Formal analysis of the Conflictive Play of Actors regarding the building of a dam

Abstract. French people were astonished to learn of the death of an opponent to the construction of a dam in the Sivens forest , in the Tarn (France), during clashes with the police on the night of 25 to 26 October 2014. However, the violence of the means deployed to realize this work and the determination of opponents, woven in the play of all the actors of this project, foreshadowed the possibility of this exceptional drama. Using a formal analysis framework based on the sociology of organized action, we present a model of this interaction system whose simulation results highlight the overdetermined nature of the emergence of a conflict of extreme intensity. Variations in this model then make it possible to identify the main determinants of this conflict and to consider another possible futures.

Keywords. social simulation, play of actors, use conflict, governance, natural resource.

Introduction

The project of a dam in the forest of Sivens, initiated by the General Council of Tarn in 2007, consisted in making a water reservoir of 1.5 million m^3 on the course of Tescou, a tributary of the Tarn in the Garonne basin, mainly for irrigation of agricultural land (up to 70%) and support for low water (30%), for a cost of € 8.4 million. This project provoked a strong protest, motivated by the disappearance of 18 hectares of a wetland recognized as "major importance of the department from the point of view of biodiversity" (GéoDiag and Ecogéa, 2007, SCOP Sagne, 2010), while, oversized, it was not a "suitable solution" (Forray et al., 2014, 2015).

This opposition manifested itself in two different ways: by the constitution in June 2012 of a Collective which acquired a strong expertise on all the aspects of the project and tried, without success, to make recognize its insufficiencies by the decision makers and the courts ; and by the occupation of the site by "Zadistes[1]", to prevent in 2013 the carrying out of the preparatory works (tracking, collection of protected species, ...) and in 2014 deforestation works. The deforestation took place from 1 to 20 September 2014. During this period, the occupiers tried to prevent deforestation (settling in the trees, burrowing on the path of the machines ...) but the support of law enforcement forces allowed the loggers to complete their work. Just before the starting of the concreting of the embankment on Monday, October 27, a coordination of opponents organizes the 25 a meeting in which several thousand people participate.

On the night of 25 to 26 October 2014, an opponent of the project, Rémi Fraisse, was killed by an offensive grenade during clashes between anti-riot forces and a group of opponents. This event raised a lot of emotion in the whole country (the two previous ones go back to 1986 and 1977) and led to the abandonment of the project without the passions subsiding on the ground.

The violence continued until the expulsion of the site on March 6, 2015, when the General Council of the Tarn acknowledged "the impossibility of continuing any activity related to the progress of the work" while deciding a new project of "water reservoir for agriculture, resized

[1] Name given to people who occupy a Zone A Défendre (Area to Be Defended).

according to the location of the site". The following summer was an opportunity for some to show the existence of water resources and for others the deplorable state of the cultures. Access to the site still banned at the end of 2015 will be monitored until the end of 2016. The "transaction protocol" between the State and the General Council of Tarn, prior to the development of a new project, will be concluded on December 11, 2015[2]. The cancellation by the Administrative Court of all the decrees regarding to the construction of the dam will give right to the opponents on June 30, 2016. The initial project being definitively sold out, the site of the wetland was rehabilitated (October 2017) and the Prefect initiated on 14 November 2016 the elaboration of the territorial project (see note 15) (still in progress at the end of 2017).

How could we get here?
In the press and elsewhere, many people have testified (Camille, 2014, Anonymous, 2015), sought to understand what may have happened (Foissac, 2015) or analyzed the dysfunctions in the management of this project (Souchay and Laimé , 2015; Lefetey, 2015), the Parliament and the League of Human Rights have undertaken inquiry commissions... On the Google search engine, the word "Sivens" gives 517 000 results (June 1, 2015).
As a matter of fact, in September 2014, several voices launched alerts: the disproportion of resources deployed on the site by the police and the violence of the confrontation are likely to cause a serious accident (Foissac, 2015; Bès et al., 2015). These warnings lead us to believe that Rémi Fraisse's death is not a fortuitous event but the unfortunately predictable result of the logic of the stakeholders involved in this project (Grossetti, 2004): in this process initiated in 2007, the behavior of each one led, in September 2014, the conflict to a level of intensity that allowed to warm of the possibility of a tragedy.

This article proposes an analysis of the conditions of the occurrence, in fact the production, of such a level of conflict by modeling the actors' representations and strategies which determined the behaviors that they adopted one vis-à-vis -vis others and led to the drama. By model, we mean a quantified description of the system consisting of the actors, their means of action and their mutual dependencies. Such a model is obviously reductive, this is the price to pay to make intelligible the complexity of the interactions between the actors, but the simplification entailed by this reduction does not prevent to account faithfully the essential features of the game among the actors. Such a model escapes the subjectivity of natural language and can serve as a support for the confrontation between divergent analyzes of events: if we agree on the semantics of the model, that is on the interpretation of value scales of numerical variables, the points of disagreement will be clearly established as disputes over certain elements of the model. Finally, by calculating analytical properties and performing simulations, such a model produces results likely to highlight certain characteristics of the system's structure and the main determinants of its configuration (Axelrod, 1997, Gilbert, 2004).
In the second section of this article, we present the analysis framework and the tools we use to develop and study our model. In the next two sections, we present the model itself: the identification of the actors and their means of action and then the quantification of their mutual dependencies. We then highlight some structural properties of the model, and the simulation results show the inevitability of a maximum level of confrontations. Finally, we

[2] Announced by the Ministry for environment and sustainable development on February 27, 2015, this protocol stipulates that (1) the General Council renounces this project, (2) does not attack the State for the cancellation of the decree authorizing the works, and (3) the State compensates the General Council for € 3.3 million.

consider changes in the strategy of the actors that lead to a model in which the level of conflict remains circumscribed, and thus highlight *a contrario* its main determinants. In conclusion, we note the paradigmatic nature of the Sivens dam project and synthesize the modeling approach.

The SocLab model of a system of organized action

Organized action system (OAS) is understood to mean a set of actors who interact in a more or less well defined organizational context (a company, an association, a political system, etc.) or in a more diffuse way around a concern of which they are stakeholders. The SocLab approach for the modeling and study of OAS is based on the sociology of organized action developed by M. Crozier and E. Friedberg (Crozier, 1963, Crozier and Friedberg, 1977); a detailed presentation can be found in (Sibertin-Blanc et al., 2013).

The SocLab software allows you to study an OAS by defining its constituent elements (its structure) and calculating indicators on structural features of the action system and on potential behaviors of actors, by exploring its state space (what everyone could do *in abstracto*) and carrying out simulations that indicate how the actors are likely to behave in practice.

The structure of an OAS consists of:

• a set of *actors*, individuals or collectives who each have means of action relating to the concern of the system;

• a set of relationships (or *relations*) that support interactions between actors.

Each relationship is *controlled* by an actor and each actor *depends* on a number of relationships for the achievement of his goals.

A relation is based on a (or a set of) resource(s) that is regulated by the actor who controls it; this control gives it a means of action and therefore a certain margin of maneuver in the management of this resource, and the behavior adopted by this actor with regard to this resource is modeled by the *state* of the relation. This state will be more or less beneficial for each of the actors who depend on it and it is evaluated on a scale of value from -10 (overall very penalizing) to 10 (overall very favorable) which characterizes its level of cooperation vis-à-vis all other actors in the system.

The *stake* an actor places on a relation depend on the importance of the underlying resource for achieving its objectives: the more a resource is needed to achieve an important objective, the more the actor will have a high stake on the associated relation. The stakes are quantified on a scale from 0 (zero) to 10 (crucial) and the sum of the stakes of each stakeholder is normalized to 10.

The *effect* of a relation on an actor is a function that determines to what extent, depending on the state of the relation, the relation impairs or facilitates the achievement of the actor's goals, whether it is the possibility of access to this resource according to his needs, hindrance or contribution to the achievement of his objectives. The effect on an actor of a relation according to its state models, on a scale ranging from -10 (worst) to 10 (optimal), the contribution of this relation to the realization of the actor's objectives.

Finally, an actor can maintain certain *solidarities*, personal or organizational, with other actors. This is reflected in the consideration of those other actors in the assessment of his own situation. Solidarities are expressed on a scale ranging from -1 (complete hostility) to 1 (complete adhesion).

We call *configuration* of an OAS the vector of the behavior of each of the actors, that is of the state of each of the relations. A configuration provides each actor with a certain *satisfaction* that assesses the extent to which its objectives are achieved, or at least made accessible, due to

the behavior of all the actors. When an actor has solidarity only with himself, his satisfaction in a configuration $s = (s_r)_{r \in R}$ of the OAS is expressed in the form:

$$satisfaction(a, s) = \Sigma_{r \in R}\ stake(a, r) * effect_r(a, s_r)$$

where R is the set of relations, *stake(a, r)* the stake of actor a on the relation r, and $effect_r(a, s_r)$ is the effect on a of the relation r being in the state s_r. The value of the satisfaction of an actor is thus in the interval [-100, +100].

In the general case, the satisfaction of an actor has the form:

$$satisfaction(a, s) = \Sigma_{b \in A}\ solidarity(a, b) * \Sigma_{r \in R}\ stake(b, r) * effect_r(b, s_r)$$

where A is the set of actors and *solidarity(a, b)* the solidarity of a for the actor b.

In a dual way, we can quantify the power exercised by an actor in a given configuration as the sum of his contributions, through the relations he controls, to the satisfaction of other actors, in the form:

$$power(a, s) = \Sigma_{r \in R;\ a\ controls\ r}\ \Sigma_{c \in A}\ \Sigma_{b \in A}\ solidarity(c, b) * stake(b, r) * effect_r(b, s_r).$$

The scales of quantification used for the stakes, the state of relations and their effects are obviously arbitrary, but that does not have any consequence. Indeed, as far as the satisfactions and powers of the actors are concerned, the values themselves are not significant: only the comparisons and the percentages (*ie* the values in proportion) are likely to be interpreted in the terms of the modeled system. This interpretation requires that each value of the state of a relation (in the interval [-10, 10]) be characterized by a concrete behavior of the actor who controls this relation.

The structure of the model of an OAS makes it possible to carry out calculations which highlight some of its properties, we will give some examples.

In addition, this structure defines the rules of a game among the actors in which they exchange their behaviors through the effect of the relations they control: when an actor modifies the state of relations he control, it increases or decreases (depending on the shape of the effect functions) their contribution to the satisfaction of the actors who depend on it. According to a hypothesis of rationality of the actors, each one tries to achieve its objectives as best as possible, which amounts to obtaining the highest possible satisfaction. Everyone will therefore test different behaviors, in order to find one that encourages others to give him a good level of satisfaction, until an equilibrium configuration is reached in which no one sees how he could increase his satisfaction. This game therefore gives rise to a collective learning to find how everyone must behave in order to better achieve his objectives, that is to say, a joint search for a configuration of the game that provides everyone with a level of satisfaction that suits him.

This social game differs from games considered in economics in that the objective of the game is not the maximization of actors' satisfactions, but to reach a quasi-stationary state. In such a configuration of the game, each one has obtained a satisfaction which he judges acceptable and so does not seek any more to modify the state of the relations which he controls. The behavior of the actors equilibrates each other and the system of action can function durably in this way, it is in a regulated configuration. The SocLab software includes an algorithm for the simulation of this collective learning. Assuming the bounded rationality of actors (Simon, 82), he calculates sustainable, socially plausible configurations. Its main properties are described in (Sibertin-Blanc and El Gemayel, 2013).

The model of the Sivens dam OAS that we present here is based on feedback from participants in this system that we interviewed in the spring and fall of 2015, quantitative data being recorded with the interview form given in the appendix. We will argue this model with the elements that we think are most significant, as the entire Sivens dam project is very well documented.

The actors of the model

Let's start by identifying the actors involved in the construction of the Sivens dam, we will then study the quantification of their mutual dependencies. Over the period 2007-2015, the system of action around the dam project has evolved, because of the succession of the holders of the Ministry of Ecology but also, endogenously, because of the evolution of the representation of actors. The model that we present here corresponds to the situation that, from the re-investment of the site by the Zadists on August 15, 2014, prevailed at the time of the tragedy.

Some elements of the national and regional context in which this dam project takes place shed light on the actors' motivations. Faced with the virulence of opposition to the construction of a new airport[3] and although all authorizations were granted, the State decided in May 2014 to suspend all operations in progress until the exhaustion of the lawsuits filed by the opponents. It is on this occasion that appeared the notion of ZAD ("Zone of Deferred Development" instituted in "Zone To be Defended") against "Large Imposed and Useless Projects", emergent movement of the contestation of big development projects in which the occupants of Sivens took place. In the course of 2014, other projects challenging the legitimacy of policies experienced the same vicissitudes (Subra, 2014).

In application of the European Community Water Framework Directive (WFD, 2000), the French Water and Aquatic Environments Act (LEMA, 2006) introduced new rules for the calculation of abstraction volumes available for irrigation with a new organization of their distribution between farms. The Adour-Garonne basin annually has a structural deficit of about 250 million m3 (Mercailloux, 2014), while agriculture represents 11% of jobs in the Tarn department and 7.1% in the Tarn-and-Garonne. In the Adour-Garonne basin, the introduction of these new regulation gave rise to a very hard conflict between the agricultural profession and public authorities, which led to arrangements between the State and the regional Chambers of Agriculture, totally contradictory with the new regulation (Souchay, 2015, Chamber of Agriculture Tarn-et-Garonne, 2011).

The report of the Court of Auditors (2015) concerning the Water Agencies recommends more transparency and selectivity in the awarding of grants and to "put in place a mechanism for preventing conflicts of interest for members of the authorities of Water Agencies and their staff ". For example, the same people sit on the General Councils, the Adour-Garonne Water Agency and the CACG. Even if, in this case, no individual fault has been identified, this logic of cross-legitimization hampers the listening of divergent points of view (Lefetey 2015).

The system of action around the project to build a dam in the forest of Sivens involves a large number of actors, both because of the institutional complexity of a highly administered country like France and of the diversity of modes of expression of "civil society". The analysis of the interests, stakes, impct of their actions on the others and strategies of these actors makes it possible to note convergences which allow the grouping of several actors of the field into a single actor of the model. This results in a simplification of the game that does not necessarily distort it and improves its understanding.

None of the actors we have identified is a homogeneous entity; each constitutes in itself a system of action, with its internal conflicts and contradictions, which could be analyzed. What justifies the groupings that we have made are the dependencies of each actor and the effects of his behavior on others. More precisely, consider the network whose nodes are the entities involved in the game and having an arc, either positive or negative, from an entity A towards a entity B according to the nature of the impact of the behavior of A on B. The quantification

[3] The Notre-Dame-des-Landes airport project, which dates back to the 1970s, was finally abandoned in January 2018.

of the model will show that the five actors in our model correspond to clusters that maximize the positive arcs within each group and the negative arcs between groups.
The model we present focuses on the occurrence of the fatal accident resulting from the clash between some opponents of the dam and the police. Organized around these two actors in the field, this model comprises five actors: the State (the regulator), the General Council of the Tarn department (CG, the project owner), the Company of Development of Coteaux de Gascogne (CACG, the project supervisor), the Testet Collective (legalist opponent) and the Zadists (activist opponent). Each actor controls a single relationship that is based on the means of action or resources he controls.

The State
By State, we mean the ministers who have directly intervened in the game: the Minister of Ecology and Sustainable Development – in this case D. Batho (until June 2013) and then P. Martin, S. Royal appointed in May 2014 only concerned late in the matter – and the Minister of the Interior, supported by the Minister of Agriculture and the Prime Minister. We also mean the Departmental Director of Public Security and the police forces over which he has authority. The Prefect of Tarn (Josiane Chevalier until August 30, 2014 then Thierry Gentilhomme) is the local representative of the State.
What are the means of action of the State? On the one hand the granting of authorizations necessary for the realization of the dam and on the other hand the commitment of the police to protect the realization of the works. If these means of action are of very different natures, they have been put into play by the State in convergent ways with similar effects on the other actors, so that their dissociation would unnecessarily complicate the model. The State actor therefore controls a single relation, *support*, whose negative values correspond to a strict control of the legality and relevance of the project undertaken by the CG and a certain tolerance with regard to the occupation of the zone of works by the Zadists, and positive values to the reverse behaviors.
CG: the Council of Tarn department, local authorities and pro-dam farmers
The *Council of Tarn department* is the leader of the pro-dam coalition: project owner of the project initiated in 2007 and definitively adopted by the department's permanent commission in May 2013, it finances it by 10%, just like the council of Tarn-et-Garonne department. This project dated back to 1978, was reactivated by a new CACG report (2001) indicating a need for 1.5 Mm3 of water and made possible by the acquisition of the Sivens Forest (1976) and two adjacent farms (in 1997 and then in 2002). The *Council of Tarn-et-Garonne*, where are located the main beneficiaries of the project for the profitable cultivation of corn seed, is also very attached to the realization of the dam, in accordance with its support to the productive agriculture. It is the same for most local politicians such as the *Mayor of Lisle sur Tarn* (newly elected in 2014), town on which the dam is to be built, the *deputy* or the *Association of mayors and elected in Tarn*. The National Federation of Farmers' Unions (*FNSEA*) and its authority in the Tarn (*FDSEA*), as well as *Young Farmers* and *Rural Coordination*, are agricultural professional unions that enlist and mobilize farmers (Callon 1986) to demand the construction of dams (Mercailloux, 2014), just like the *Tarn Chamber of Agriculture* where they are the majority. The policy implemented by the GC is (consistent with) the one they wish to be adopted. Finally, this coalition is supported by the *Avet* (Water Life Tescou Association, http://www.testet-sivens.com) which has aroused, on the occasion of the construction of the dam, the constitution of a real militia of people who do not support the presence and way of life of the Zadists.
The means of action of the Council of Tarn are the communication in the press and with the population to justify the project, and the establishment of the administrative acts necessary for the realization of the works, in particular the work orders for the project supervisor, the

CACG. The means of action of agricultural unions are the support (protests, press, leaflets ...), at the national and local levels, against the construction of the dam, occasionally accompanied by the Avet. Avet's means are commando operations and intimidation in situ. These various means of action have been activated jointly in the same direction, which allows us to gather them in a single relation, *commitment*. Its positive values correspond to the implementation of these means for the construction of the dam and against the opponents, its negative values to the refusal of the dam.

The Coteaux de Gascogne Development Company (CACG)

The CACG has been the delegated developer of the project since 2009 and is the very likely manager of the future dam, but here, we consider it as the project supervisor of its construction. The CACG is a mixed economy company with 200 employees dedicated to "the land design, equipment and economic development of the Midi-Pyrénées and Aquitaine regions" whose mission is, among others, the control of water. It is the only major operator of this type in Midi-Pyrénées. The CACG has been interested in making this water reservoir since 1983 (Lefetey, 2015). It was the CACG which, after a preliminary draft in 1989, drew up the 2001 report that led to the adoption of the dam project and did not examine the other alternatives. Costs and oversizing were identified by experts appointed by S. Royal (Forray et al., 2014, 2015). This report served as a basis for further administrative documents, notably the master plan of water development and management (SDAGE), that allowed financing the dam project by the Adour-Garonne Water. This report will not be accessible during the public utility investigation which ended in November 2012.

The action of the CACG is carried out by the *construction* of the dam, whose positive values correspond to its determination to build it.

The Testet Collective

This actor brings together the "*Collective for the safeguarding of the Testet wetland*" (http://www.collectif-testet.org/) and the numerous local and national associations which mobilized with him to challenge the legality as well as the relevance and the cost of this dam, or to criticize the way its construction was conducted. The *Confédération Paysanne* agricultural union went in the same direction, as well as the online newspaper *Reporterre* (http://www.reporterre.net) which closely followed the entire project. The Collective has a very strong expertise on all aspects of the file. The competent agencies, namely the *CNPN* (National Council for the Protection of Nature), the *CDPNE* (Departmental Committee for Nature and Environment Protection) and the *ONEMA* (National Office for Water and Aquatic Environments), concluded in the same way as the Collective. It turns out that the State can override their opinions, so that these instances do intervene in the game only by the echo that the Collective gives to their opinions.

The Collective's means of action is to make this proficiency recognized by the authorities concerned, the courts and the public. The positive values of the *expertise* relation it controls correspond to an important activity for that.

The Zadists

While the Collective embodies the legalistic – even co-managerial – modality of the militant protest, the Zadists embody the activist modality by the concrete occupation of the field. We group under this term all the people who have participated in one way or another in the occupation of site of the construction of the dam, accompanying those who instituted it in Zone A Defendre (Area To be Defended) (https: //tantquilyauradesbouilles.wordpress.com) from autumn 2013: participants at meetings organized on site, hosted occasionally or living in the area, coming from afar or nearby residents bringing material and food necessary for daily life on this isolated site.

Their motivations are diverse, polarized towards ecology or towards the challenge of "big useless imposed projects", they are defenders of biodiversity, anticapitalists, anarchists,

antispecists, vegans ... (Truong, 2014). As a result, they have involvments (search for a way of life free of constraints, egalitarian and autonomous, pacifists, rejection of the barrage, hostility to the police force) and behaviors (physical commitment by biding to the top of trees or by burying themselves on the passage of the machines, clowneries, exactions, confrontation with the forces of the order) extremely differentiated. But any decomposition of the community of occupants into autonomous actors would be more or less arbitrary and we will only consider here the emergent effect of these behaviors.
This actor controls the *occupation* relation, whose positive values correspond to the deployment of strong obstacles to the progress of the work.

Other actors

There are other stakeholders involved in the dam project which, for a variety of reasons, do not appear among the actors in the model.
The Adour-Garonne Water Agency: it is an essential partner of the project, since it finances 52% of it. AEAG's policy is to finance the works recommended by the SDAGE, which it decided on November 4, 2013 concerning the Sivens dam, after the Minister of Ecology P. Martin removed the restrictions on the financing of this type of work put by his predecessor D. Batho. In 2014, the Water Agency no longer has to intervene in the progress of the project and there is no reason to consider it as an actor of our model. Following the tragedy, AEAG's policy was to stand aside from the conflicts to preserve its legitimacy in the development of the forthcoming "Territory Project".
The European Union: The dam was to be financed by 24% by the EU, via the European Agricultural Fund for Regional Development. But as early as November 2013, the EU asked Paris for an explanation of this project, then warmed in July 2014 of the possibility of an infringement procedure to the Water Framework Directive. As the State has ignored these warnings, the EU will intervene as an actor only after the triggering of this procedure on November 26, which notifies the impossibility for the EU to finance this dam.
The Testet Collective won its case in 2016 for all the annulment actions it filed in 2013 and 2014. On the other hand, he lost all the suspension summonses before the *Administrative Court* and the *High Court*, with even a condemnation with the expenses of justice. Technically, it appears that during the period we are considering, the court has aligned itself with the prefecture and has therefore not behaved as an autonomous actor.
The neighbors: the pro-dams are grouped with the CG, the anti- divided between the Collective and the Zadists.
The media: Essentially, the national newspapers did not consider the subject until the death of R. Fraisse and thus did not intervene in the system of action that we consider here. At the local level, major media have not engaged to the point of having an impact on the evolution of the project. The main newspaper in the region is *La Dépêche du Midi* whose boss is Chairman of the Tarn-et-Garonne Council (since 1985) and the Radical Left Party (since 1996). Implicitly favorable to the dam, it factually reported events since the beginning of the project, but without analyzing the project on its merits. The same is true of the main local TV channel, *FR3*, which, however, gave more voice to the various parties. The *free Tarn* newspaper reported the project closely, with more analysis on the merits.

Actors of the model	Actors in the field	Controled relations
State	concerned Ministers, police forces, Prefect	**support**
CG	Tarn and Tarn-et-Garonne Councils, local politicians, agricultural community, Avet association	**commitment**
CACG	The Coteaux de Gascogne Development Company	**construction**

T_Collective	Testet collective, the environmentalist movement (associations, union, green political party), environmental agencies	**expertise**
Zadists	Visitors and occupants of the site	**occupation**

Table 1 : *The actors of the model, groups of actors in the field.*

Quantification of the model

Our model therefore consists of five actors who each controls one relation (Table 1). Quantification of dependencies (stakes and effect functions) of each actor on relations is established from the data collected during interviews with participants, using the form given in the appendix. We argue the values of stakes and effect functions presented in Table 2, without justifying them in detail for lack of space.

The State

The State puts only 2 points of stakes on the relation it controls, *support*, because it is sufficiently established to depend only little of its own behavior. The form of his own effect function shows that what suits him best is to exercise his power but without excess (the maximum is reached for a cooperativity of 4 on a scale [-10, 10]). Not taking into account the unfavorable opinions of the environmental agencies, the State gives little importance to the expertise (1), and it takes more account of the occupation of the site (2) of which it must control the possible excesses. The sum of the stakes of the State is only 5 because it has, in addition, a solidarity of 0.5 with the CG according to the free administration of territorial entities. This very strong support for the CG is due to the proximity of the Minister P. Martin (notably President of the Council of Gers, headquarters of the CACG) with the supervisor of the project and the commitment of the prefect in favor of the dam. The State depends on relations *commitment* and *construction* only through his solidarity with the GC.

The CG

The retrospective analysis conducted by Foissac (2015) provides worthy insights into the behavior of T. Carcenac, Chairman of the Tarn Council. The CG relies on the State (2) whose authorizations are essential for the realization of the project. With his democratic legitimacy, the CG is very determined that the dam project, voted by 43 out of 46 councilors, be completed (3), even at the expense of its wetland preservation policy and its charter of citizenship (Foissac, 2015). It is equally important that the CACG makes every effort to build the dam (3). He gives little importance to the expertise (0.5: he does not acknowledge the meeting requests from the Collective) and values it negatively since it calls into question the project. As for the occupation of the site, it obviously contravenes its objectives and arouses sometimes violent hostility on the part of the Avet.

The CACG

The CACG relies on the State to protect access to the site (0.5), but above all on the commitment of the GC (2.5). Privately owned company whose turnover fell by 10% between 2012 and 2013, the realization of this dam is for him essential (4). He takes no account of the expertise and is very bothered by the occupation of the site (3).

The Testet Collective

Although the Declarations of Public Utility and General Interest and other authorizations were signed (October 2013), the Collective still relies on the State for suspension summonses (1.5). He no longer hopes to be heard by GC (0.5) and is very worried by deforestation, which is gradually destroying the wetland (2.5). His own expertise is essential for the Collective (3) because it bases his existence and legitimates his opposition to the project. Even if the Collectif wishes to stand out from the Zadists, especially its excesses, the occupation of the site remains his only recourse (2.5) against the "state of necessity" established by the start of work.

The Zadists

The intervention of the police reinforces the action of the Zadists by advertising (2.5), to a certain extent beyond which they can no longer prevent the progress of work. Beyond a certain level, the actions of the militias actually degrade their living conditions (1). They attach less importance to the construction of the dam (1,5) than to their emblematic fight against the State (Bès et al., 2015). Even if the Zadists give limited credit to the legalistic strategy of the Testet Collective, his expertise justifies their action and is indispensable to them (1), as long as he does not occupy the first place. For them, occupying the ZAD is essential (4): this is what bases their identity. Some people are aware that an excessive influx of occupants prevents the establishment of a common culture, and therefore compromises the effectiveness of the action, especially as the site's resources are limited. Others, less politicized or less experienced, value the confrontation in itself and, for example, do not resist the provocations of the police. The effect of occupation on Zadists is the result of these two trends.

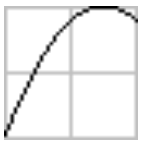
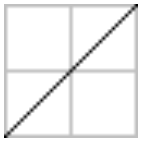
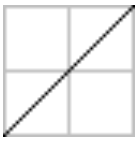
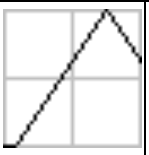
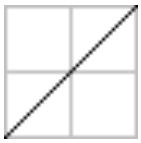
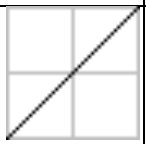
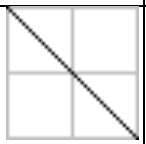
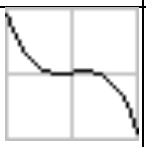
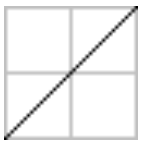
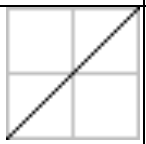
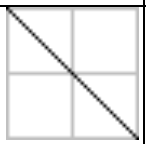
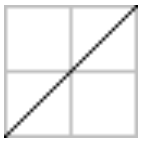
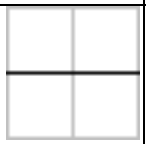
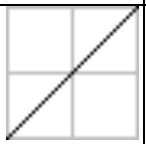
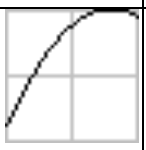
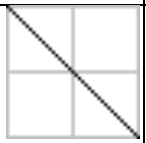
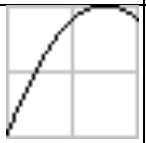
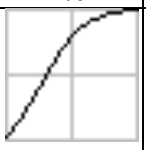
	State	CG	CACG	T_collect.	Zadists	Relevance
support	 **2.0**	 2.0	 0.5	 1.5	 2.5	**9,5**
commitment	 0.0	 **3.0**	 2.5	 0.5	 1.0	**8,5**
construction	 0.0	 3.0	 **4.0**	 2.5	 1.5	**12,5**
expertise	 1.0	 0.5	 0.0	 **3.0**	 1.0	**5,75**
occupation	 2.0	 1.5	 3.0	 2.5	 **4.0**	**13,75**

Table 2. *Matrix of dependencies, effect function and stake, of actors (in columns) on relations (in rows).*

On the diagonal, the dependence of the actor on the relation he controls.

For effect functions, the abscissa corresponds to the behavior of the actor controlling the relation (from non-cooperative to left to cooperative on the right), the ordinate to the resulting satisfaction of his objectives for the dependent actor.

The last column "Relevance" indicates the sum of the stakes placed on each relation.

Each actor has a solidarity of 1 towards himself, the State has also a solidarity of 0.5 for CG.

Model Analysis

The death of an opponent of the project during clashes with anti-riot police is an event whose possibility increases with the importance of State's support (support → 10) and the vigorous occupation of the area (occupation → 10). These are the two relations that we will consider with the greatest attention.

Structural Analysis

The structural analysis of a model makes it possible to highlight some structural properties and the range of possibilities. Table 3 shows the most satisfactory configurations for each of the actors, and the most global satisfactory and unsatisfactory (i.e. summing the satisfaction of the actors). It appears that everyone would have the opportunity to achieve his goals (satisfaction between 90.4 and 100) ... as long as others agree.

Regarding conflicts, the comparison of the columns of this Table shows that (1) the main conflict is between the State, the CG and the CACG on the one hand and the Collective and the Zadists on the other hand (the maximum satisfactions of the ones corresponds to negative satisfactions of the others, the maximum and minimum global satisfaction clearly distinguish the two groups); (2) the interests of the State are the most convergent with the general interest (its maximum is the closest to the global one) – not surprising to these, the opposite would call into question the validity of the model – and (3) the Collective is in particular in conflict with the GC and the Zadists with the CACG. This last result is not trivial, it can not be easily deduced from the data in Table 2, and draws attention to a significant fact: the direct opposition on the ground lies between the Zadists and the CACG, and that on the legality and relevance of the project between the Testet collective and the GC.

		Satisfactions						
		maximum						***minimum***
		GLOBAL	**State**	**CG**	**CACG**	**T_collect.**	**Zadists**	**GLOBAL**
State of relations	**support**	5.0	8.0	10.0	-10.0	-10.0	5.0	-10.0
	commitment	10.0	10.0	10.0	10.0	-10.0	-10.0	-10.0
	construction	10.0	10.0	10.0	10.0	-10.0	-10.0	-10.0
	expertise	10.0	10.0	-10.0	-10.0	10.0	6.0	-10.0
	occupation	-3.0	-10.0	-10.0	-10.0	5.0	10.0	10.0
Satisfaction of actors	**State**	77.3	**90.4**	74.6	19.6	-72.8	-27.0	-93.4
	CG	73.1	85.5	**99.5**	59.5	-96.4	-67.5	-89.5
	CACG	79.0	100.0	100.0	**100.0**	-85.0	-100.0	-100.0
	T_collective	3.5	-36.2	-99.2	-69.2	**100.0**	60.0	34.5
	Zadists	15.9	-39.9	-64.1	-95.4	43.3	**97.9**	30.0
	GLOBAL	**248.7**	199.8	110.7	14.5	-110.9	-36.5	**-218.3**

Table 3. In columns, the configurations corresponding to the satisfaction extrema, (e.g., the 2nd column describes the configuration that gives the maximum satisfaction to State, 90.4). In rows, the state of each relation (the higher this value, the more the actor who controls this relation acts energetically) and below, the satisfaction of each actor.

	State		CG		CACG		T_colective		Zadists	
	behavior	**influence**	**behavior**	**influence**	**behavior**	**influence**	**behavior**	**influence**	**behavior**	**influence**
minimum	-10	-59	-10	-61	-10	-45	-10	-40	10	-13
maximum	5	53	10	61	10	45	10	41	-3	49
range		112		122		90		82		61

Table 4. *The range of influence that each actor is able to exercise.*

What is the range of influence that each actor can exercise, that is to say, his ability to contribute to the achievement of the objectives of others and thus influence their behavior?
The relevance of the relations (see Table 2) could lead us to believe that the Zadists and the CACG are the most powerful actors since the relations they control receive the most stakes. It is not so. The configurations of the maximum and minimum global satisfaction (first and last column of Table 3) are also those in which each actor adopts the behavior that maximizes or minimizes the influence he exerts. Table 4 shows these extrema and the amplitude of influence that each actor is able to exercise. The GC benefits from a great range of influence because of the combination of the stakes and the orientation of the effects of his behavior: there are 7 points of stakes on the increasing effect functions of the relation commitment and only 1.5 points on the decreasing effect functions; for the Zadists, the ratio is 6.5 / 7.25 so that the overall effect of their behavior is always divided, what is positive for some being offset by what is negative for the others.
The "best" (the configuration of the global maximum) would be that the State supports moderately (5) and the Zadists do not occupy (-3), thus avoiding the possibility of an accident. But are the losers likely to accept this?
Simulation results
The SocLab simulation algorithm provides an answer to this question by computing configurations in which it is plausible that the actors' game is regulated. Simulations are repeated because the algorithm has a part of randomness (when an actor does not know what behavior to adopt, he chooses it randomly). The simulation results, the details of which can be found at (Sibertin-Blanc, 2016), are therefore amenable to statistical analysis (Villa-Vialaneix et al., 2014); we are interested here only in the average and the dispersion of the variables. The deviation of the state of a relation is an indicator of the margin of maneuver, or indecision, of the actor who controls this relation. Table 5 shows these results.
With regard to the state of relations, the State supports (10) and the Zadists occupy (10) the maximum of their possibilities, the conditions of the occurrence of an accident are therefore met. In addition, the deviation is zero, all simulations lead exactly to the same blocking configuration: the game is overdetermined, no actor sees how it could behave otherwise.

	state of relations	
	average	**deviation**
support	10.0	0.0
commitment	10.0	0.0
construction	10.0	0.0
expertise	10.0	0.0

	satisfaction of actors		*influence of actors*	
	value	**proportion**	**value**	**proportion**
State	37	71 %	37	86 %
CG	61	80 %	61	100 %
CACG	40	70 %	45	100 %
T_collective	5	52 %	41	100 %

occupation	10.0	0.0

Zadists	30	65 %	-13	0 %
GLOBAL	172	84 %	172	84 %

Table 5. *Results of 100 simulations that all give the blocking configuration.*

As regards the satisfaction of actors, the CG appears as the winner and the Testet collective as the loser, the other actors being in an intermediate situation. These results correspond to what should have happened if the game had not been dramatically interrupted by the death of an opponent: the concreting of the dike was to begin on October 27th. Apart from the State, the behaviors adopted by the actors correspond to a Nash equilibrium: each one adopts the behavior which suits him the best, not counting on the others to achieve his objectives. This regulation is all the more stable as it is in line with the interest of the majority – CG, the CACG and the Collective (100% of their influence) – but opposed to that of the Zadists. These results are robust: the simulations of the models obtained by randomly varying each stake of ±1.5 around its value (while keeping to 10 the total stakes of each actor), produce the same configuration.

Models for moderation of State-Zadist conflict

What other representations and strategies of actors would change the structure of the game to the point of moderating the conflict between the State and the Zadists?

On the side of the State, one could expect that his mobilization of the police remains proportionate and that his solidarity with CG under the free administration of territorial entities principle does not exceed his attention to the expertise of agencies. The productivist orientation of Minister Martin and the prefect's personal commitment to the dam led the State to manifest his preference for the construction of the dam.

On the side of the principal concerned, the CG owner, one would expect that he accompanies less the agricultural community and that he values positively the expertise of the Testet collective.

On the side of CACG and Testet collective, their representation is the expression of their raison d'être and they have no reason to change it.

For the Zadists finally, better organized they could have coordinated to better control the excesses of some of them. This can be taken into account in the model by limiting the state of the relation occupation to 7.

The distribution of the stakes of this second model is given in Table 6, the solidarity of the State with CG being reduced to 0.3 and the effect functions remaining the same (see Table 2), with the exception of the function of the relation expertise on the CG whose slope becomes increasing.

	State	CG	CACG	T_collective	Zadists	Relevance
support	**2.0**	2.0	0.5	1.5	2.5	9,1
commitment	0.0	**2.0**	2.5	0.5	1.0	6.6
construction	0.0	2.5	**4.0**	2.5	1.5	11.25
expertise	3.0	2	0.0	**3.0**	1.0	9.6
occupation	2.0	1.5	3.0	2.5	**4.0**	13.45

Table 6. *Matrix of stakes of actors regarding relations in model 2.*

Simulation results of this second model are shown in Table 7. The importance of the deviation (2nd column) of the support relation leads to look at the dispersion of the results. It turns out

that the State balances between two very different behaviors: a third of the simulations give exactly the same blocking configuration as before (in Table 5), except the limitation of the occupation to 7. So we have a chance in three that the conditions of the occurrence of an accident are met. The other simulations, whose average and deviation are indicated in the 3rd and 4th columns, give configurations that we will describe as moderate. In these configurations, if the CG, the CACG and the Testet collective adopt almost the same behaviors as in the previous model, the expected change, a moderation of the support by the State and occupation by the Zadists, is well achieved. This results in a 10% improvement in global satisfaction, for the benefit of the State, the Testet collective and the Zadists (gain of about 15 satisfaction points each). The outcome of the game is much more balanced: the Collective is no longer ridiculed, the State exercises his full power and it is not sure that the dam is built.

	state of relations			
	average	**deviation**	**average**	**deviation**
support	6.6	**3.3**	3.4	0.6
commitment	9.7	0.6	9.5	0.8
construction	9.8	0.5	9.7	0.7
expertise	10	0.1	9.9	0.2
occupation	6.2	1.2	5.4	1.2

	satisfaction of actors		*influence of actors*	
	average	**proportion**	**average**	**proportion**
State	50	77 %	46	99%
CG	58	79 %	36	99%
CACG	48	74 %	32	99%
T_collective	20	60 %	94	100%
Zadists	45	73 %	13	40%
GLOBAL	221	94 %	221	94 %

Table 7. Results of 100 simulations of model 2. The 3rd and 4th columns show the results for simulations that do not produce the Table 5 configuration.
On the right, results concerning the actors in these moderate configurations.

What are the determinants of the possibilities offerded by this model? It is not the change of CG's representation, however the most concerned and powerful actor (cf Table 4): one obtains the blocking configuration even if he grants more stakes to the expertise that to the construction of the dam. Nor is it the ceiling on occupation of the Zadists at 7, which, in all the variants of this model, has just the direct effect of limiting the state of this relation.
It is thus the change of the State's representation which opens an alternative way. This fact is well established insofar as it is not sensitive to a variation of ± 1 of actors' stakes. In this model 2, the State dissociates, more than in the previous model, the exercise of its two functions, the issue of authorizations and the maintenance of order.
For the blocking configuration to be frankly discarded, the State, as a simple regulator, must abandon its solidarity with the GC and attach equal importance to the expertise-authorization and occupation-policing aspects. We then obtain the results of table 8, (Sibertin, 2016) gives details on this model and model 2.

	state of relations	
	average	**deviation**
authorization	- 4.06	2.06
commitment	9.12	1.12
construction	9.78	0.36
expertise	9.91	0.13
occupation	6.32	2.1

	satisfaction of actors		*influence of actors*	
	value	**proportion**	**valeur**	**proportion**
State	43.4	68.5 %	61.4	99.6 %
CG	37.8	68.5 %	24.5	98.5 %
CACG	43.3	71.8 %	24.4	99.0 %
T_collective	22.8	61.9 %	78.3	99.6 %
Zadists	41.0	73.2 %	0.1	27.2 %

policing	5.1	1.2	**GLOBAL**	188.4	87.3%	188	87%

Table 8. *Simulation results of a model that dismesses the posibility of a dramatic accident.*

Some properties are common to the simulation results of each of these models; they are images of characteristics (of our apprehension) of this system of action that deserve to be noted:

- The state of the relations commitment, construction and expertise is close to their maximum value with a small deviation, while the deviation of relations controlled by the State and Zadists is significant. This is due to the focus of our models on the conflict between the State and the Zadists; their representation of the game is more complex and gives them more room for maneuver, while the other three actors are essentially auxiliary to this conflict.
- The Testet collective is the actor who always gets the least satisfaction, although his contribution to the whole (94 in the model 2) can be very high; the legalistic opposition is a thankless role.
- On the other hand, the Zadists still exercise a very weak influence; they have their own way of playing the game, which does not fit with that of the other actors.

Conclusion

In their report submitted on October 27, 2014, and therefore drafted before the occurrence of the drama, N. Forray and P. Rathouis wanted "Sivens to be considered as a turning point in the management of water in Adour-Garonne, the last project of an era, the first stage of a major evolution ". This seems to be the case with, *e.g.,* the circular of 4 June 2015 concerning the financing by the water agencies of the substitution reservoirs, the law of 8 August 2016 for the reconquest of biodiversity, nature and landscapes following the Richard report (2015), or the modification of the nature and use of munitions used in law enforcement operations following the report (Baudet and Miramon, 2014).

Contrary to what some have said[4], the death of R. Fraisse will not have been useless, since it allowed to stop the implementation and to make visible the failures of the Sivens dam project, from the view both its management and its purpose (water management). Compared to complex projects with innumerable tangled issues such as the airport of Notre Dame des Landes, the stakes of this project were relatively modest: 8 M €, 12 to 17 ha of wetland and maize seed growing in about twenty farms. The contrast between the relative simplicity of this project and the gravity of the accident to which it gave rise makes the Sivens dam project a paradigm for these "Imposed Large Unnecessary Projects" which arouse to serious conflicts between the French administrative and political systems and the development of citizen movements bearing a conception of the common good that is sustainable, meaningful and effective from the environmental, social and economic points of view (Foissac, 2015).

Beyond the legislative and regulatory evolution mentioned above, the awareness of the disastrous consequences of such hiatus encourages the use of the National Public Debate Commission to guarantee the democratic legitimacy of these projects. It also highlights the need for participatory deliberation approaches for the elaboration of a project that is shared and agreed by the actors of a territory. Such processes greatly benefit, in support, from methods and tools based on integrative modeling and simulation such as Wat-A-Game (Abrami et al., 2012) or Maelia (Thérond et al., 2014). Used as a negotiation support tool for

[4] "To die for ideas is one thing, but it's still relatively stupid and stupid", T. Carcenac, (*La Dépêche du Midi, 27/10/2014).*

the management of socio-ecological systems (Barreteau, 2003, Etienne et al, 2005, Adreit et al., 2011), the modeling makes it possible to objectify the positions and behaviors of the stakeholders and the simulation to highlight the consequences of their choices.
The SocLab model presented here has another concern, since it does not focus on the matter of the project but on the social dimension of the process of its design and implementation. This model is diagnostic assistance in that it is problematized around the question it aims to illuminate (in this case the State-Zadist conflict). Given the issue studied, the models presented here stand at a meso level, intermediate between the micro level that would examine the interactions between the physical actors in the field and the macro level for which the Sivens dam project would only constitute episode among others.
The SocLab meta-model of Organized Action Systems provides firstly a process for the acquisition (see Appendix) and the representation (see Tables 1 and 2) of knowledge about the system that the we consider. The quantitative nature of this representation makes it possible to highlight properties which, although the direct consequence of what one has put in the model, are not for all that trivial and whose robustness can be evaluated by analyzes of sensitivity.
SocLab offers the possibility of testing hypotheses by observing the consequences of modifications made to the model. Each of these tests is an experiment capable of extending the knowledge and deepening the understanding of the model. In this way, we have been able to uncover constituent elements of the structure of the studied system of action that could be its essential determinants.

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Annex

This form is used to collect data from actors in the field to quantify the model, *ie* fill in the columns of Table 2. We start by presenting to the interviewee the architecture of the model using Figure 1 and the interpretation of the effects functions, so that he knows how his statements will be used to fill a column of Table 2.

	Interviewee: . . . . . as model's actor:	**Resources**		
		R1	**R2**	**- - -**
1.	**What are the resources do you need** to perform your tasks, to achieve your objectives ? **What does matter** for you?			
2.	**On who do you depend** to access the resource, to use it according to your own need? Who controls the resource?	<actor name>	<actor name>	<actor name>
3.	**How much important** is that resource for your own work (on a scale 0 … 10)?			
	What is the behavior of the person who controls the resource that would be:			
4.	**a- the worst case for you?** describe this behavior			
5.	assess the effect of this behavior on your capability to achieve your objectives (on a scale -10 … 0)			
6.	**b- the best case for you?** describe this behavior			
7.	assess the effect (on a scale 0 … 10)			
8.	**c- the neutral case, neither favourable or unfavourable?** describe this behavior			
9.	assess the effect (on a scale -10 … +10)			
10.	**d- the behavior that you experience usually?** describe this behavior			
11.	assess the effect (on a scale -10 … +10)			
12.	**Who does matter for you?** favorably (on a scale 0 … 10) adversely (on a scale -10 … 0)	actor XX: . . . . . actor YY:		