"Shrimp" only is fish in the leaving tide: conflicts in water management in a hydrographic basin committee

"Camarão" só é peixe na vazante da maré: conflitos na gestão de águas em um comitê de bacia hidrográfica

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ABSTRACT

The case illustrates the dilemma experienced by Marcelo, a government employee, member of the Advisory Committee of the Water Resources Management of the Rio Cariri Basin, who at some point decides to support shrimp in captivity (shrimp farming) in a weir in Ceará. But the solution that seemed ideal, generated strong environmental impacts for the communities that live below the reservoir, putting the Committee in a delicate situation. Elaborated from a real experience in one of the fourteen political and administrative regions of Ceará, the presented problem is at the middle of the management of water resources in the Brazilian hinterland, which permeates actions of coexistence with the Semi-Arid today. The case stimulates the debate on the need to consider multiple alternatives to the "water problem", analyzing the management perspective - business and public - which should guide decisions based on the observance of complex variables that affect different social groups. The teaching notes comprise the pedagogical aspects of the case, as well as presenting the sources and methods of data collection for its elaboration and suggests questions and debates to be applied to the students.
Keywords: coexistence with the semi-arid; water resource management; river basin committees.

RESUMO

O caso ilustra o dilema vivido por Marcelo, um servidor público integrante do Comitê de Assessoramento da gestão de recursos hídricos da Bacia do Rio Cariri, que em determinada altura, decide apoiar a criação de camarão em cativeiro (carcinicultura) num reservatório hídrico no Ceará. Mas a solução que parecia ideal, gerou fortes impactos ambientais, para comunidades que viviam abaixo do reservatório, colocando o Comitê numa

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RESUMO

situação delicada. Elaborado a partir de uma experiência real vivida por um órgão colegiado em uma das quatorze regiões político-administrativas cearenses, a problemática apresentada tem como cerne a gestão de recursos hídricos no sertão brasileiro, que perpassa ações de convivência com o Semiárido em dias atuais. O caso estimula o debate sobre a necessidade de se considerar múltiplas alternativas para o "problema da água", analisando a perspectiva da gestão – empresarial e pública – que deve nortear decisões pautadas na observância de variáveis complexas e desdobramentos que afetam diferentes grupos sociais. As notas de ensino compreendem os aspectos pedagógicos da utilização do caso, bem como apresentam as fontes e métodos da coleta dos dados para sua elaboração e sugere questões e debates a serem aplicados aos alunos.
Palavras-chave: convivência com o Semiárido; gestão de recursos hídricos; comitês de bacias hidrográficas.

PART I – The Case

INTRODUCTION

Marcelo, after finishing another day of work, went to contemplate the Cariri Weir, an artificial water reservoir created in the riverbed of the Cariri River as a way to store water and, thus, guarantee the water supply of the residents and rural producers who live and work around it. He sees, with great joy, that all the effort of the government of the State of Ceará has been positive in providing that the local inhabitants have drinking water throughout the year, even in periods of prolonged drought.

However, at the same time that he was admiring the river, he remembered that, in the next day, the dispute over the use of the waters of the weir would end, which had a strong repercussion in several social groups, causing the suffering of most of those involved. When remembering the beginning of the conflict, Marcelo had difficulties in understanding how that solution, which would benefit the Ferreirinha community, ended up getting where it is. His greatest career achievement so far has become a scene of dispute between communities.

After a few minutes contemplating the weir, Marcelo decided to return to the building to get some documents that would be important for the audience. Upon entering it, he bumped into his co-worker.

— Are you nervous? – asked Miguel.

— Nervous? These debates of the last days don't leave my mind and I'm barely sleeping, my wife complains every night – he replied with a wry smile – and imagine that it all started because of shrimps...

THE COMMITTEE

Marcelo's activities are part of the unfolding of an action by the Brazilian State triggered by the publication of Law number 9.433/1997, which instituted the National Water Resources Policy and created the Watersheds Committees as members of the National Water Resources Management System.

Figure 1 Map of the twelve Watersheds Committees in Ceará

Source: Adapted from the Ceará State Water Resources Secretariat (2018).

These committees, in particular, are composed of a series of diverse social actors that try to represent the society directly and indirectly interested in the management of the waters of a certain watershed. Associations of residents and rural producers, representatives of municipal, state and federal governments, in addition to the board directors itself, make up these spaces as long as there is "articulation and consensus building" (PORTO; PORTO, 2008, p. 49).

The focus given to heterogeneous participation emphasizes the possibilities of improving the management of the public sphere in these places in order to privilege contradictory and well-founded criticism (SPINK; BURGOS, TEIXEIRA, 2018) and contemplate the need to observe "the social diversity of the target populations, their socio-cultural, regional and local characteristics" (MENDES; AGUIAR, 2017, p. 1.105).

Besides, they tension the action of multiple social actors towards the generation of jobs and income connected to development processes that are guided by the distribution of wealth and the improvement of the living conditions of the less affluent (SANTOS; CARVALHO; BARRETO, 2017).

The committee where Marcelo works has good autonomy and financial independence to work. This meets what Morais, Fadul and Cerqueira (2018) present in their contribution, by stating that, in the country, "several committees are still at an early stage of the implementation process" and this his gave the committee good visibility around the Cariri River.

TRYING TO LIVE WITH THE SEMI-ARID REGION: A POSSIBLE SOLUTION

Two years before, at the beginning of 2015, the rainy season in Ceará hadn't been very intense. Across the state there were the rumor and worrying projection of a future – and not so distant – lack of water for agricultural production and human consumption. Even though the Cariri weir signaled a considerable drop in water rates, the Cariri River Watershed Management Committee had already been deliberating on the best management of the remaining waters.

Gathering the assembly – composed of government members, private sector, organized civil society and other interested parties – in an ordinary session, Marcelo presented statistical data about the flow levels of the Cariri weir as opposed to the rainfall indexes provided by the state meteorological agency.

From this comparison, he demonstrated that the entire Ceará territory already had water deficits, but the Cariri Watershed would still support that whole year without more stringent water controls. On the other hand, the situation wasn't comfortable and the management committee should outline a plan that would guarantee the maintenance of the weir without compromising – or limiting – the access to the water available there.

In this moment, Marcelo remembered an improvement course in coexistence with the semi-arid that he had taken in a sertaneja (from the dry region of northeast Brazil) non-governmental organization, through which he had access to the new paradigm of non-drought combat, guided by the strategic definition of actions related to the permanence of the sertanejo (country person) in his land (BAPTISTA; CAMPOS, 2013; CONTI; PONTEL, 2013). After everyone present there expressed their opinions on what should be done with the water in the next months, Marcelo resumed his speech and proposed:

— We could think of some economic activity that could be carried out in the weir. Therefore, we would use the water stored in it not only for human and animal consumption, nor just for fishing, but for other viable production here in our outback (sertão).

Upon exclamations of agreement from the assembly, Miss Marta, one of the people present, reminded:

— But will this not hinder anyone who benefits from the water released by the weir? We must take into account that the Cariri River continues after the weir and many other families use its water to drink, raise animals and water their crops. Is there no risk?

Marcelo immediately replied and stated that this initiative should, first of all, be very well analyzed and verified if it wouldn't cause any problem or environmental impact. What the group should have as a priority was the full use of the resources available there with a view to improve the income of families in the region.

The group's decision approved Marcelo's appointment. Shortly thereafter, the Management Committee met the producers and listened to opinions to find out what productive activities could be implemented at the Cariri weir. From the many suggestions received, shrimp farming, which is the creation of shrimp in nurseries, drew attention. This activity wouldn't require considerable investment and could be

used in both fresh and salt water. It is an activity with short-term cultivation, not requiring great climatic conditions for high density production. In addition to its market power, it has a high value and shrimp consumption is increasing not only in Ceará, but in neighboring states. In this way, many advantages met this new proposal.

Three months later, in May 2015, the management committee had purchased the cages for raising the shrimp, the first specimens and the necessary supplies. Three families of rural producers who lived in the surroundings of the weir were selected, so that the exercise of the new activity wouldn't displace the families from their homes. The idea was to minimally interfere with the socioeconomic dynamics there. After being selected and trained, three family groups started raising shrimp, which quickly prospered.

"SHRIMP" IS ONLY A FISH WHEN IN THE EBB TIDE. OR WHEN IN THE WEIR!

In May 2018, two years later, Maria woke up before the alarm clock even rang, due to her anxiety for the celebration of the cultivation. Two years ago, the group of the Cariri Watershed Management Committee was coming to the *Ferreirinha* community to present shrimp farming. She remembers that, initially, some families were resistant and didn't believe in the cultivation. "It won't work! It will end with our weir, poor fishes!" – these were commonplace speeches by some members of the community.

However, for Maria, despite all the difficulties in raising her four children, shrimp farming seemed to be the perfect solution to her problems. After the initial resistance of the community, there was a three-week training course, teaching residents what they needed to know to master the entire process of raising shrimp in captivity.

At the beginning, the results were slow to appear and efforts didn't seem to generate any benefit for the community. Despite that, Maria believed that it was only a matter of time and, after a few cycles, the inhabitants of the region would be able to reap the fruits that they planted.

She was right! Cultivation grew, families, supermarkets and restaurants in the region began to buy shrimp, even schools in the city added it to their meals. Due to the fair price and the quality of the product, the community gained visibility beyond the regional market, starting to sell to other states.

At that time, Maria was grateful for those gentlemen who came two years ago to introduce this activity into the life of the community. With the help of what she gained from cultivation, she was able to support her children and have a much more comfortable life than she had before. It was thinking about everything that she achieved and the changes in the community brought by shrimp farming that Maria proposed the celebration party, the perfect moment to celebrate and thank the staff of the Watershed Management Committee.

But not everything is a celebration...

CONFLICTS ARISE: CELEBRATE WHAT?

While Maria was worried about the preparations for the celebration party, Joana, who lives in the community below the source of the weir, woke up with no reason to celebrate. In the past few months, the water in the weir that served as a sustenance for its community was less and less potable. The *Barreira* community is a major producer of bananas and the livelihood for families came from planting and commercialization of these foods at fairs in neighboring cities.

Over the months, Joana realized that the production was different, the number of customers looking for her products at the fair was decreasing and some of them even reported a difference in fruit flavors. She suspected that the problem was due to the weather or her bad luck with the harvest.

— The situation will be better, God willing – repeated to herself.

Meanwhile, Mr. Francisco, her husband, had another hypothesis about the cause of this problem: since the news that the Watershed Management Committee wanted to implement a culture of shrimp farming reached the communities down river, he was concerned about the impacts of this implementation. What differences would they feel over the years?

Time only confirmed his fear. His years of life gave him enough experience to know that it wasn't a plague problem or a lack of nutrients in the soil. In addition, even cows refused to take water from the river, which meant one thing: there was a problem with the river and, probably, it was related to the recent shrimp farming.

Meeting with the other members, Mr. Francisco reported his suspicions. The producers also stated that they had some problems with the harvest and that they had already communicated to the committee, but they didn't get any response. Mr.

Francisco convinced them to go and talk to Marcelo, because of all the members of the Weir Management Committee, he was the one who was most accessible, besides being the main responsible for the beginning of the creation.

Away from all of that, Maria had been organizing the celebration party with the help of the community for at least two months, so she wanted everything to be perfect. It would be the moment to celebrate all the progress that the community has made since the beginning of the shrimp farming. Marcelo arrived at the party before the other members of the Committee, found Maria organizing some tables and greeted her:

— Maria, the place is beautiful. Congratulations!

— Mr. Marcelo, it's just our way of thanking and celebrating these last two years... If it weren't for the shrimp farming, I wouldn't even know what would be of us.

Marcelo couldn't be more proud. Remembering the beginning of everything, when there seemed to be no solution to the drought problem, he had no expectation that everything would go so well. Straying in his thoughts after the meeting with Maria, Marcelo was interrupted by Miguel, one of the members of the Committee, who had a look of concern and urgency.

— You need to come with me. There are some people who want to talk to you.

There were about ten people in the group waiting for them. Other members of the Committee were already there. As Marcelo approached, he noticed that there was a lot of noise in the discussion.

— You ruined our weir and are celebrating?!

That was the first reaction to Marcelo's arrival. Apparently, the group present there were residents of the *Barreira* community, which was below the source of the river and who received less attention in recent years due to the collective efforts to implement shrimp farming for the riverside of the weir.

— Calm down! But what are you talking about? Is there any urgency that needs to be addressed? – Marcelo interrupted.

At this moment, the farmers were silent and gave voice to Mr. Francisco.

— We hope so. In the last few months we have been experiencing several problems with the weir. The water is getting saltier and saltier; it's becoming impossible to use for anything. Our plantation is being destroyed because it depends on the weir and not even the cattle are taking the water. And all of this is because of those shrimp that are making the water salty. We have tried to contact the Commit-

tee several times, when they don't answer that the problem has nothing to do with the shrimp, they say they will find out, but they do nothing. We have been going through this for months and you are here celebrating!

Marcelo was surprised by the attitude. He had already heard some comments from co-workers that the residents of the surrounding areas of the weir had some complaints about the water. It never seemed serious and a team had analyzed the project's feasibility before the implementation. Everything seemed completely adequate.

— Mr. Francisco, since the beginning of the implementation of shrimp farming in the community, we have evaluated the impact that this activity would have here. And cultivation may not the reason for the problem you're experiencing – Marcelo replied.

— Marcelo, all these problems started to happen after the shrimp cultivation: it is no longer possible to cook, the animals don't want the water anymore and the plantation doesn't grow. We have already started to lose money on this!

— Calm down, Mr. Francisco! – replied Marcelo – we are going to find out what's going on. But I think it's too early to blame the shrimp production. Let's be patient and really see what can be done.

After a few minutes of conversation, Marcelo managed to contain the spirits of the group and guaranteed that, sooner, a study would be carried out to find out what was happening to the river water. Even in a celebration mood, Marcelo was worried and went to talk to Maria to talk about what happened.

He, who had started the day proud of the gains that the implemented activity had for the community, realized that the significant benefits of shrimp farming aren't shared by all communities. His greatest pride in his career at the head of the Cariri River Watershed Management Committee can become a big nightmare if he doesn't make the right decisions. But now, if all of Francisco's reports were true, what should he do?

DOWN THE DRAIN...

In the following week, the committee met and discussed possible solutions to the conflict, determining that a group of experts would collect the water and analyze the material to identify whether there was, in fact, excessive salinization of the water.

During a few days, the team collected samples from the water at the Cariri weir, from the water that reaches the reservoir (upstream) and the river's ebb (downstream). Everyone's expectation was hovering when the results arrived.

Shortly thereafter, the post brought a correspondence with the technical report, which confirmed that the water coming out of the weir was with levels of salts far above those recommended for human, animal consumption and for the production of foodstuffs. The analysis showed that the inputs used as feed for the prawns were salinizing the water from the weir too much and, after being concentrated, it flowed again through the river. After reading the result, Marcelo felt a coldness run down his spine. At that time, he knew that encouraging shrimp farming in the weir had been a mistake. But how had no one thought of it? A decision needed to be made and it couldn't wait longer.

In that moment, Marcelo knew that, besides the pressure from the two communities, there was also pressure from the media, which was constantly reporting and emphasizing the absence of a decision made by the committee. The first thing he needed to do was clarify the situation. News was spreading and some hasty information was the main subject among the communities. He needed to explain to everyone what was going on, talk to those most impacted by the situation and make a decision.

A meeting was scheduled with all residents a week later. Agents went to each house in the surroundings of the weir to invite community members in order to present the problem that was occurring and what were the possibilities for solving it. The main auditorium of the building where the committee met for large events was chosen to hold the meeting. Marcelo hoped that, with this meeting, he would be able to propose solutions to the problem and end the conflict that had been intensified in recent days. Little did he know, however, that the conflict was greater than he imagined!

WHAT NOW, MARCELO?

The complexity of the situation was what scared him most; his decision wouldn't impact only one person, but dozens of families that have the weir as the main source of their income. He was forced to decide: accommodate the request of the ebb producers which was to end the production of shrimp, affecting newly su-

pported families or, on the other hand, the Committee might not accommodate the request, maintaining the production of the shrimp, but making the lives of families installed along the river below the weir unfeasible.

Furthermore, the committee's image had never been so weakened. After two years of congratulations on the successful implementation of the activity, how were they unable to predict the impacts caused and how weren't they concerned with the families of the ebb? Gradually, the residents arrived and occupied the auditorium spaces.

As expected, many residents of the communities showed up and Marcelo tried, with not much success, to remain calm, showing to the residents the complete scenario and how the Committee was willing to help both communities.

— Dear, everyone already knows why you are here this morning. I will try to be as objective as possible when explaining the situation and we will try to come up with a solution. This past week, we received the results of the tests performed with the water from the weir. The need was to identify whether the creation of shrimp in captivity salinizes the river water and if it was affecting the cultivation and consumption of other communities. The analysis showed that the level of salts in the water is above the high level due to the inputs used for feeding and raising shrimp.

When he said that, there was a moment of murmuring among those present. Several people wanted to speak at the same time and Marcelo tried to coordinate them:

— We will listen to all of you, but we need each one to speak in your turn. Our intention is to reach a point of agreement that favors everyone.

— How did this happen? We don't feel anything different in the water and, nowadays, shrimps are our main source of income. What will the community do if they take this away? I have four children to provide for and everything I have achieved in the last few months was thanks to shrimp farming. Today we sell shrimp to many restaurants and markets in the region and to other states. We are known for quality and well done work. What are we going to do if we don't have that anymore? – Maria was the first to question.

In his speech, Marcelo reported that shrimp farming, in fact, meant an activity capable of changing the lives of many families. Hundreds of people were

employed once most of them had no source of income and today they are responsible for providing for their own homes. The possibility of changing this scenario would be arduous.

However, Marcelo was interrupted by Mr. Francisco:

— Son, in fact, this is a complicated situation. It is admirable what all of you achieved with shrimp farming, we are all happy for you. The problem is that, right below you, there is our community. We didn't receive the rightful attention and today we suffer a lot because of it. I was always against shrimp farming because I thought the result would be that. Currently we don't have good water to drink nor to produce our bananas, which is the source of livelihood for many people in the community, not even our cattle can drink the water! If the solution is not to stop shrimp farming, what will it be?

The discussion went on. With each comment, the decision seemed to be even more difficult. The debate exposed the needs and difficulties of both parties. Both were correct in their arguments and Marcelo had to make a decision. Should he maintain shrimp farming while the other community was affected by the salinization of the water? Should he choose to end shrimp farming, leaving another community without its main source of livelihood? How could Marcelo make this decision in order to reduce the damage to both communities, ensuring everyone's survival and the committee's reputation?

PARTE II – Teaching Notes

Teaching Notes are recommended for the exclusive use of teachers and/or users of the Case. Here, we indicate the usage guides defined for the best applicability of the Case, which include the source of data collection; educational objectives; the applicability and pedagogical aspects of the case; possible solutions for the case presented; suggested questions for debate; and the recommended bibliography for preparing the students, group discussion and search for solutions divided into themes of coexistence with the semi-arid, water resources management and shrimp farming management.

EDUCATIONAL OBJECTIVES (TEACHING)

The problem presented by this Teaching Case has as its core the management of water resources in the Brazilian outback (*sertão*), which permeates actions of coexistence with the semi-arid region nowadays. Moreover, it involves the discussion about the introduction of new cultures in the interior of Brazil, as the case reported, that permeate the performance of different social actors involved in a water resources management committee.

The analyzed case has as its purpose to illustrate the daily lives of these committees and to urge the student to put himself in the same position as the managers of these spaces, as illustrated by the central character, Marcelo. Students of bachelor's degrees in Bussiness Administration, Public Administration and members of collegiate bodies of water resources, in particular, are invited to realize the usefulness of theoretical knowledge towards praxis in collegiate bodies. However, this doesn't exclude the applicability of this Teaching Case in graduate courses.

Nevertheless, the reflection on the *modus operandi* of the Administrator, or of the manager, seems suitable when using a Teaching Case of the same nature as this one. In addition to business management, public decision-making spaces deepen the idea of the Athenian Agora and expand the sphere of action of the Administrator and that is one of the reasons of this case.

Therefore, at first, it is suggested the initial reading of texts that deal with the processes of coexistence with the semi-arid region so that students are awakened to this new paradigm of "seeing" and social, political and economic performance in semi-arid regions of Brazil.

Consequently, the person who applies the case can start the debates by addressing the need to consider multiple alternatives to the "water problem" and insert the current presence of water resources management as a sub-function of Business Administration and Public Administration. Works as the ones of Apostolaki, Koundouri and Pittis (2019) and Rolfe and Harvey (2017) present conclusions on how good water management can have beneficial effects on the development of human societies, so that this presents itself as a necessity to be considered in the work of administrators and public administrators.

Then, it is recommended that students be encouraged to debate the management perspective – business and public – which should guide decisions based on

the observance of complex variables and repercussions that affect different social groups. For this reason, treating the case from the perspective of water resources management appears to be the second didactic step associated with this teaching-learning tool.

Lastly, assuming Marcelo's place at the core of the matter will help students understand the nuances of the activity of the Administrator-manager, who must consider the multiplicity of conditioning factors before the councils, collegiate bodies and water management committees, especially in semi-arid regions where the performance of this professional is highly required.

This can contribute to a theoretical-practical formation much more related to the reality and the problems that surround the sectorial management bodies in Brazil, as they cross the limits of the proposed case. It is in this context that the importance of discussing **conflict management** stands out as a skill to be developed by future professionals in Business Administration and Public Administration in Brazil.

As a result, it is considered that this case may be endowed with a wide educational possibility by foreseeing a potential work activity for students of Business Administration and Public Administration in the country.

SOURCE AND METHOD OF DATA COLLECTION

This Teaching Case was elaborated from a real experience lived by a collegiate body in one of the fourteen political and administrative regions of Ceará. On the other hand, the names of the locations, institutions and people who inspired the construction of this Teaching Case have been changed to preserve their privacy. The data were obtained through a semi-structured interview with a representative of the committee in 2015.

RELATED/SUGGESTED DISCIPLINES TO THE USE OF THE CASE

This Teaching Case is suggested for higher education courses in Business Administration and Public Administration, both of undergraduate and graduate levels. In these, disciplines involving water resources management, social management, management of civil society sectors, environmental management, public policies, water engineering, sustainability, social impact, governance, negotiation,

conflict management and stakeholder management are strongly encouraged to apply this case.

It is important to say that teachers can't necessarily apply this case, but training agents in training spaces for water resource management committees, for example, are strongly encouraged to use this case for teaching. In Brazil, according to Penteado, Almeida and Benassi (2017, p. 301), "reservoir management, whether public or private, is dynamic and complex, as new variables appear that change the entire set of established conflicts", which raises the development of the profile of the decision maker to those individuals involved in the water resources management.

In this manner, it should be said that this possibility of multiple application of this instrument characterizes it as an interdisciplinary teaching-learning tool. The integration of knowledge proposed by Penof, Leonardo and Farina (2020) and by Trindade et al. (2019) encourages it to become part of a typical piece of applied social sciences and brings up the comments of Rigo, Nascimento and Brandão (2018) and Nascimento and Rigo (2020) when proposing their alignment with applied social sciences, in general, which are illustrated in the aspects in which environmental conditions appear as the background of this teaching case.

POSSIBLE TASKS TO PROPOSE TO STUDENTS

The center of discussion and debate in this case is the water management in a watershed in the state of Ceará, passed by the dilemma of continuing or not with the creation of shrimp in captivity in a weir managed by a management committee. In this context, the decision is not easy. It is necessary to observe variables that encourage the student to think about the variables present in each potential decision and their consequences for each group of individuals involved in the dilemma of the case.

Establishing opportunities for the sustainable management of food production is a sensitive issue for communities surrounding water reservoirs in the interior of the Brazilian Northeast, where "the specificities of the territory can be enhanced, generating economic growth and quality of life for the people" (MASCARENHAS; BARBOSA, 2019).

For this reason, two tables are presented here. The first (TABLE 1) lists the questions proposed for the debate that can be undertaken among students, me-

diated by the case's applicator. Then, Chart 2 presents the solutions visualized for the climax of the case, in which Marcelo (or the students and their place) needed to make a decision.

Table 1 Proposed questions for discussion.

General order	Specific order
a. What is the main question raised by the case? Why did his decision prove to be so difficult? b. What are the main variables that Marcelo should consider when taking the decision to the committee? c. Given the condition of the collegiate body, how would it be possible for Marcelo to mitigate the problems and guide the group to a decision? d. How do you evaluate the team's risk management? What other possible measures could be taken by the committee? e. What are the main consequences possibly observable for each group involved in the dilemma? Does it highlight the possible social impacts? f. How do you evaluate the efficiency of conflict management and transparency with the committee's Stakeholders? g. Each group has an interest in the decision that the committee will make. Taking a position on Marcelo's side, how is it possible to evaluate your leadership? h. How would you, in Marcelo's place, act in order to resolve the existing conflicts between the users of the weir waters and the members of the Committees?	**I – About the coexistence with the semi-arid region** a. How would it be possible to identify aspects of the coexistence with the semi-arid region in the proposed case? b. What other agricultural production alternatives could have been thought besides the shrimp farming? **II - About water resource management** a. What are the main actions carried out by the management committee in the illustrated case? b. Was the decision to insert shrimp farming in captivity correct? If so, to what extent? c. In your opinion, were the available elements sufficient to insert shrimp farming as the most appropriate for that space? **III - About management of watershed committees** a. How was it possible to perceive Marcelo's relationship with the other people involved presented in the case? How did this articulation reverberate at the moment of the decision? b. To what extent, in your opinion, should watershed committees decide on the use of water and its consequences?

Source: Elaborated by the author (2019).

Based on the table elaborated by Rigo, Nascimento and Brandão (2018), the following correlation of possible solutions for the dilemma presented in this case for teaching was established as shown in Table 2:

Table 2: Possible solutions to the dilemma

Decision		Repercussion (Consequences)		
		For the Management Committee	For shrimp farmers	For producers downstream
1	Maintain shrimp farming and guarantee the families' around the weir	a) It ensures that the project that generates the highest returns for the community will continue; b) It can have its image compromised by guaranteeing the efficiency of consumption, production and supply of water available to a community and harming others; c) It is responsible for the need to treat the weir water with products for its desalination, which can generate high costs.	a) It ensures that shrimp farming continues; b) And families increasingly enjoy the gains of this production.	a) It makes the planting, production, consumption of animals and the lives of families installed along the river below the weir unfeasible if the water isn't treated with a view to reduce the salt rates present in it.
2	Move shrimp farming to controlled tanks near or in the areas below it	a) It guarantees the project continuity and the household income; b) It improves the Committee's image, since it demonstrates to the population the inclusion of a less harmful alternative to the already established economic activities; c) It increases in its work with the need to obtain new financing for its viability.	a) It ensures that shrimp farming will continue; b) And families increasingly enjoy the gains of this production.	a) It makes possible the planting, production, consumption by animals and the lives of families installed along the river below the weir.

3	Discontinue shrimp farming, following the request of the producers of the river ebb	a) The most successful project ever created by the committee is closed; b) It damages the image of the committee in relation to the performance, quality and development of projects; c) Loss of community confidence in future	a) It extinguishes the community's main source of income; b) It forces the community to create other economic activities.	a) It allows the communities of the river below to return to quality in their production and the water to be used for consumption by animals and residents.
4	Alter shrimp farming to fish farming	a) The most successful project ever created by the committee is closed, while it has another one proposed for its place; b) It damages the image of the committee in relation to performance, quality and development of projects, but presents a new solution for shrimp farmers; c) Increased community confidence in future activities.	a) It extinguishes the community's main source of income; b) It forces the community to create other economic activities.	a) It makes possible the planting, production, consumption by animals and the lives of families installed along the river below the weir.

Source: Elaborated by the author (2019).

POSSIBLE CLASS ORGANIZATION TO USE THE CASE

Table 3 Possible case organization

Preparation	The present Teaching Case seeks to promote discussion on water resource management in the disciplines of social management, management of sectors of civil society, environmental management and public policies. As it is a teaching case that relates theory to practice, it is advisable that the mediator provide basic references and theoretical texts about the subject, being up to his or her criteria to use the ones suggested here or to search for other studies. It is recommended that these references be made available at least two weeks in advance and that they must be mainly focused on the issues of coexistence with the semi-arid region, water management and studies about social, political and economic activities in semi-arid regions of Brazil. Subsequently, one week in advance, the case and the proposed questions should be assigned and, if the mediator wishes, he or she can suggest other tasks. Lastly, it is advisable to ask for answers to questions in writing.
Application	This case application can be carried out individually (large group discussion) or in smaller teams (from two to five members), being up to the mediator criteria or/and the number of participants who will be part of the discussion. It is recommended that the case be applied in two hour-classes (one hundred minutes) and save the first fifteen minutes to welcome students, make a brief presentation of the case, highlight the evaluation criteria that will be used, start to highlight the need for studies on the "water problem", inserting the importance of water resource management as a sub-function of Business Administration and Public Administration in order to start the discussion. In the seventy minutes, the mediator role is to stimulate the discussion and participation of all members, who must have the answers to the questions in hand. At last, in the last fifteen minutes of the class, the mediator should use this moment to make comments, taking back the speech for himself, making an overview of the main points discussed and relating the discussion with the theory studied.
Evaluation	If the measurer chooses to use the case as an evaluation method, it is suggested that the following criteria be established: 1. submission of proposed questions in writing; 2. coherence of the answers with the reality of the case and the theory studied; 3. level of participation and quality in the discussions about the case; 4. relevance of the arguments for discussion and association with the studied theory.

Source: Elaborated by the author (2019).

BIBLIOGRAPHY SUGGESTIONS

For the full usefulness of this case for teaching, it is recommended to use the bibliography below, organized into four theoretical pillars: general questions with an emphasis on conflict management; coexistence with the semi-arid region; water resource management; and watershed management committees, as follows:

a) About general issues with an emphasis on conflict management

I – Preparing the students

BARBALHO, M. G. DA S.; CASTRO, S. S. DE. Aptidão Agrícola das Terras e Avaliação dos Conflitos de Uso das Bacias dos Rios Claro e dos Bois, Estado de Goiás. **Fronteiras: Journal of Social, Technological and Environmental Science**, v. 8, n. 2, p. 284-306, 1 maio 2019. Disponível em: https://doi.org/10.21664/2238-8869.2019v8i2.p284-306

SOBRAL, S.; CAPUCHO, F. A gestão de conflitos nas organizações: conceptualização e diferenças de género. **Gestão e Desenvolvimento**, n. 27, p. 33-54, 11 set. 2019. Disponível em: https://doi.org/10.7559/gestaoedesenvolvimento.2019.373

II – Discussion

BERNARDI, I.; SILVA, L. R.; FALCO, P. B.; PIRES, J. S. R.; DOS SANTOS, A. C. A. Análise comparativa das ferramentas de gestão: Plano de Manejo da APA Itupararanga e os Planos Diretores Municipais. **Sociedade & Natureza**, v. 32, p. 75-91, 10 fev. 2020. Disponível em: https://doi.org/10.14393/SN-v32-2020-36541

III – Elaboration of possible solutions

Rossetti, J. P., & Andrade, A. (Ed.7.). (2014). Governança corporativa: fundamentos, desenvolvimento e tendências. Editora Atlas SA.

b) About the coexistence with the semi-arid region

Table 3 Recommended bibliography – part 1

I - Preparing the students

BAPTISTA, N. Q.; CAMPOS, C. H. Educação contextualizada para a convivência com o Semiárido. CONTI, I. L.; SCHROEDER, E. O. (Org). In: **Convivência com o Semiárido Brasileiro: Autonomia e Protagonismo Social**. Brasília: Editora IABS, 2013.

CONTI, I. L.; PONTEL, E. Transição paradigmática na convivência com o Semiárido. In: CONTI, I. L.; SCHROEDER, E. O. (Org). In: **Convivência com o Semiárido Brasileiro: Autonomia e Protagonismo Social**. Brasília: Editora IABS, 2013.

II – Discussion

GUALDANI, C.; FERNÁNDEZ, L.; GUILLÉN, M. L. **Convivência com o semiárido brasileiro: reaplicando saberes através de tecnologias sociais**. Brasília: Editora IABS, 2015.
FERNÁNDEZ, L.; GUALDANI, C.; LUMBRELAS, J. (2015). **Avaliação de cisternas escolares no semiárido alagoano.** Vol.6. Brasília: Editora IABS, 2015.

III – Elaboration of possible solutions

CONTI, I. L.; SCHROEDER, E. O. **Estratégias de Convivência com o Semiárido Brasileiro: Textos e Artigos de Alunos(as) Participantes.** Vol.3. Brasília: Editora IABS, 2013.
CONTI, I. L.; SCHROEDER, E. O. **Construindo saberes, cisternas e cidadania: formação para a convivência com o semiárido brasileiro.** Vol.4. Brasília: Editora IABS, 2014.

Source: Elaborated by the author (2019).

c) About water resource management

Table 4 Recommended bibliography – part 2

I – Preparing the students

CECH, T. **Recursos Hídricos - História, Desenvolvimento, Política e Gestão.** 3ª ed. São Paulo: Editora LTC, 2013.
SOARES, S. A. **Gestão de recursos hídricos.** Curitiba: Editora InterSaberes, 2015

II – Discussion

AGÊNCIA NACIONAL DE ÁGUAS – ANA. **A Evolução da Gestão dos Recursos Hídricos no Brasil**. Brasília: Editora ANA, 2002.
TUNDISI, J. G.; MATSUMURA-TUNDISI, Takako. **Recursos hídricos no século XXI**. São Paulo: Oficina de Textos, 2011.

III – Elaboration of possible solutions

ASSEMBLEIA LEGISLATIVA DO ESTADO DO CEARÁ, e Conselho de Altos Estudos e Assuntos Estratégicos. **Plano estratégico dos recursos hídricos do Ceará**. Fortaleza: Editora INESP, 2009.

Source: Elaborated by the author (2019).

d) About management of watershed committees

Table 5 Recommended bibliography – part 3

I – Preparing the students

TEODORO, V.; TEIXEIRA, D.; COSTA, D.; FULLER, B. O conceito de bacia hidrográfica e a importância da caracterização morfométrica para o entendimento da dinâmica ambiental local. **Revista Brasileira Multidisciplinar**, v. 11, n. 1, p. 137-156, 2007. Disponível em: <https://doi.org/10.25061/2527-2675/ReBraM/2007.v11i1.236>.

PORTO, M. F. A; PORTO, R. L. L. Gestão de bacias hidrográficas. **Estudos avançados**, v. 22, n. 63, p. 43-60, 2008. Disponível em: <https://dx.doi.org/10.1590/S0103-40142008000200004>.

II – Discussion

GOMES, J. de L.; BARBIERI, J. C. Gerenciamento de recursos hídricos no Brasil e no Estado de São Paulo: um novo modelo de política pública. **Cadernos EBAPE. BR**, v. 2, n. 3, p. 01-21, 2004. Disponível em: <https://dx.doi.org/10.1590/S1679-39512004000300002>

CAMPOS, M. V. C. V.I; RIBEIRO, M. M. R.; VIEIRA, Z. M. C. L. A Gestão de Recursos Hídricos Subsidiada pelo Uso de Indicadores de Sustentabilidade. **Revista Brasileira de Recursos Hídricos**, v.19, n.2, p.209-222, 2014. Disponível em: <http://dx.doi.org/10.21168/rbrh.v19n2.p209-222>.

III – Elaboration of possible solutions (with emphasis on shrimp farming)

FERREIRA RIBEIRO, Luisa et al. Desafios da carcinicultura: aspectos legais, impactos ambientais e alternativas mitigadoras. **RGCI - Revista de Gestão Costeira Integrada**, v. 14, n. 3, 2014.
FIGUEIRÊDO, Maria Cléa Brito de et al. Impactos ambientais da carcinicultura de águas interiores. **Engenharia Sanitária e Ambiental**, v. 11, n. 3, p. 231-240, 2006.

Source: Elaborated by the author (2019).

CURIOSITY: THE REAL FOUND SOLUTION

When considering all the alternatives and their respective impacts, the management committee of the real case chose to discontinue shrimp farming in the weir so that the water could be desalinated. Families that lived on the production of shrimp in captivity were encouraged and supported to develop other productive activities.

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NOTA

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