THE ROLE OF STAKEHOLDERS' INVOLVEMENT TO COMBAT DESERTIFICATION: A CASE STUDY IN THE APULIA REGION

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Abstract - **Drought and desertification are largely considered as the major and most complex natural hazards. This is mainly due to the complexity of the web of impacts that ripple through too many sectors causing serious economic, social and environmental consequences.**

Hence, a wide range of actors are interested by drought effects. Empirical investigations in scientific literature have highlighted the differences between the stakeholder' perceptions of drought and desertification phenomena and the results of scientific – technical evaluation.

There is no unique definition of the problem, but each individual has her/his own perception of drought and desertification, which is influenced by previous drought experiences and the mental models used to analyse these experiences.

This could result in ambiguity in the definition of the problem. The ambiguity in drought and desertification definition could have a strong negative impact on the effectiveness of mitigation strategies.

For these reasons, the involvement of stakeholder in the decision making process for drought and desertification management since its early stages has played a fundamental role.

This work describes the experiences done to support drought and desertification management in the Apulia Region (Southern Italy).

The methods and tools adopted in two different phases are described and the lessons learned during the process are discussed.

The work is structured as follows: in section 1 there is an introduction and a description of the backgrounds regarding the project and the investigated territory. The objectives of the study and the empirical methodology applied state in section 2. Section 3 presents discussion and suggestion on decision making process. Conclusions and final remarks are proposed in section 4.

Keywords - **Stakeholder, desertification, decision making process.**

I. Introduction

In 2007 the National Committee to Combat Drought and Desertification financed the pilot project *"Experimental implementation of the new Directive on soil protection aimed at combating desertification in Apulia"* which was promoted by the Apulia Department of Environment.

The project applied the experimental methodological approach defined in the Proposal for a Directive of the European Parliament and of the European Council (COM 232; 22.09.06) which stated the adoption of a comprehensive EU strategy for soil protection [1].

Analyzing environmental, social and economics dimensions of desertification and soil degradation in Apulia was the purpose of the project. Besides, attention was dedicated to identify what kind of actions could contribute to improve planning and management of those phenomenon which influenced desertification hazard and soil degradation. The project framework aimed to integrate several activities and the enhance the collaboration among several scientific organizations i.e. National Institute of Agricultural Economics (INEA), Water Research Institute of Italian National Research Council (IRSA-CNR), Regional Agency for Environmental Protection (ARPA) and Mediterranean Agronomic Institute of Bari (IAMB).

The work described in this contribution regards one of the project activity, that is, the involvement of local actors in drought and desertification.

An innovative method based on a systemic vision of phenomena was applied. The research group involved in this activity was composed by INEA and IRSA-CNR.

The research activities were carried out in Apulia Region (Southern Italy) and involved five municipalities of the province of Taranto (Fig. 1). Those were the most representative areas at desertification risk in Ionian coastal strip that recently scientific research and National Statistics classified as seriously affected by desertification hazard [2].

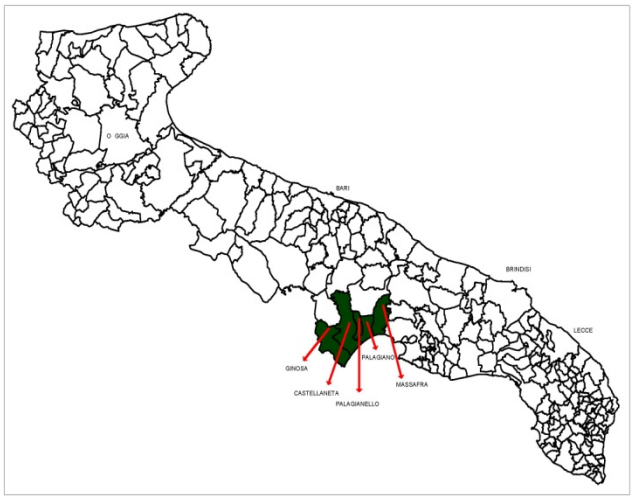

Fig. 1 The five selected municipalities in the province of Taranto

The territory of province of Taranto covers 2.429 sq Km – largely composed by level lands (55%) - and it includes 29 municipalities.

In 2008, the five municipalities total population was about 96 thousand inhabitants (ISTAT, 2008) which represented about 2,3% of regional population.

From an economic standpoint, in 2007 total value added of the province of Taranto was 64.676 millions euros whose 67% was given by services sector whereas agriculture was only 13%. Despite that the Utilized Agricultural Area (UAA) was about 38.256 hectares that represents 28% of the provincial surface area and about 3% of the regional one. Agricultural activity coexists with heavy industry and competition between agricultural and industrial use of land is massive.

The per capita Gross Domestic Product (GDP) is lower than the regional. In 2004, it was about 12.431 euro while regional mean value was 14.484 euro (ISTAT, 2005).

The territory is mostly included in a large industrial area that is one of the highest degraded in Europe because of the presence of the greatest iron and steel industry in Italy. This has several effects on environmental sustainability, particularly in terms of protection of water, soil and air. In the chosen area of study, precipitation is very low (regional mean value was 602 mm/year), and the hydrographical system is very limited.

The coastal aquifer shows evident signs of progressive saline contamination and the situation has been aggravated by the recent years of drought.

II. Materials and methods

In order to make these assessments we adopted stakeholder approach. Two methods were used: the first was known as Stakeholder Analysis (Freeman, 1984) and the second was the Cognitive Group Mapping. The tools adopted in the two different procedure were interviews with key informants, literature review, semi-structured questionnaires, focus groups and workshop. The mix of those produced both qualitative and quantitative data which used will be described as follow.

A. Objectives

A territory is widely considered as a complex system, characterized by several components and complex relationships. Among them, two macro-components could be identified, i.e. the “environmental resources” and the “socio-economic system”. In accordance with this definition, drought and desertification vulnerability has to be assessed considering both environmental and anthropic components, and their capability to react to the phenomenon.

While the desertification impacts on the environmental resources have been widely considered in scientific literature, the assessment of the socio-economic vulnerability to desertification requires further investigations.

This work aims to contribute to the discussion on socio-economic issues in drought and desertification management by analysing the different understandings of desertification impacts on socio-economic system.

Empirical investigations emphasize the ambiguity in drought and desertification perception and definition (Noemdoe et al., 2006). There is no unique definition of the problem (Lane and Oliva 1998; Rosenhead and Mingers, 2001), but each individual has her/his own perception of drought and desertification, which is influenced by previous experiences (Obeidi et al., 2005; Slegers, 2008) and the mental models used to analyse these experiences (Kolkman et al., 2005).

The way a phenomenon is defined influences a stakeholder's expectation of future occurrence, and leads stakeholders to adopt different behaviors and to act or react in different ways (Checkland, 2001; Slegers, 2008), according to different system of values and objectives (Bana e Costa et al., 2001). The potential interference between decision-makers – i.e. when the goals' attainment of at least one party is or could be undermined by others – should be taken into account. This actually describes a conflicting situation (Obeidi et al., 2005). In this condition, the perspective of the single decision-maker, who is able to significantly contribute to reduce drought and desertification impacts with his/her own actions, has to be overcome.

For these reasons, the involvement of stakeholders in the decision making process for drought and desertification management since its early stages plays a fundamental role.

To this aim, a multi-step process to facilitate stakeholders' involvement in drought and desertification management was implemented. The different phases were:

i. the definition of an empirical model which identify, categorize and map stakeholder already involved in desertification management and/or which have to be involved;
ii. the definition of a model (Cognitive Map) as close as possible to the cognitive representation made by stakeholder about the problem.
iii. The enhancement of stakeholders' involvement in the decision-making process.

This contribution focuses on the first two objectives. The following section describe the methods adopted to achieve these two objectives.

B. Stakeholder analysis

The term “stakeholder” originated in the early '60s as a play on the word "stockholder" to signify that there are other parties having a "stake" in the decision-making of the modern, publicly-held corporation in addition to those holding equity positions [3].

Professor Edward Freeman gave the first definition of stakeholder in the volume *"Strategic management. A stakeholder approach"* [4]. He defined the term as follow: a stakeholder in an organization is (by definition) any group or individual who can affect or is affected by the achievement of the organization's objectives.

According to this definition, stakeholder is anyone who shows interest in a specific business even if he/she does not hold formal decision power (stockholder). Examples of stakeholder groups are employers, suppliers, competitors, creditors, customers, governments, and communities.

Therefore, organizations turned their attention also to the external groups. The main result was the increase of networks of relationships between organization and stakeholder. It was no more sufficient to request information about their activity. Organization was called to develop a dialogue with external groups. Moreover, it started to involve stakeholder in business decisions till to co-planning. The aim became generating constant relationships with external reference group.

This often suggested as ethically responsible management that includes careful attention not only to stockholder but to stakeholder generally in decision-making process.

During the last two decades, term stakeholder has become an international neologism. As well as in business, it started to be applied in public administration where primary purpose was to produce public goods and services to community. Therefore, ethically responsible management was extended from the field of business ethics towards that of public ones.

Modern public administrations started to involve stakeholder in decision making process [5]. They took part to the definition of the problem expressing their own perception of the question. In this way public organization and stakeholder have elaborated common development plans sharing objectives, matters and solutions.

Overall public sector takes in a procedure that become to be known as principle of inclusiveness which consists in stakeholder involvement on matters of social, economics and environmental relevance [6].

Ethical management and principle of inclusiveness are loosely referred as "stakeholder analysis".

Frequently, stakeholder analysis is suggested as the whole procedure of inclusiveness which starts with identification and ends with definition of strategy.

But a distinction have to be done between two different phases of the procedure: stakeholder analysis and stakeholder synthesis (Goodpaster, 1990) that was originated by a framework for conscientious decision making known as the sequence Pascal.

According to this, the decision making process is represented as a sequence of six steps to be followed after an issue or problem presents for resolution. It consists in: (i) perception or gathering about the information available and their implications; (ii) analysis of the decision-maker's goals, objectives, values and responsibilities.; (iii) synthesis of this information according to the priorities of the decision-maker; (iv) choice among the options provided by the synthesis; (v) implementation of the chosen option; (vi) learning from the outcome of the decision [7].

Stakeholder analysis is a process that covers the first two steps described above therefore it represents the opening phase of a decision making process. It consists in identification of individuals or groups that turn around organization determining the positive and negative impacts on organization's actions. Instead, stakeholder synthesis consist of the next sequence of decision making steps: synthesis, choice, and action (Goodpaster, 1990). It offers a pattern by which to move from stakeholder identification to a response or resolution [8].

C. Activities in stakeholder analysis

In this paper we propose the application of stakeholder analysis revisited with reference to the issue of desertification in the Ionian areas. The implementation of stakeholder analysis was a constructive and interactive process with intersected activities which were grouped into three main phases named: (i) stakeholder identification, (ii) stakeholder mapping, (iii) stakeholder classification. The first phase was aimed at the identification of stakeholder connected with drought and desertification issue operating in the chosen catchment's area.

To achieve that brainstorming was used and a Stakeholder's Categorized Map (SCM) was defined. The second phase consisted of describing the main features of stakeholder and their categorization in four fundamental areas of intervention. The main outcomes of this activity was the Stakeholder Mapping (SM), which supported stakeholder categorization in four fundamental areas of intervention: air, water, scraps, biodiversity. Network of connections, points of strength and weakness of relationships among actors and their management were also revealed. The third phase was directed to stakeholder classification on the base of their interest and power in protection of soil and desertification hazard for the province of Taranto. The Power/Interest Matrix (PIM) was defined. It classified stakeholder in two variables: the leverage that actors were able to implement and their degree of attention on the topic in object.

D. Stakeholder's Categorized Map

The analysis stared first identifying who were the stakeholders connected with desertification in the territory of Taranto. *"Who can be considered stakeholder on drought and desertification management in province of Taranto?"* was the first question which we had to answer. We defined stakeholder as follow: *"stakeholder is any public institution, organization, group of individuals or individual which are able to further or oppose the diffusion of best practice to reduce drought and desertification in the chosen*

catchment's area". Therefore, stakeholders were identified as anyone impacted by and impacting public programmes of soil protection.

Starting with this definition, a check-list of all "likely stakeholder" was realized. The list contained all institutions, groups, organizations and individual concerning with the environmental issue in object. To achieve that literature review and brainstorming was used and a *Stakeholder's Categorized Map* (SCM) was defined (Fig. 2). It was an useful tool which clustered stakeholder and outlined the whole situation.

SCM classified stakeholder into three macro-groups: public institutions, private structured groups and non-structured groups. Public institutions grouped national and regional public authorities, local governments, local authorities, local agency, research institutions, school system, professional associations and other institutions. In private structured groups were clustered local development agencies, farmers' associations, unions, professional organizations, consortia, organic certification bodies, media, political parties, cultural associations, environmental organizations, consumer associations. Lastly, *non-structured groups* included citizens and communities.

E. Stakeholder Mapping

In our methodological framework, Stakeholder's Categorized Map was a preliminary step in the process of stakeholder analysis. In order to continue with the identification of stakeholder to be involved in decision making process, information of stakeholder's perceptions, interests and priorities were investigated.

We asked to stakeholder to draw up a questionnaire which contained information in terms of size, assets, knowledge of desertification, role and strategic positioning in public decisions processing.

Twenty seven questionnaires were drown up. They were structured in three parts.

The first one concerning general information about stakeholder, such as localization, number of employers, number of office and target. The second one interested on stakeholder's knowledge of desertification hazard and the activities they implemented on the environmental protection. Finally, the organization's involvement in decision making process on environmental topics and the effectiveness of those who were investigated in the third part.

The main outcomes of this analysis was the *Stakeholder Mapping* (SM) which supported stakeholder's categorization in four fundamental areas of intervention: air, water, scraps and biodiversity. Those clustering supported the construction of Cognitive mapping (see section G).

Besides, this activity identified areas of tension between groups and points of strength and weakness of relationships among stakeholder that were discussed below.

F. Power/Interest Matrix

The last stage of the stakeholder analysis was the stakeholder classification in relationship to the power that they hold and the extent to which they are likely to show interest in the issue of the desertification.

According to stakeholders Gardner et al. (1986) the *Power/Interest Matrix* (PIM) provides valuable information on how to handle each of the stakeholders identified and which groups have to become included in the making decision process. Concerning public strategies to combat desertification, PIM proposed in this study had the aim to indicate what type of relationship public institution (province of Taranto) should have with each of the stakeholder identified.

Power or impact of a stakeholder was generically defined as the extent to which they are able to induce or coerce others into following certain courses of action. In this study, the analysis of stakeholder power was necessary to evaluate their ability to influence public actions connected with protection of soil.

No single indicator is likely to uncover the power and position of a particular stakeholder in relation to the Pubic institution. The level of influence of each stakeholder derived from several quantitative and qualitative variables. In our study we restricted the field on five indicators: dimension, representative image, resources available, knowledge and skills, strategic placing. On the other hand, interest was defined on the base of stakeholder's actions incidence in desertification management and their pressure applied on political.

Matrix classified stakeholder as follows: *Key players* (stakeholders with high power and high level of interest) to whom public administration must give primary consideration and have to be involved. *Keep involved* (stakeholders with high power and low level of interest) who should be involved. *Keep informed* (stakeholders with low power and high level of interest) who is recommended to keep relationships with but is not essential to involve [9].

In order to draw the matrix, three different data sources were mixed. They were semi-structured interview, focus group and questionnaires. Key informants were chosen among Province of Taranto public officials and councillors. The information derived from the interviews clarified the perceptions that public institutions had about the environmental issue in object. Besides, key informants said their idea of the problem and their point of view about the efficiency of stakeholder involvement in decision making process. Focus group activated involved totally twenty stakeholder. The participants were asked to respond to the follows questions: *(i) "How stakeholder are been involved in decision making process in desertification (or more generally in environmental topics) recently?", (ii) "What kind of network of relationships exist among stakeholder?", (iii) "What your proposals to improved currently stakeholder involvement in decision making process and network of relationships existing?"* .

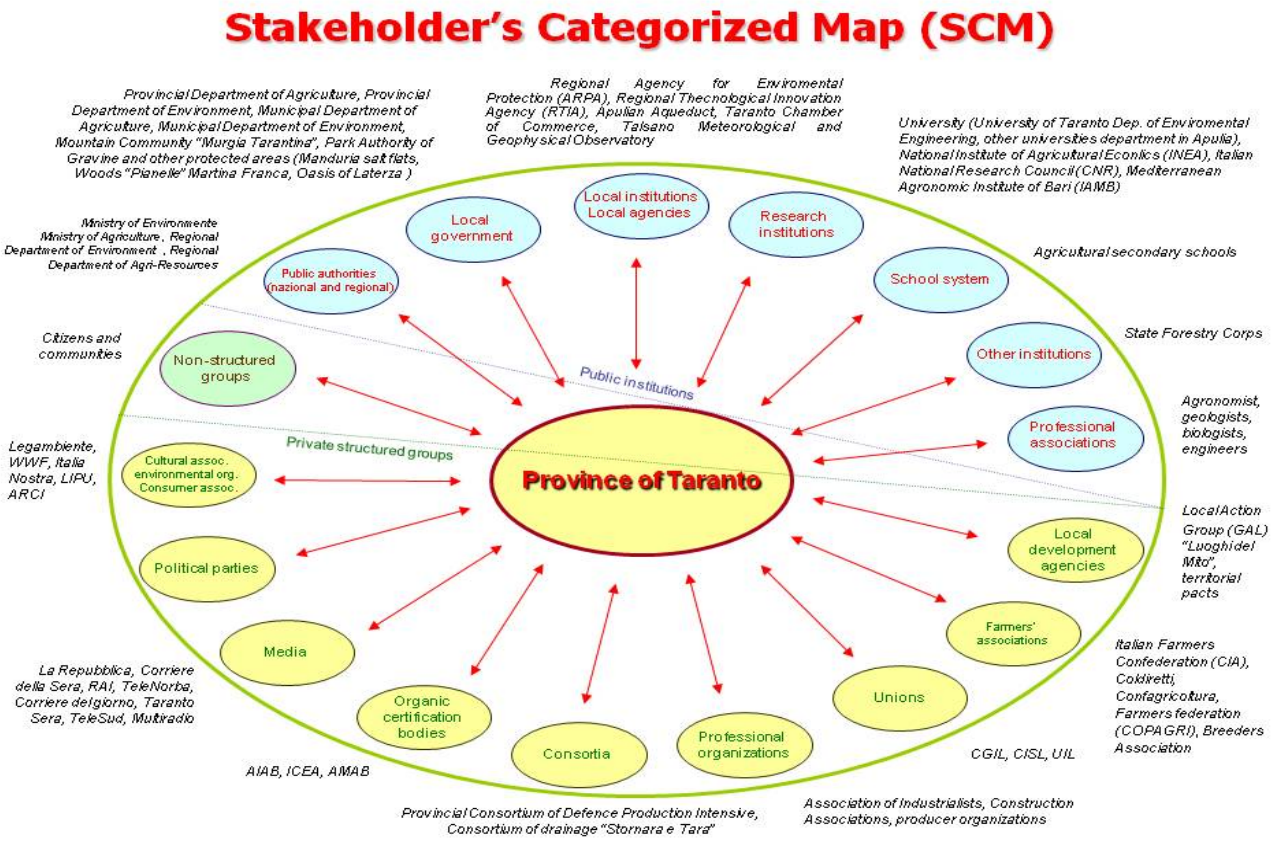

Fig. 2 Stakeholder's Categorized Map (SCM)

During focus group each stakeholder described his/her perception of the problem and his/her experience of involvement in decision process. Finally, information collected by interviews and focus groups were mixed with those from questionnaires described in the previous section. The data were summarized in order to obtain a stakeholder specific assessment tool, addressing each one in the PIM. The outcome of the above approach will be briefly discussed in the next paragraph.

III. Results

Each activity, as we discussed above, produced information useful to identify stakeholder and to define their main features. A closer look at the results also suggested which ones have to be involved by public administration and revealed the network of relationships among stakeholders. Although the whole stakeholder listed are been informed of, a small part of them responded to the involvement as required by our research. Twenty seven of all likely stakeholder were assessed. Even if the study can not be considered fully complete we thought that they were a significant stakeholder representation because of their interest in participation.

About them we could say that they were essentially local organizations (regional and provincial), small to medium. Stakeholders prove interest in environmental issues and regard drought and desertification hazard. Several respondents declare high degree of knowledge of the subject (40%) and many organization use more than four employers in environmental matters (58%). In recent years, only 39% of those organizations have activated actions/events on the issues in object. Besides they were poorly involved in decision-making processes implemented by local public administration. Concluding, stakeholder were agree in saying that public institutions expressed little interest on stakeholder's involvement during last years.

According to the outcomes of Power/Interest Matrix (PIM), we realized that the quadrant which identify stakeholders with low influence and low power remained empty because represented an *area of no interest* while in our analysis we identified only stakeholder to involve in the procedure. The *Key players* grouped the largest number of organizations (Tab. 1).

Table 1 Level of power/influence assigned to stakeholders

Stakeholder	Power						Interest		
	Dimension	Representative image	Resources available	Knowledge and skills	Strategic placing	Level of power	Incidence	Pressure applied	Level of interest
Public authorities (nazional and regional)	+++	+++	+++	+++	+++	+++	+++	+++	+++
Professional associations	++	+++	+++	+++	++	+++	+++	++	++
Environmental organizations	+	+++	++	++	++	++	++	++	++
Organic certification bodies	++	+++	+++	+++	+++	+++	+++	+	++
Farmers' associations	+++	+++	++	++	+++	+++	+++	+	++
Professional organizations	++	+++	+	++	++	++	++	+	+
Local institutions and local agencies	+++	+++	+++	+++	+++	+++	+++	++	+++
Consortia	+++	+++	++	+++	+++	+++	+++	++	+++
Media	+++	+++	++	+	+++	++	+	++	+
Research institutions	+++	+++	+++	+++	+++	+++	+++	+++	+++
Local developement agencies	++	+++	+	+	+++	++	+	+	+
Unions	+++	+++	+	+	+	++	+	+	+
Local government	++	+++	+++	++	+++	+++	++	+	+
Consumer associations	+	++	+	+	+	+	++	++	++
Cultural associations	+	+	+	+	+	+	++	+	++
School system	+	+	+	++	+	+	++	++	++
Non-structured groups	+	+	+	+	+	+	+	++	++

+ low; ++ medium; +++ high.

They were public institutions directly connected with research subjects, public authorities, local institutions and local agencies, research institutions, professional associations, consortia, organic certification bodies, environmental organizations and farmers' associations.

They represented stakeholder that public administration must involve in a making decision process on desertification matters because they have key role. Stakeholder to keep involved had to be listen actively because of they have an operative role.

Those were local development agencies, local governments, media, professional organizations and unions.

Lastly, Stakeholders to keep informed were those who were marginal even if it recommended to informed of the decision process steps.

They were cultural associations, consumers associations, school system and non-structured groups. However, the involvement of stakeholders classified as *keep informed* or *keep involved* depending on administration choices and strategies (Fig. 3).

By focus group discussion and interviews on key informant unstructured network of relationships among stakeholders was emerged.

Stakeholders were called to suggest solutions to improve relations and to create a steady network. These results were shown in Table 2 and Table 3.

Table 2 List of obstacles in the network of relationships

Obstacles	**Degree of importance**
Insufficient communication	High importance
Improvement of water management	High importance
Scarce information exchange	High importance
Lack of coordination	High importance
Private interests in desertification management	High importance
Lack of planning activities	High importance
Scarce competent staff on issue	Medium importance
high fragmentation of actors	Medium importance
Scarce perception of desertification hazard	Medium importance
Bureaucracy	Medium importance
Overlapping of responsibilities	Medium importance

Table 3 List of solution in the network of relationships

Obstacles	Degree of importance
Public administration interventions should be planned with continuity	High importance
Successful models of participatory approaches implemented in others territory could be developed	High importance
Observers or conciliation tables could be created	High importance
Linkages to other relevant on-going projects must be clearer	High importance
Projects should have action on the ground	High importance

These were considered the first steps to built an efficient management among organizations and to encourage the involvement of stakeholders in decision making process.

G. Cognitive Group Mapping

A cognitive map (CM) can be defined as a representation of thought process for how something works in the real world. The constructivist view of knowledge assumes that knowledge is considered to change dynamically, in order to understand the reality. According to the constructivist approach, a cognitive map is a construct that can be useful to generate reflections on the decision maker (Eden and Ackermann, 2001). A CM could be defined as a network of ideas connected by arrows: the arrows indicate the way in which one idea may lead to, or have implication for, another. The CMs are developed using formal modelling technique with rules (Eden, 2004). CMs are characterized by a hierarchical structure which is most often in the form of a means/ends graph with goal type statements at the top of the hierarchy. When the map has been coded properly the top part of the map ("heads") will depict the "goal system", and the bottom part the detailed potential action points or options. In this work CM were used to structure stakeholders' understanding of the drought and desertification phenomenon.

The objectives was to identify the main issues to be addressed and the most important actions to be implemented in order to cope with drought and desertification according to the stakeholders' opinions. To this aim, two sequential phases were implemented, involving the stakeholders identified during the previous steps:

1- definition of the elements of drought and desertification, i.e. main impacts on the local socio-

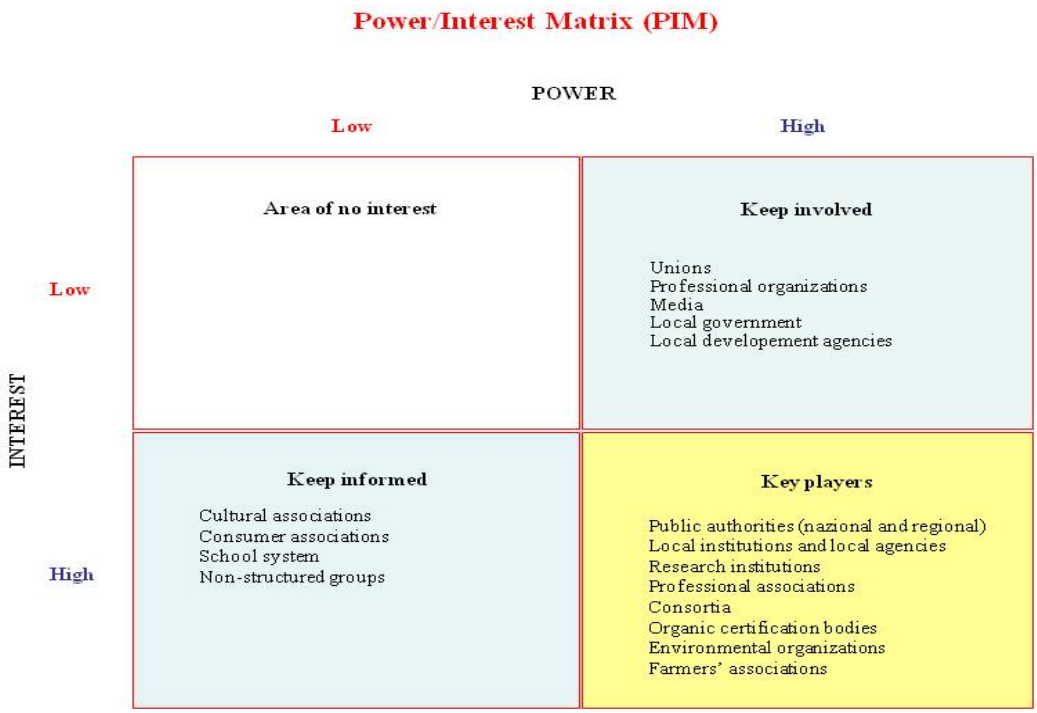

Fig. 3 Power/Interest Matrix (PIM)

ecological system and the main causes of system vulnerability, and definition of the main objectives to be achieved.

2- identification of the potential actions to be implemented to reduce the drought and desertification impacts.

For what concerns the first phase, a cognitive mapping session was organized in the study area.

The hierarchical approach to develop the CM was adopted.

Participants were required to define the main objectives to be achieved in order to reduce the effects of drought and desertification in the area.

Individual contributions were collected. Participants were then required to cluster the objectives according to a similarity degree, and to name the cluster. At the end of this phase, the following main objectives were defined:

1. biodiversity conservation;
2. sustainable management of wastes;
3. reduction of air pollution;
4. local-global integration.

Starting from these results, participants were required to specify the main obstacles which are hampering the achievement of these objectives (Fig. 4).

Similarly to the previous phase, clusters were created and named.

To complete the cognitive mapping process, participants were required to define the links between the different elements.

The obtained final CM is shown in Figure 5.

As shown in Figure. 5, the links were drawn between obstacles and between them and the objectives.

The CM analysis (Eden, 2004) were used to analyze the developed CM and to assess the degree of importance of the main elements in the stakeholders' understanding of drought and desertification [10].

The CM analysis are based on the assumption that the more central is the concept in the CM the more important is for the participants.

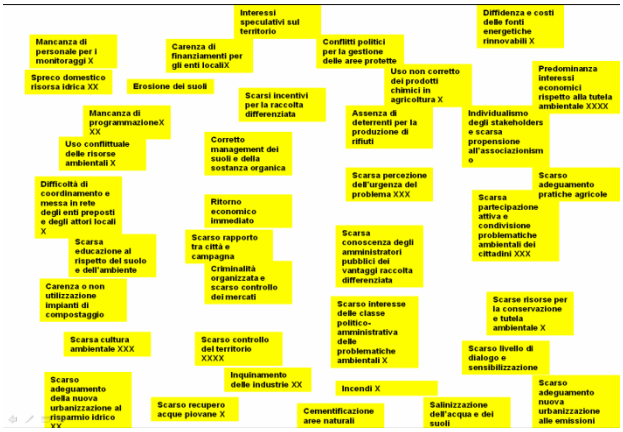

Fig. 4 Main problems to be solved in drought and desertification management.

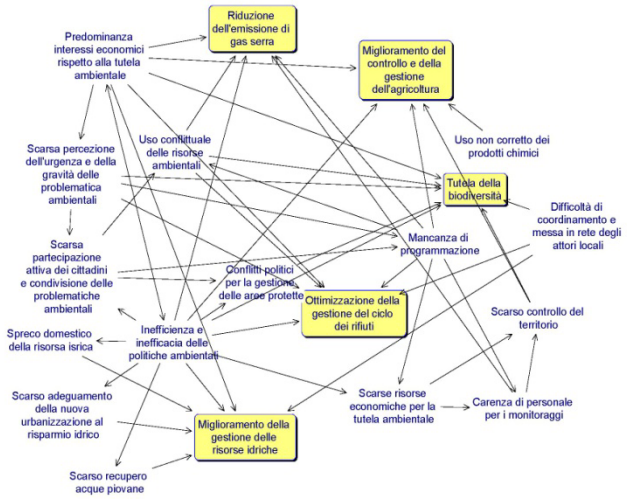

Fig. 5 CM with objectives and obstacles

Thus, the centrality degree of each elements in CM were assessed (Eden, 2004). To this aim, Decision Explorer, a software package developed by Strathclyde University (www.banxia.com) were used. Table 4 and Table 5 show the results of this analysis [11].

Table 4 Degree of importance for the objectives

Objetives	**Degree of Importance**
Sustainable waste management	High importance
Improvement of water management	High importance
Biodiversity conservation	High importance
Improvement in agricoltural practices	Medium importance
Redection of air pollution	High importance

Table 5 Degree of importance for the obstacles

Objetives	**Degree of Importance**
Ineffective environmental policies	High importance
Economic interests in resources management	High importance
Ineffective planning	High importance
Scarce perception of desertification urgency	Medium importance
Low territory control	Medium importance
High degree of conflict between political actors	Medium importance

These results were discussed and validated with the participants. Objectives and obstacles were, then, used to support the debate aiming to identify the main actions to implement to combat drought and desertification.

In the second phase, participants were required to suggest potential actions to overcome the main obstacles and to achieve the selected objectives. To facilitate the debate

among the stakeholders, the causal chains concerning the main objectives contained in the CM were shown to the participants Figure 6.

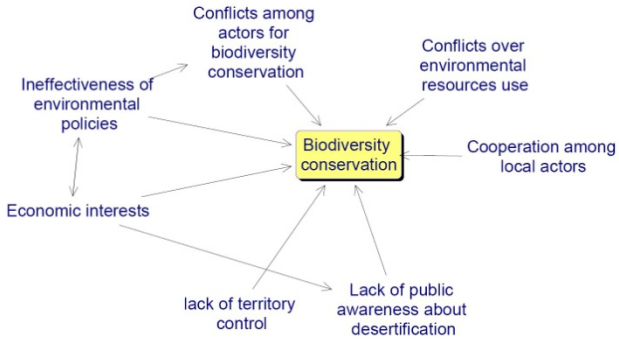

Fig. 6 Causal chain of the objective "biodiversity conservation"

Individual contributions were collected and clustered according to their similarity, as shown in Figure. 7.

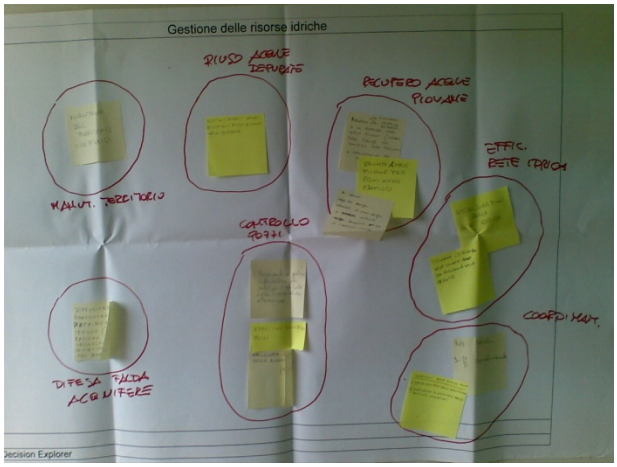

Fig. 7 Clusters of actions to achieve the objective "Improvement of water management"

At the end of this phase, the required actions for each objectives were defined by the participants.

Tab. 6 List of actions suggested by the stakeholders

Objectives	**Actions**
Improvement of water resources management	Wastewater reuse Rainfall reuse Water distribution efficiency Coordination among actors Groundwater protection Territory maintenance
Reduction of air pollution	Best management practices Re-forestation Improve air quality monitoring Improve policies
Biodiversity conservation	Coordination among the different political actors Public awareness Protection of local species
Improvement of waste management	Coordination among the different political actors Public awareness Improvement of differentiated wastes collection
Improvement of agricultural practices	Technical assistance to farmers Territory control Reduction of pesticides use Promotion of local products Improvement of planning

Participants were, then, required to define the expected impacts of the selected actions. That is, they drew arrows to link the actions to both objectives and obstacles. Two kinds of links were available, that is, positive and negative. A positive link means that the implementation of the action will result in an increase of the value of the connected element. A negative link means that the implementation of the action will lead to a reduction of the value of the connected elements.

Figure 8 Shows the links drew by participants for the objective "Improvement of water management".

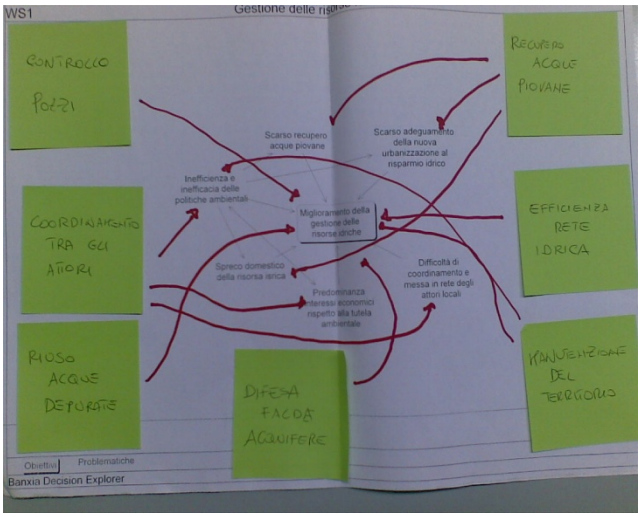

Fig. 8 Expected impacts of the actions suggested for "improvement of water management"

The aggregation of these causal schemes allowed us to developed the final CM, obtained by adding the actions and their links in the CM developed at the end of the first phase (Fig. 9).

This CM represents the stakeholders' understanding of the drought and desertification phenomenon in the study area. In other words, the CM could be considered as the local mental model to represent the phenomenon. Therefore, the CM were used to analyze different scenarios, and to simulate the impacts of the proposed actions and to assess their effectiveness. This phase aimed to rank the alternatives according to the stakeholders' mental model.

To this aim, the CM were converted into Fuzzy Cognitive Map (FCM) (Axelrod, 1976). The elements were transformed into variables, a weight was assigned to each links according to the stakeholders' opinions. The higher is the influence of a variable over another, the higher is the weight assigned to the link.

The formula used to simulate the different scenarios is:

$$A_i^{t+1} = f\left(\sum_{j=1, j\neq i}^{n} W_{ji} A_j^t \right) \quad (1)$$

The value of the variable A_i at time t+1 is assessed considering the value of the connected variables (A_i) at time t and the weight of the links.

The simulation is carried out considering the initial state vector, that is, the set of the value of each variable, and the adjacency matrix. The latter is developed considering the weight of each link.

The impact of the suggested action was simulated by turning "on" their state – i.e. assigning the value 1 in the initial state vector.

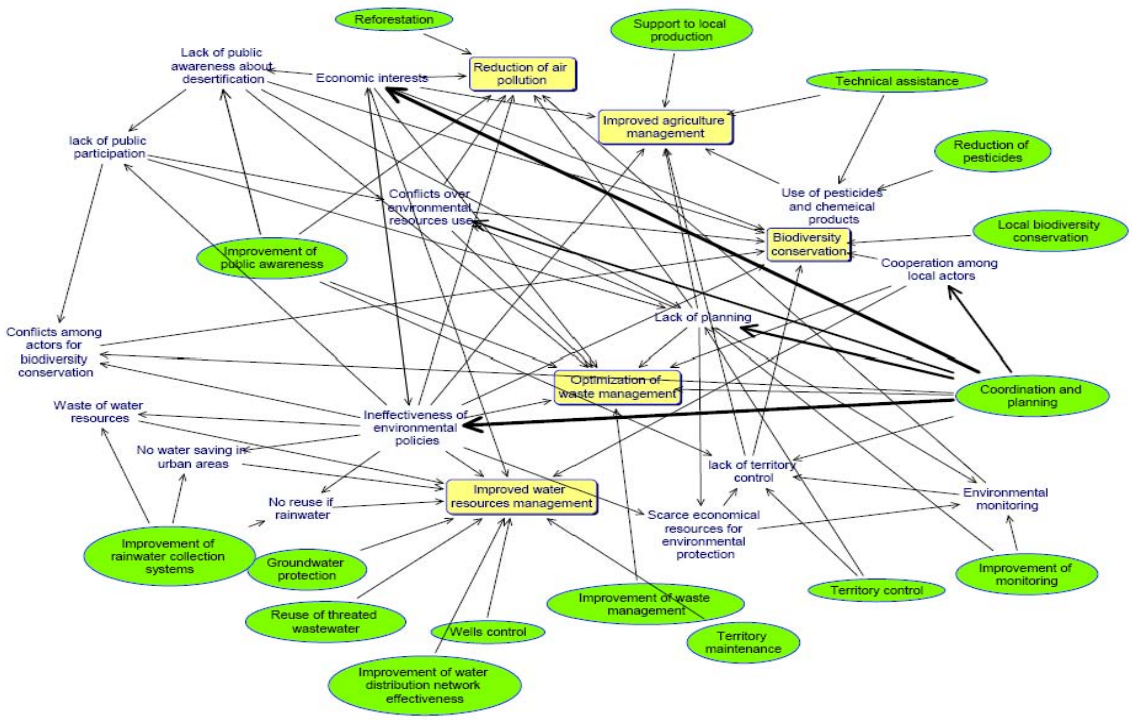

Fig. 9 CM with actions and expected impacts

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The impact of an action on the main elements of the FCM was analyzed by comparing the state of the variables without action (the action value is 0 in the initial state vectors) and the system state after action implementation (the action value is changed to 1 to simulate its effects). The comparison between the system states is done taking into account the stable states, that is the state achieved by the system at the end of the simulation processes.

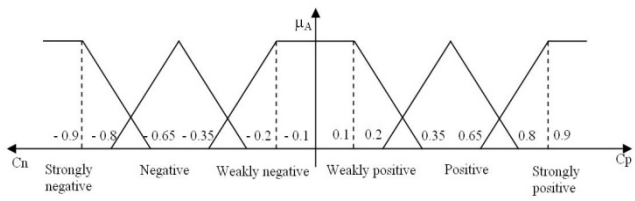

Fig. 11 Fuzzy function to describe the degree of change due to the actions

The degree of change for each element in the FCM due to the implementation of the action was assessed using the fuzzy linguistic variable shown in Figure 11.

Where C_n represents negative changes due to the action. A negative change can occur either when a negative element increases or when a positive element decreases. C_p represents positive impacts.

The degree of change was normalized to 1 as a ratio between the change of the i-th element due to the action a, and the maximum change due to the same action.

In order to rank the different alternatives, a score was assessed considering the impacts of each action on the selected objectives and obstacles. The score was assessed according to the following formula:

$$S_{Xi} = \frac{\sum_j P_j(Xi) \times Wj}{P_j \max \times Wj} \qquad (2)$$

In which, $P_j(X_i)$ represents the effects of the action X_i on the objective j according to the FCM simulation; W_j represents the importance degree of the j-the objective.

At the end of the ranking phase, the most effective actions to combat drought and desertification according to the stakeholders' understanding are:

– improving coordination among actors;
– public awareness;
– technical assistance to farmers.

IV. Discussion

The analysis of the experiences carried out in the case study allowed us to identify some important benefits of proposed approach.

For what concerns the Stakeholders Analysis approach, the usefulness consisted in the identification of groups which interest on desertification management in the chosen territory to involve in decision making process. This allowed to understand that where public participation and stakeholders' involvement are useful and appropriate, they provided feedback and direction for the development of public participation strategy.

Besides, stakeholder analysis assisted the identification of potential areas of conflict among groups and suggested measures to avoid these conflicts for better action effectiveness.

For what concerns the Cognitive Mapping approach, the main benefits are related to the two main phases, i.e. the divergent thinking phase and the convergent thinking phase. The former refers to the CM development phase. During this phase the main issues to be addressed were disclosed, different views were encouraged and proposed, alternatives to cope with desertification were generated, objectives to be achieved were defined.

The convergent thinking phase refers to the assessment of actions' impacts. During this phase, the performances of alternatives on the objectives were measured, allowing us to rank the alternatives according to the interests and the points of view of all involved stakeholders. This, in turn, could lead to a reduction of the conflict level due to the implementation of the desertification mitigation measures.

V. Conclusions

The experiences done in the case study allowed us to draw some conclusions concerning the effectiveness of stakeholders involvement to support drought and desertification management. The analysis of the lessons learned highlighted both benefits and weakness of the adopted approaches.

For what concerns the main benefits, both Stakeholder Analysis and Cognitive Mapping showed their ability to make explicit the existence of different perceptions of a drought and desertification. During the whole process, participants became aware about the interests and concerns of the other on desertification phenomenon. Moreover, the results of the stakeholder analysis allowed participants to learn more about the role and the importance of the other actors in environmental management. This could lead to facilitate the development of an interaction network between stakeholders interested in desertification management and, in turn, it could increase the effectiveness of management strategies.

The main weakness concerns the difficulties in achieving a satisfactory level of participations in all phases of the stakeholders' involvement process. Particularly, the level of participation has been quite low in the last phase, concerning the definition of the actions.

This was mainly because of the low confidence of participants towards the real willingness of political decision-makers to implement the actions selected during the process. The main causes is the current socio-political context in the study area

References

1. Commission of the European Communities (2006) Communication from the commission to the council, the european parliament, the european economic and social committee and the committee of the regions thematic strategy for soil protection, Brussels, 2006.
2. National Committee to Combat Drought and Desertification (2000) Desertification, climate change, biodiversity and forest: synergies for an inter-regional agenda between northern and southern mediterranean countries, Proceedings of the workshop, Rome, 2000 pp 33-65.
3. Goodpaster K E (1991) Business Ethics and stakeholder analysis, in Business Ethics Quarterly, Vol. 1, n. 1, pp. 53-73.
4. Freeman R. E (1984) Strategic Management: A stakeholder approach. Boston: Pitman. ISBN 0273019139
5. Goodpaster K E (1989) Pascal: a framework for conscientious decision-making. Harvard Business School Publishing Division, Cambridge.
6. Bisio L (2005) Bilancio sociale: strumenti e modalità di individuazione e coinvolgimento degli stakeholder. ISBN 0273019139
7. Bobbio L (2004) Amministrazioni pubbliche, imprese, associazioni e cittadini nei processi decisionali inclusivi, edizioni scientifiche italiane, Naples.
8. Freeman R E, Rusconi G, Dorigatti M (2007) Teoria degli stakeholder, Franco Angeli, Rome.
9. Celata F (2005) Pianificazione collaborativa, governance e partecipazione. Department of geo-economic statistics historical linguistic analysis for regional, University "La Sapienza", n. 32; Rome.

10. Eden C (2004) Analyzing cognitive maps to help structure issues and problems. European Journal of Operational Research 159: 673-686.

11. Eden C, Ackermann F (2001) SODA – The principles. In: Rosenhead J, Mingers J (eds) Rational Analysis for a Problematic World. John Wiley and Sons, Chichester, UK.

12. Viviani M (2006) Il coinvolgimento degli stakeholder nelle organizzazioni socialmente responsabili, Maggioli Editore, Rimini.

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