: Wheat	Cluster C: Corn	Cluster D: Groves
99.5% FC – 0.5% MO	83.8% FC – 16.2% MO	96.3% FC – 3.8% MO	99.5% FC – 0.5% MO
Genil-Cabra			
Cluster A: Conservative	Cluster B: Commercial	Cluster C: Intensive olive	Cluster D: Vegetables
65.3% FC – 34.7% MO	75.9% FC – 24.1% MO	98.3% FC – 1.7% MO	94.6% FC – 5.4% MO
Bembézar M.Dª			
Cluster A Corn	Cluster B: Diverse	Cluster C: Fruit	Cluster D: Vegetables
96.4% FC – 3.6% MO	90.4% FC – 9.6% MO	97.4% FC – 2.6% MO	82.6% FC – 17.4% MO
El Villar			
Cluster A: Commercial		Cluster B: Conservative	
95.3% FC – 4.7% MO		64.6% FC – 35.4% MO	

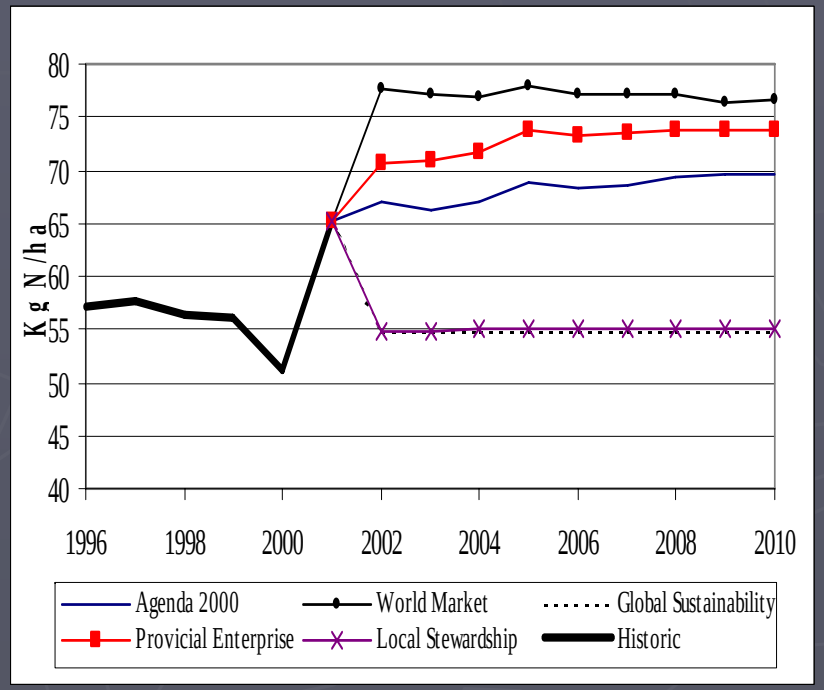
Farm income and labour (Guadalquivir)





Water demand & N balance



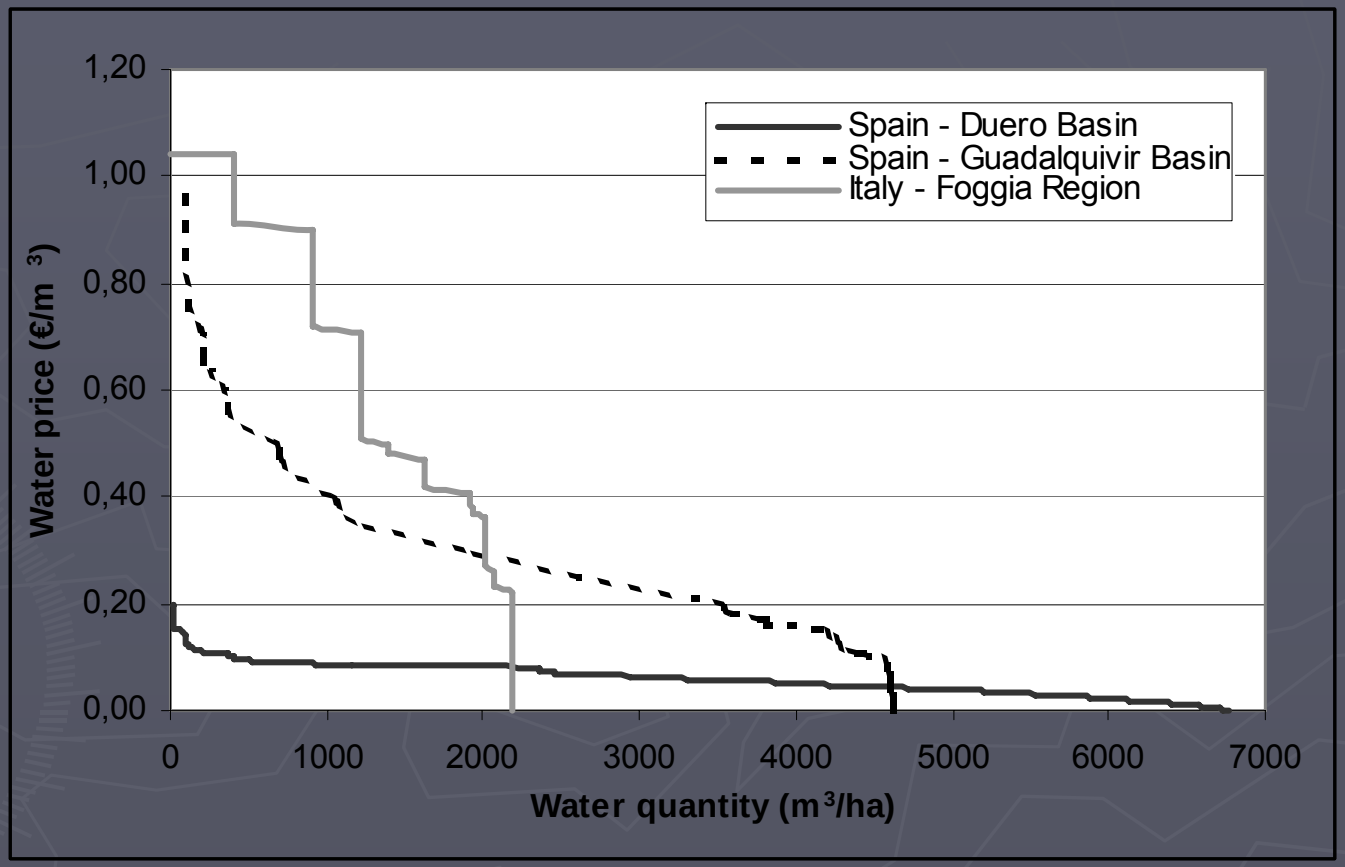


Summary of impact of the different on indicators for the whole River Guadalquivir basin

INDICATOR	SCENARIO				
	Agenda 2000	World Market	Global Sustainability	Provincial Enterprise	Local Stewardship
Socio-Economic indicators					
Farm Income	☺	☹	☺	☺	☹
Contribution to GDP	☺	😐	☺	☺	😐
Direct payments	☺	☺	☺	☺	☺
Employment	☺	☺	☺	☺	☺
Environmental indicators					
Water consumption	😐	☹	☺	☹	☺
Genetic diversity	☹	☹	☹	☹	☹
Soil cover	☺	☺	☺	☺	😐
Toxicity Index	☺	☹	☺	☺	☺
Nitrogen balance	☹	☹	☺	☹	☺
Energy balance	☹	☹	☹	☹	☹

Impact meaning: ☺ Positive, 😐 Neutral, ☹ Negative

Other European results



Water demand characteristics.

Duero	•Guadalquivir	•Foggia
•Demand disappears at 15 cents	•Elastic demand 0 to 1€	•Elastic Demand 0 to 1 €
•Elastic demand	•Inelastic up to 10 cents. •Then, elastic	•Inelastic up to 23 cents. • Then, elastic
•High response to water price	Low response to water price	Low response to water price

Summary

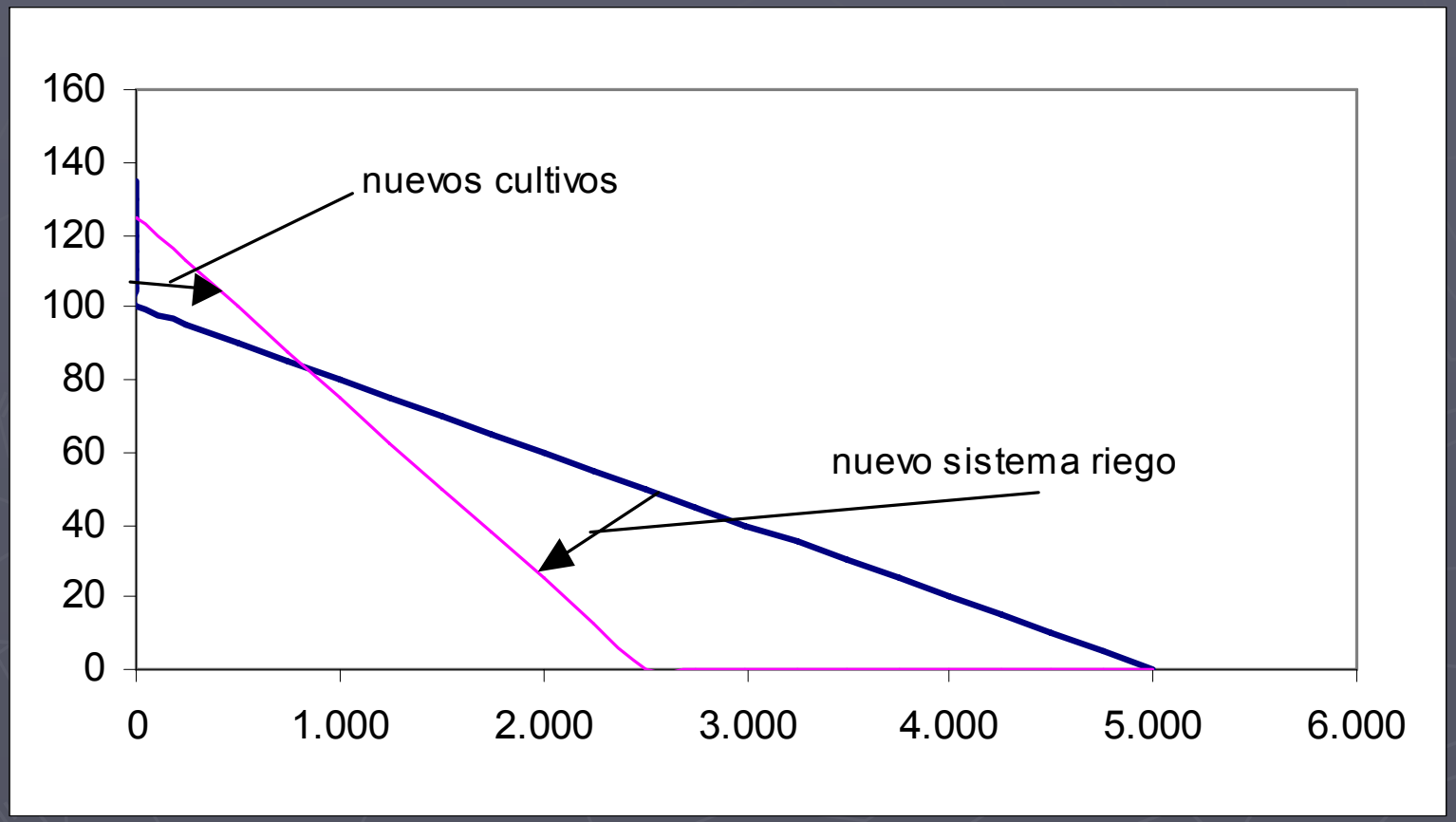
- We improve the description of present day irrigation activities.
- Information on pressures in the system
- Good evaluation of future evolution of pressure indicators
- Multicrtiteria method gives us more and more accurate information BUT IT IS NOT THE FINAL SOLUTION

IV FUTURE RESEARCH NEEDS

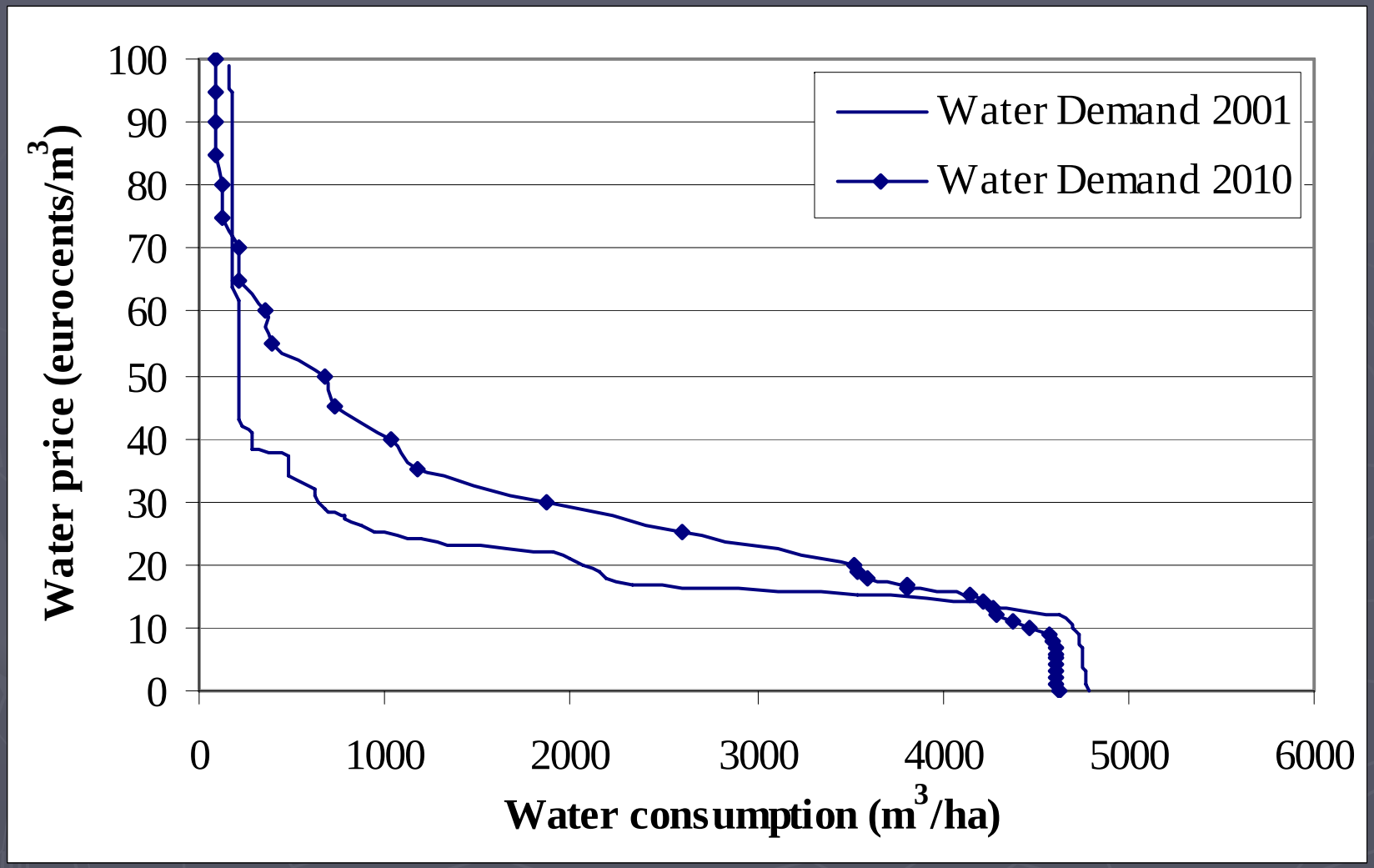
New research needs

- Dynamic evolution
- Non-price instruments
  - Market
  - Quotas
  - Others...
- Indirect impat of irrigation
- Trade-offs

Dynamic evolution irrigated demand (case of Guadalquivir)



Guadalquivir irrigated water demand



Irrigation cost/Total output

Cultivo	Zona	Demarcación	Producción €/ha	Coste cent/m3	%agua/ fact
Invernaderos	Holanda	Holanda	120.000	15,0	0,8%
Fresas	Chanza (HU)	Guadiana	48.193	15,0	1,6%
Invernaderos	Almeria	Mediterranea Andaluza	90.361	25,0	1,7%
Olivar (*)	Jaen	CH Guadalquivir	6.000	15,0	5,0%
Maiz (*)	Francia	Varias	1.910	10,0	10,5%
Trigo (*)	Córdoba	CH Guadalquivir	1.506	8,0	10,6%
Algodón	Sevilla	CH Guadalquivir	4.000	8,0	12,0%
Remolacha	Palencia	CH Duero	3.000	6,0	12,0%

Fuente: Datos aproximados, elaboración propia

(*) riego de apoyo

Indirect impact (positive)

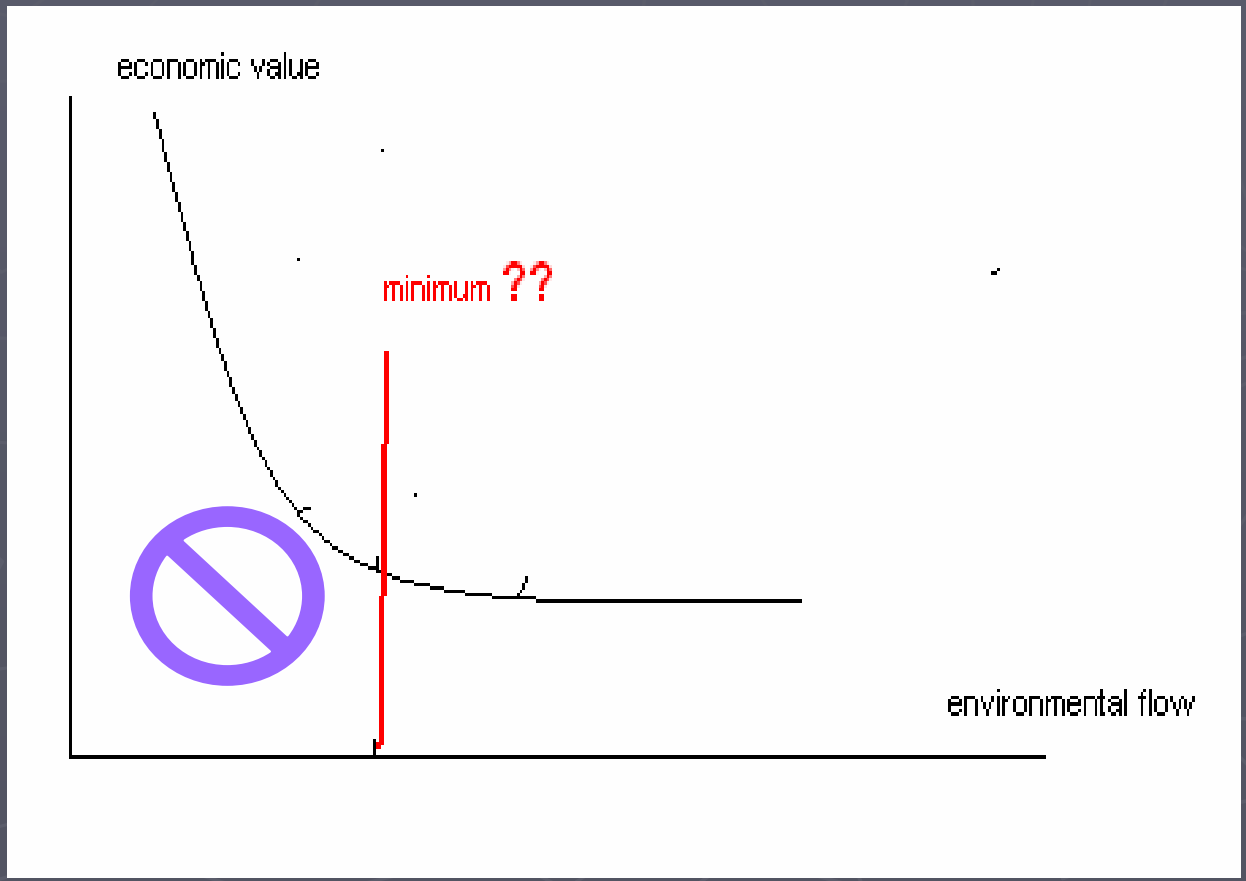
Euros	directo	indirecto	suma
en la producción	1.000.000	593.970	1.593.970
en la renta	622.746	258.627	881.373
en el empleo (1)	37,5	14,0	51,6

Fuente: Titos, 2000

(1) Cifras en UTA

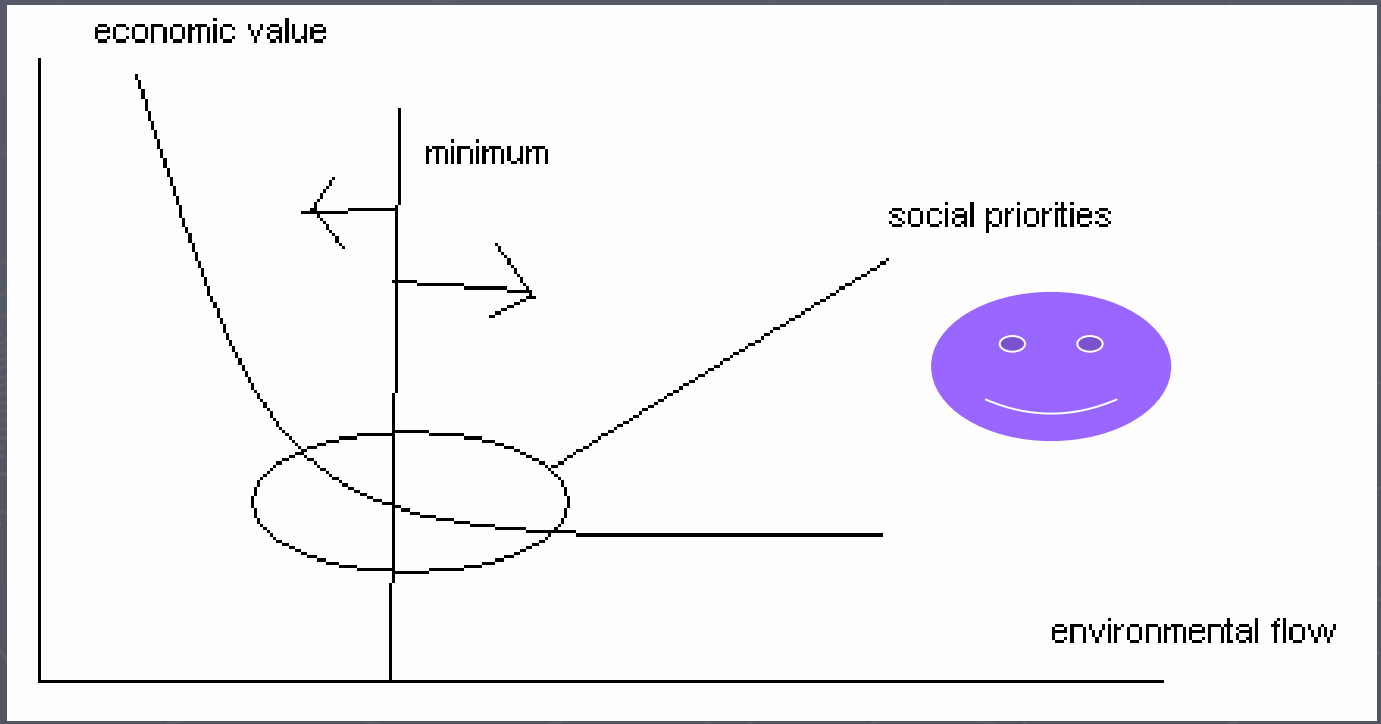
Indirect impact (negative)

- We need to know the trade-off between cirteria, e.g.



Cost-efficiency & Social Priorities

- Trade-offs explicit



Programa de medidas

- Quantity of water
- Quality of water
- Total economic value of the system
- Social priorities

Escenarios 2015 de planificación hidrológica.

	Situación	Escenarios de planificación hidrológica			Escenario PNR-estricto
Escenario	Actual (02)	**Verde (*)**	**Naranja**	**Rojo**	(2015)
(Hm3/año)	3.949	**3.632**	**4.036**	**4.440**	4.380
% Consumo / Recursos renovables	49%	**< 45%**	**50%**	**< 55%**	54%

(*) Plan de Cuenca

Fuente: elaboración propia

Conclusion

- Improve economic typology
- Improve predictive power of model
- Enlarge information on impact/pressures of activities
- Need to integrate the model with next step of analysis: cost efficiency, environmental cost of water uses, ...