



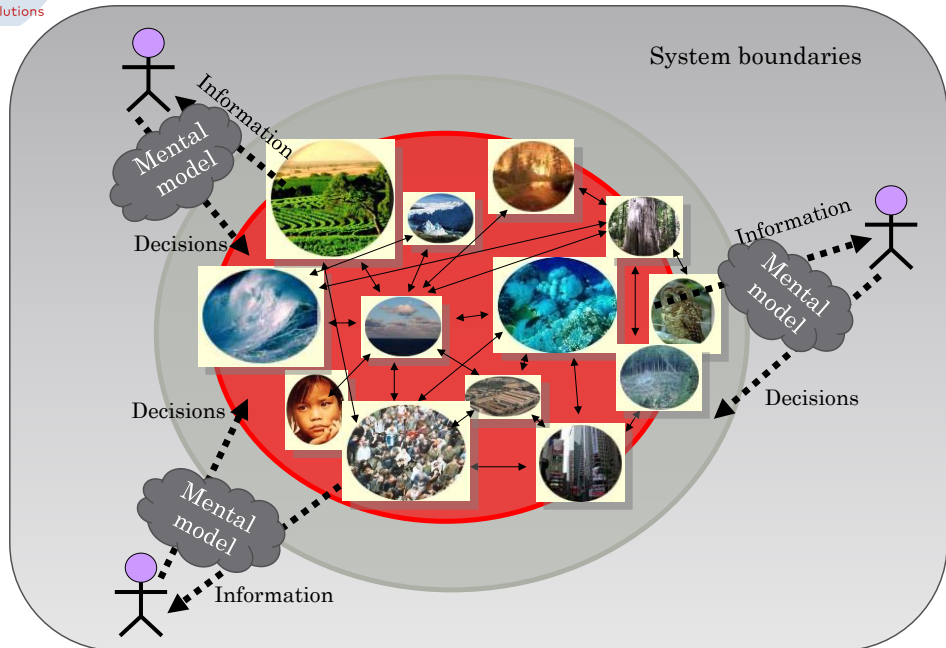
**Integrating conflict analysis in drought risk management:  
Some hints from the Mediterranean area**

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Rotterdam, 10 may 2016



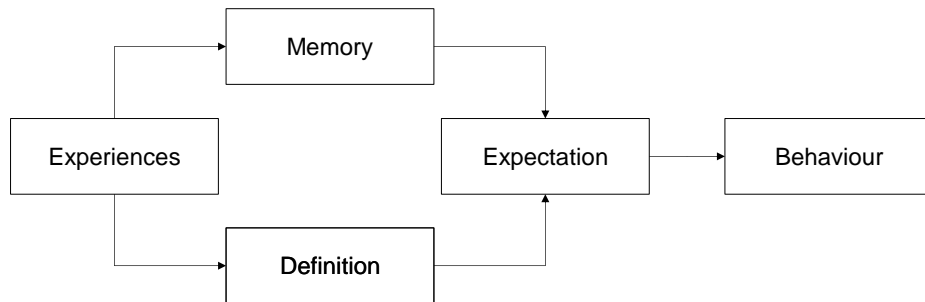
**Drought and problem framing**



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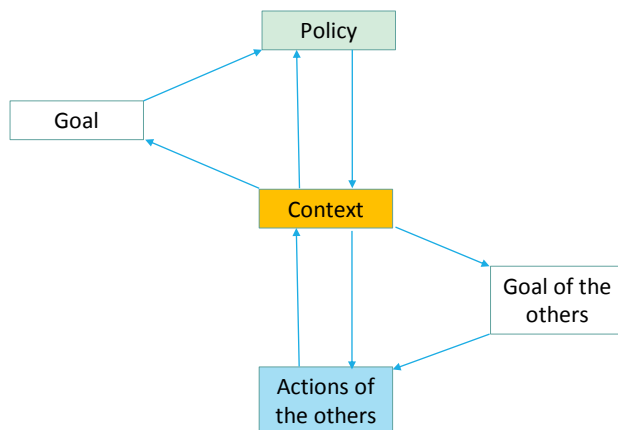
## Drought and problem framing



The way drought is defined influences a stakeholder's expectation of future drought, and leads stakeholders to adopt different behaviours and to act or react in different ways during a drought phenomenon → **conflicts**.

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## Drought risk management in the context



### ~~Ecology of action~~

~~As soon as an individual takes an action, whatever that action may be, it begins to escape from his intentions. The action enters into the universe of interactions and in the end, it is the environment that seizes it in the sense that it can become the opposite of the initial intention.~~

~~E. Morin, On Complexity~~

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## Drought risk management in the context

Drought risk management policies failures occur because they do not match the peculiarities of the **contexts** in which they are implemented



Densely ramified network of interactions (**COMPLEXITY**) that happen among actors with different problem frames (**AMBIGUITY**)

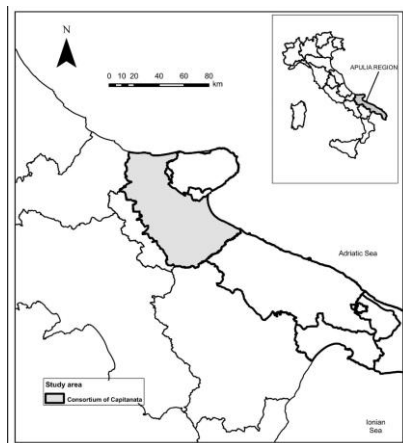


What other decision-actors involved in the network are going to do is largely unknown, making difficult to predict whether the choices pay off or not (**UNCERTAINTY**)

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## Drought risk management in the Apulia Region

### THE CASE STUDY



The regional water authority proposed the enforcement of restrictive measures in the use of groundwater in case of drought

The new legislation caused strong conflicts between farmers, the regional authority and the irrigation consortium due to the expected economic damages to the agricultural sector.

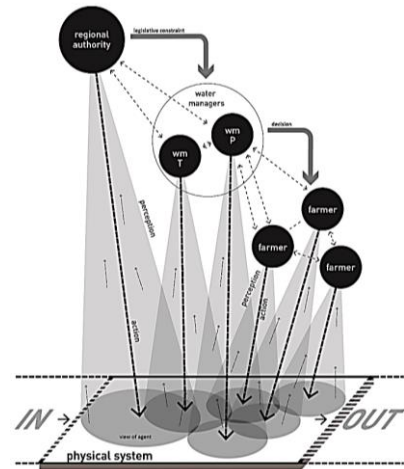
Due to this conflicting situation, the Water Protection Plan has not been implemented yet, and the regional authority is carrying on a time consuming revision process.

This work aims at **investigating how ambiguity affected the policy implementation.**

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## THE DECISION AGENTS

	Agent name	Role	Type
$M_{WT}$	Water Manager Consortium of Capitanata (technical side)	Technician (middle level)	Organization
$M_{WP}$	Water manager Consortium of Capitanata (political side)	Seller (middle level)	Organization
$F$	Farmers	Users (Low level)	Individual
$R$	Regional Authority	Controller (high level)	Organization



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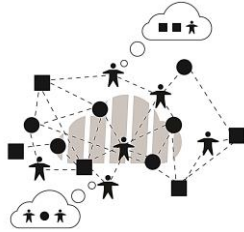
## THE METHODOLOGY

- Decision-actors' understanding of the interaction space
- Decision-actors' understanding of the system dynamic (Mental Model of Dynamic System)
- Ambiguity analysis
- Learning process

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### THE INTERACTION SPACE



$$IS = \langle A, O, R, S \rangle$$

Formal structure to describe the system of interactions within a finite set of actors.

	Objects	Actors	Resources
$o_1$	Environmental protection	$a_3$ Regional Authority	$r_2$ Legislative constraints and regulations
$o_2$	Agricultural productivity	$a_1$ Irrigation consortium	$r_1$ Economic resources (water price)
		$a_2$ Farmers	$r_3$ Information flow
$o_3$	Effectiveness of the irrigation water management	$a_1$ Irrigation consortium	$r_5$ Water accessibility
		$a_3$ Regional Authority	$r_6$ Illegal actions
$o_4$	Water availability	$a_1$ Irrigation consortium	$r_8$ Yield
		$a_2$ Farmers	$r_1$ Economic resources (water price)
$o_5$	Decrease of groundwater overexploitation	$a_3$ Regional Authority	$r_3$ Information flow
		$a_1$ Irrigation consortium	$r_3$ Information flow
$o_6$	Water distribution and control of the irrigation network	$a_2$ Farmers	$r_6$ Illegal actions
		$a_3$ Regional Authority	$r_8$ Yield
$o_7$	Reduction of water consumption during drought	$a_1$ Irrigation consortium	$r_2$ Legislative constraints and regulations
		$a_3$ Regional Authority	$r_2$ Legislative constraints and regulations
$o_8$	Env., econ. and social sustainability of the agricultural activities	$a_1$ Irrigation consortium	$r_1$ Economic resources (water price)
		$a_2$ Farmers	$r_7$ Technical resources
			$r_1$ Economic resources (water price)
			$r_2$ Legislative constraints and regulations
			$r_3$ Information flow
			$r_4$ Decisional power
			$r_7$ Technical resources
			$r_7$ Technical resources
			$r_6$ Illegal actions
			$r_4$ Decisional power
			$r_7$ Technical resources
			$r_2$ Legislative constraints
			$r_9$ Control of the territory

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### The methodology



### THE DECISION-ACTORS' UNDERSTANDING OF THE INTERACTION SPACE

**GW PROTECTION POLICY**  
 $\langle A, O, R, S \rangle_{REG}$

(A) <sub>REG,1</sub>	Perception of other actors	$a_2$	Farmers
(O) <sub>REG,1</sub>	Perception of other actors' objectives	$o_2$	Agricultural productivity
(R) <sub>REG,1</sub>	Perception of other actors' resources	$r_5$	Water accessibility
(A) <sub>REG,2</sub>	Perception of other actors	$r_8$	Yield
(O) <sub>REG,2</sub>	Perception of other actors' objectives	$a_1$	Irrigation consortium
(R) <sub>REG,2</sub>	Perception of other actors' resources	$o_6$	Water distribution and control of the irrigation network
		$r_7$	Technical resources

Regional authority

**Regional Authority**  
 $\langle A, O, R, S \rangle_I$

(A) <sub>I,1</sub>	Perception of other actors	$a_2$	Farmers
(O) <sub>I,1</sub>	Perception of other actors' objectives	$o_2$	Agricultural productivity
(R) <sub>I,1</sub>	Perception of other actors' resources	$o_4$	Water availability
(A) <sub>I,2</sub>	Perception of other actors	$r_3$	Information flow
(O) <sub>I,2</sub>	Perception of other actors' objectives	$r_8$	Yield
(R) <sub>I,2</sub>	Perception of other actors' resources	$a_3$	Regional Authority
		$o_1$	Environmental protection
		$r_2$	Legislative constraints and regulations

Farmers

Consortium

Irrigation consortium

Regional Authority

		$\langle A, O, R, S \rangle_F$	
(A) <sub>F,1</sub>	Perception of other actors	$a_1$	Irrigation consortium
(O) <sub>F,1</sub>	Perception of other actors' objectives	$o_6$	Water distribution and control of the irrigation network
		$o_7$	Reduction of water consumption during drought
(R) <sub>F,1</sub>	Perception of other actors' resources	$r_1$	Economic resources (water price)
		$r_2$	Legislative constraints and regulations
		$r_4$	Decisional power
		$r_7$	Technical resources
(A) <sub>F,2</sub>	Perception of other actors	$a_3$	Regional Authority
(R) <sub>F,2</sub>	Perception of other actors' resources	$o_5$	Decrease of groundwater overexploitation
(R) <sub>F,2</sub>	Perception of other actors' resources	$r_2$	Legislative constraints and regulations

Farmers

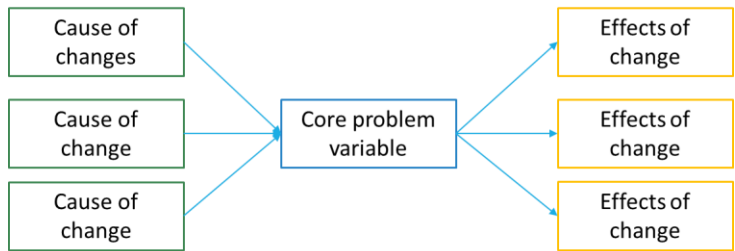
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## The methodology

### THE DECISION-ACTORS' MENTAL MODELS OF DYNAMIC SYSTEM (MMDS)



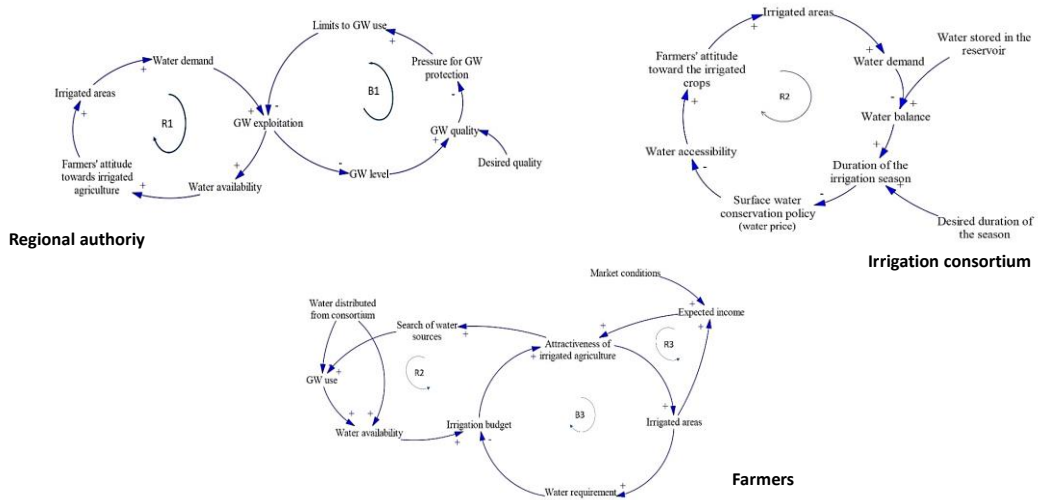
Representing the perceived cause-effect chains influencing the dynamic evolution of a system



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## The methodology

### THE DECISION-ACTORS' MENTAL MODELS OF DYNAMIC SYSTEM (MMDS)



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## The methodology

### THE AMBIGUITY ANALYSIS

Differences in IS perception:  
the Jaccard index

	Actor	J index	Distance
Analyst	Irrigation consortium	0,42	0,58
Analyst	Farmer	0,48	0,52
Analyst	Regional Authority	0,35	0,65

#### The main differences:

- 1) the irrigation consortium neglects the capability of the farmers to activate illegal pumping ;
- 2) the irrigation consortium considers the information flow as a crucial resource in the interaction with farmers;
- 3) the regional authority ignores the role played by the market;
- 4) the regional authority perceives the control of the territory as a crucial resource to achieve its main goal

Differences in MMDS:  
the Model Distance Ratio (MDR) index

	Regional authority	Irrigation Consortium	Farmers
Regional authority	-	0,21	0,90
Irrigation Consortium	0,21	-	0,82
Farmers	0,90	0,82	-

#### The main differences:

- 1) The regional authority perceives the limits to GW as an action to restore the system equilibrium;
- 2) The regional authority and the irrigation consortium perceive the water availability as the only driver influencing the system dynamic.

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## The methodology

### THE LEARNING PROCESS

The irrigation consortium became aware of the importance of providing information to farmers in time to actually influence their decision process.

The irrigation consortium became aware of the illegal pumping activities, which requires a better understanding of the impact of the water price policy.

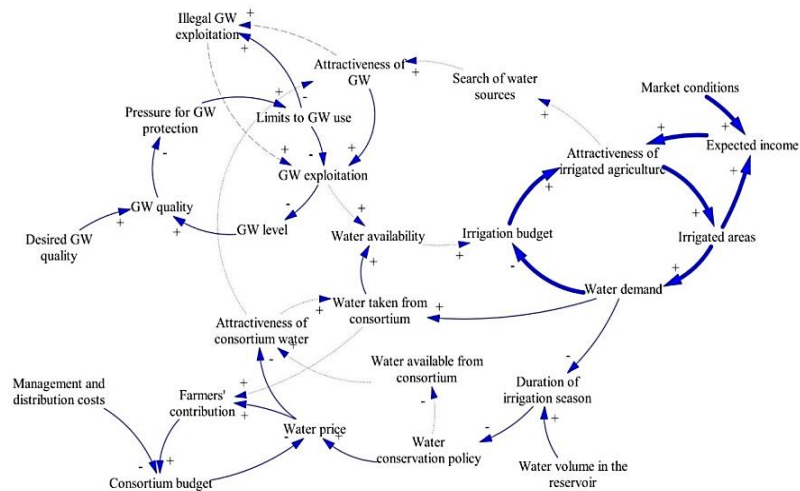
The regional authority introduced the irrigation consortium's role in influencing the farmers' behaviour.

	Actor	J coefficients
Analyst	Irrigation consortium	0,64
Analyst	Farmer	0,53
Analyst	Regional Authority	0,62

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## The methodology

### THE LEARNING PROCESS



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## Concluding remarks

### THE LESSONS LEARNED

Decision actors have a limited understanding of the complexity of the interaction space.

Decision actors tend to neglect the existence of different and equally valid problem framing → they ignore the ambiguity.

In order to take actions, decision actors make assumptions about how the others are going to act and/or react to their actions → conflicting situation.

Collaborative drought risk management claims for a decision-making environment in which the parties are fully aware of their role and the roles of the others in the interaction environment (**interdependency principle**).

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