

Strategic Environmental Assessment for Planning Mangrove Ecosystems in Guinea

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Located between the cities of Conackry, Dubréka and Boffa, the Sangarea Bay is home to mangrove-type forests undergoing various forms of pressure. In 1992, a forest management plan was put into place in order to manage the resources. It aimed at promoting socioeconomic activities while keeping the mangrove ecosystem in balance. This plan was assessed in 1999. The results showed that even though it integrated environmental and economic objectives, it failed to include the social as well as cultural contexts and it did not involve the social actors in the decision process. Hence, the plan did not meet the expected results. Still today, the economic, environmental, social and cultural criteria and effective actor involvement in the resource management have to be taken into account to maintain the fragile balance of the Bay. This study is an attempt to include these criteria while opting for a new approach for a sustainable management of the resources of the Bay. This study is a Strategic Environmental Assessment (SEA) based on the use of the multi-criteria decision tool in a context where there are several actors involved. Structuring objectives and issues at stake allows the criteria to be identified. Using the sociological data available simulated the value-system of each actor involved, and subsequently, they were all put into a model by giving various weights to the criteria. The SEA compares the existing plan (sector-wise approach) with alternative scenarios includ-

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ing an “integrated management plan” scenario (holistic approach), or “a complete protection of the area” scenario. The scenarios were assessed according to the quantitative and qualitative data available. The results illustrate how the multi-criteria method can be relevant as a decision tool when choosing a sustainable way to manage natural resources.

Introduction

Mangrove ecosystems have high ecological, economic, and cultural values. They combine productivity and diversity in both terrestrial and aquatic ecosystems (Diallo, 1993). Mangrove areas are used for rice cultivation, fishing, salt extraction, and firewood supply. However, these human activities have put them under a great deal of pressure because of their activities and the mangrove has been showing a 2.4% annual rate of decline (Rue, 1998; Cormier, 1994).

Mangrove is the main ecosystem in Sangarea Bay, and its degradation is intensified due to its proximity to large urban centers like the capital city Conakry.

The recession of the mangrove forest, the reduction of the yielding of the resources, and the call from the international community to preserve wetland areas led the Guinean authorities to put conservation measures into place for the mangrove. Concretely, a National Environmental Action Plan was developed in 1991. The “pilot” project of mangrove planning, which we study here, comes from this plan (DNCF, 1993). This project was meant to follow a rationale of sustainable development, aiming at combining the promotion of economic and social activities with the preservation of the mangrove, and the resource management of the Sangarea Bay.

The assessment of the pilot project in 1999 showed that less than 50% of the activities planned were completed. Despite the important measures taken in the field, the project did not meet the conservation objectives for the mangrove ecosystem (Guinea, 1999; Petit, 1999). The facts that the population went back to old detrimental activities and that there was a high number of encroaching incidents in the identified protected zones were signs that the population did not follow the project. Keeping that in mind, the measures taken would have to be integrated and accepted by all parties involved in order to conserve effectively the ecosystem of the bay. Finding a solution to that problem would require the inclusion of the criteria of sustainable development when doing research.

This study follows that framework and contributes to the development of methodological tools by using data to see what the outcomes *could have been* if the actors had been involved in the decision-making process regarding the management of their own renewable resources.

After a brief presentation of the study area, this paper makes a simplified description of the methodology based on multi-criteria analysis. The results are presented in this order: the categories of actors identified, the criteria used to make the comparing assessment as well as the ranking of the planning options according to the actors. The discussion gears towards the value system of the actors, the ranking of the resource management options made by all the actors and the usefulness of multi-criteria analysis as a decision aid for resource management and for the conservation of particular ecosystems.

Sangarea Bay: Description, Activities, and Issues at Stake

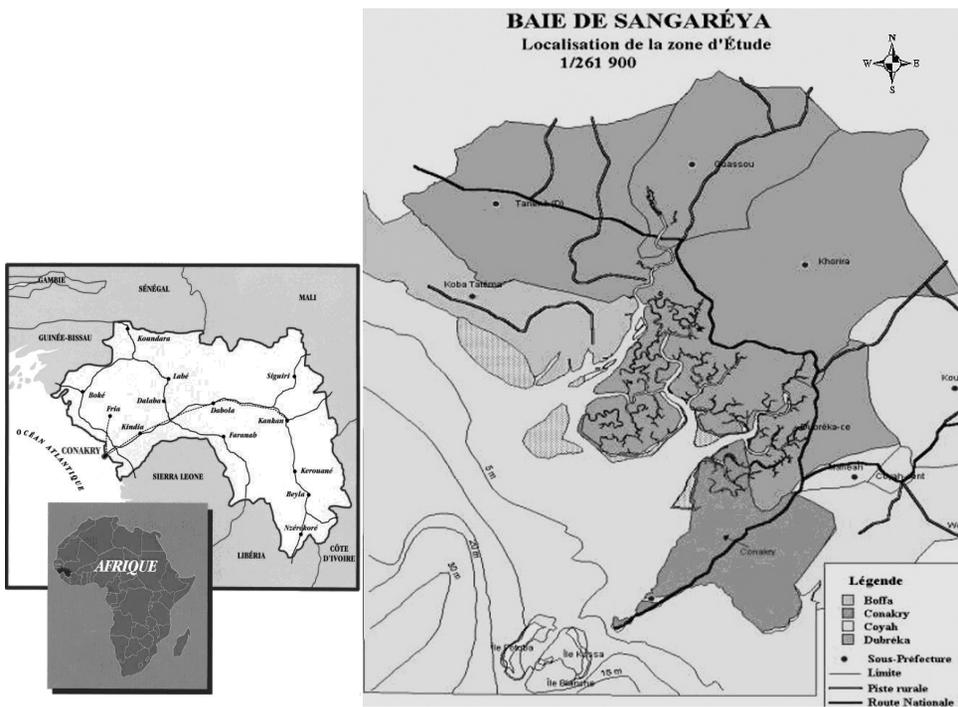
Presentation of the Study Area

The area covers roughly 56,000 ha with a population of 23, 480 souls. The study area is within the larger Guinean coastal area, which is in the tropical zone of sub-Guinean type (Picard, 2000). The area is made of islands and coastal floodplains. Mangrove forests make up most of the flora. In 1993, there were 51 villages (23,480 inhabitants) in the Sangarea Bay, while only six of them were permanently established villages of about 1,500 to 2,000 people. The local population lives from the exploitation of the resources of the mangrove.

The Planning Project of the Bay and Its Results

Exploiting the resources of the bay (firewood, rice, salt, fish) contributes to the economic growth of the region. However, it causes the environment to be under a great deal of pressure resulting in the degradation of the mangrove. This is the reason why fighting against such degradation has become such an important concern for national authorities. Within this framework, several actions have been taken, like the forest planning project in the Sangarea Bay. The “Schéma directeur de la mangrove,” SDAM (mangrove management system) was adopted in 1991. It recommended setting up a program in order to exploit the resources of the bay in a more sustainable way.

Figure 1
Localization of the Study Area



This program was indeed put into place and was part of a larger forestry program: “program to support the forests of Coastal Guinea,” the PAFT (“*le Programme d’Appui aux Forêts en Guinée Maritime*”).

The objective of the mangrove management system was to reverse the deterioration of the mangrove forests by

- taking advantage of the potential of the mangrove ecosystem while maintaining traditional activities where appropriate,
- favoring the sustainable use of the resources to benefit the population while giving them incentives to exploit and protect the ecosystem at the same time,
- promoting an appropriate resource management and valuing resources.

Nonetheless, these activities were only partially implemented. Moreover, the efficiency of the plan was limited by several problems:

- applying the perspective of foresters to an integrated management plan,
- having late and insufficient public participation,
- not giving enough sense of responsibility to the population,
- not taking into account the interests of the residents,
- not valuing enough marginal resources and,
- not integrating the results of other projects taking place in the same area.

Petit (1999) shows that some areas were reforested and foresters got sensitized to selective woodcutting. Unfortunately, since the monitoring activities included in the management system stopped in 1999, we have observed a significant increase in illegal woodcutting activities. Besides, several conflicts started between the residents of the bay and the foresters over the control of the farmable-forested sites. This was due to the fact that some sites were put under the control of the foresters based in the harbors and dedicated to the lumber business.

Likewise, the information collected in the area by different groups was not used. The management system helped to experiment new techniques of resource exploitation, like salt extraction or the water management of rice fields. Yet, until now, the peasants still do not use these techniques. The results of the management system was not so positive considering the fact that some objectives were not met, in particular the ones regarding the decrease in woodcutting and changes in the behavior of the population (MAEF, 1999).

Exploiting the Resources of the Sangarea Bay: What Is at Stake Now?

Of the four main activities using resources in the Konkouré estuary, rice cultivation is the most important one. Fishing, the extractions of salt and woodcutting activities are done mostly by the rural population to generate extra income. Hence, economic and social stakes are involved in the exploitation of the Bay at the local, regional and national levels. From an environmental point of view, these activities contribute to the deforestation and the mangroves losing their ecological balance. Moreover, the hydroelectric dam of Garafiri, located upstream from the estuary, causes changes in salt concentration (Pig, 2003) with impacts on the distribution of resource exploitation in the bay.

Objectives of the study

There are some important environmental, social, economic and cultural issues in the Sangarea Bay, despite various attempts to improve the situation. Among these issues, there are

- environmental pressure put on the bay,
- population growth,
- decrease in the standards of living of the local population,
- new ecological changes since the start of the exploitation of the dam located upstream in 2000, and
- the lack of public participation in decision-making.

Such problems lead us to wonder: *How can a sustainable management system for the resources of the Sangarea Bay be set up?*

The sustainable development of the region should include elements such as equity among generations, democracy, participation and the co-evolution of natural and human systems. These values are ingrained in culture, society, history and territory. Keeping that in mind, we ask ourselves: *How can the local population become involved in the decision-making process?*

Integrating these values into resource management in the context of such a vulnerable environment requires specific tools like Strategic Environmental Assessment (SEA). According to Brown et al. (1999), SEA would be the tool including ecological, social, economic, and institutional dimensions allowing policymakers to develop policies, plans, and programs. Such assessment is based on the use of tools like multi-criteria analysis which helps decision makers by giving them the opportunity to make their decisions taking into account several relevant aspects and by involving the actors in the decision-making process. This study uses multi-criteria analysis called specifically Multi-Criteria Decision Aid (MCDA) to find sustainable resource management for the bay.

We have to make an important note here. The actors were not directly involved. We used the information we had on them and the input of local experts to play their role. We simulated what they would have responded if they had been involved in that process. Afterwards, the results were then presented to the actors in the field themselves to show them the use of SEA and to get some feedback regarding the use of MCDA in the Sangarea Bay. A secondary objective of the study was to see how MCDA could be best included in the field, basing ourselves on the comments made by the actors. Such improvements could then be done in that context. A final aspect was to stimulate more a global thinking about managing the Sangarea Bay.

Methodology

Strategic Environmental Assessment (SEA) can be applied in many ways since uses plans, programs and policies. The new perspective on environmental concerns introduced by multi-criteria and multi-scenarios analyses to environmental concerns makes it even more pertinent to use in this context (Côté et al, 2000). This new dimension is based on the fact that most actors should be involved in the process.

Indeed, resource use studies often generate contradictory results depending on the users involved. According to Schlaepfer (1997), multi-criteria methods are often recommended to reach agreement on the choice of the priorities. Vincke (1989) defines Multi-Criteria Decision Aid as an approach aiming at providing the proper tools to decision makers, so they can resolve the issue while taking into account contradictory points of view. Multi-criteria analysis ensures that actors are involved in the decision-making process in order to legitimize the decision and to ensure that they make decisions theirs (Risse, 2004).

This study applies multi-criteria analysis to the spatial domain. It analyses a set of resource use activities in the area of the Sangarea Bay in Guinea in order to find the best resource management option.

The methodological approach follows the steps below:

- *Identifying the actors*: the main people using and having an impact on the resources were identified from the data available through studies done within the framework of the planning project in the Dubréka mangroves. Then, they were split into categories based on their interests, the social or professional groups to which they belong as well as their spectrum of intervention (local or regional).
- *Identifying the criteria*: the stakes related to the mangrove in the bay were the basis to create a series of objectives. These objectives were then translated in terms of criteria. For each criterion, we identified some indicators to be measured in the area.
- *Identifying actions*: several management options were developed from the present management of the resources and other similar experiences found in the literature. They are not the only ones that could have been suitable for the study but they appeared to be the most adequate ones here.
- *Weighting of the criteria by the actors*: in a multi-criteria analysis, the criteria have to be validated by the actors. In this simulation, the members of the study group did this validation. Simultaneously, a measuring scale was assigned to each criterion, each scale going from 1 to 5, 1 being the least desirable and 5 the most desirable. The actors have a total of 100 points, which they can distribute however they wish, giving more points to the criteria that matter most to them. The weighting is the critical part where the researchers played the role of the actors by assigning a certain number of points for each criterion, depending on what they believed would have been the actors' choice.
- *Assessing the actions according to the criteria*: by assessing the actions, we can bring out the biophysical and human impacts by taking into account the criteria selected. This is a qualitative assessment because of the lack of quantitative data available. Nevertheless, it remains consistent with the tendencies observed in the field.
- *Developing the matrix of performance with the software Decision lab*: at this stage, the criteria, as weighted by the researchers, were put into the matrix of performance in the software *Decision lab 2000*. It is a software program designed to perform multi-criteria analyses and to rank actions according to the weight of the criteria and to the assessment of the actions
- *Analyzing the results*: *Decision Lab* contains the tools PROMETHEE and GAIA, which are different ways of visualizing the results.

PROMETHEE is a tool doing the ranking of the actions for each actor individually and also by group. This method uses positive or negative fluxes depending on arguments for or against that action. The ranking with PROMETHEE II considers only the global flux; it does only a partial ranking. On the other hand, PROMETHEE

It does a comprehensive ranking and compares positive and negative fluxes. It takes into account the situation where it may be impossible to compare two actions for various reasons. This would happen for instance when the difference between the positive and the negative fluxes is too small to be certain of a given ranking.

Decision Lab gives the possibility to have a three-dimensional representation of the matrix of performance called GAIA mapping. GAIA mapping for criteria allows us to visualize the position of the criteria or of the actions in comparison to the location of the desired solution, called “the axis.” Similarly, GAIA-scenario allows us to visualize the position of the actors in comparison to that same axis.

Presentation of the Results

Identification and Categorization of the Actors

The available data were used to identify the actors. More precisely, we used a report written about the identification of the right actors involved in the management of the bay, their roles and their perspectives and concerns (Diawara, 2000). We can break down the actors present in the area of the Sangarea Bay into two groups depending on their regional or local influences. The categories of actors identified are: social actors, economic actors, political and institutional actors, research groups and environmental services.

The following table presents the actors, their needs and interests as well as their area of influence.

Presentation of the Criteria

The analysis of the stakes allowed us to translate them into 22 criteria. In order to facilitate the study, we aggregated some of them and were left with only 10 criteria and split into three categories: environmental criteria, political and institutional criteria and socio-economic criteria.

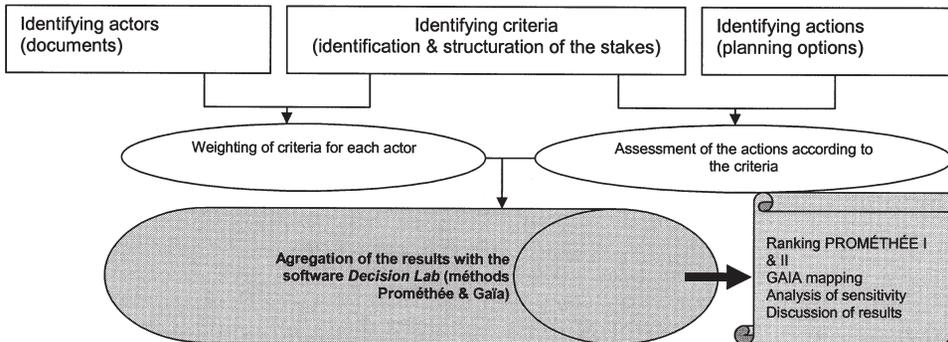
We may inform the reader that the criteria “SOC 1” includes the increase of the main production activities i.e. the increase of the yielding of rice, salt, wood and fishing.

Identifying Actions

We identified several actions according to the objectives and the various types of resource management in the Sangarea Bay. We limited ourselves to four actions in this study.

Mangrove Management System in the Bay of Sangareya. This action corresponds to the type of management that was attempted in the Bay in 1993 and that had to stop in 1999. We suppose here that it was never interrupted. It was developed by managers (top-down approach) and imposed onto the users without involving them in the conception of the project. This action aims at optimizing the mangrove use while maintaining the resources at a sustainable level. The project also includes, to a lesser extent, the exploitation of the other resources (rice, salt). Another pole of interest of this project is improving access to drinking water and implanting health

Figure 2
Visualizing the Simulation in Multi-Criteria Decision Aid



centers in the area. The project aims at enhancing the consciousness of the population to change their way of using resources, like foresting methods. It particularly targets foresters. Alternative exploitation techniques of the resources are introduced within the context of this project but their yield is much lower than the ones from traditional activities because of their focus on environmental protection. The success of this project depends upon a coercive application of it.

Status Quo. This is the current situation characterized by traditional activities to exploit resources that do not respect the environment. This corresponds to the situation before mangrove management system in 1993 and which was reinstalled in 1999. It plans zoning and reforestation activities, promoting silvicultural practices. It is geared towards foresters in particular, and does not consider other forms of resource exploitation.

Integrated Management of the Resources of the Bay. It is a new kind of approach to resource management based on public participation, finding a strategy to exploit resources rationally and mangrove conservation. MCDA would be one of the tools of this approach for example.

Establishing a Completely Protected Area. It implies establishing a protected marine area in the bay of Sangareya. Such approach would require to move part of the population living in the mangrove and to prohibit all exploitation activities. These activities would then be practiced at the outskirts of the mangrove. Within this approach, the population would be encouraged to go for ecotourism activities instead.

The Performance Matrix

The performance matrix created through the software *Decision Lab 2000*, are made of individual tables reflecting the actors' value judgment for each criteria (weighting of the criteria). These matrices allow us to take into account the perceptions and concerns of the various actors while making a decision. These are the steps followed: attributing a weight to the criteria, defining the preference functions, and assessing the actions according to the criteria.

Weighting the Criteria. We simulated the opinion of the actors by using the data available describing them and their perceptions. We allocate a total of 100 points

Table 1
Table Showing the Actors Present in Sangarea Bay

Actor Category	Composition	Needs and Interests	Geographical Area of Influence
Social Actors	<ul style="list-style-type: none"> - Village associations - Village committee 	<ul style="list-style-type: none"> - Maintain the exploitation of resources - Improve production to increase commerce and local consumption - Maintain sustainable level of resources 	<ul style="list-style-type: none"> - Local
Economic Actors	<ul style="list-style-type: none"> - Economic groups - Entrepreneurs 	<ul style="list-style-type: none"> - Improve economic productivity - Maximize profits 	<ul style="list-style-type: none"> - Local - Regional
Political Actors	<ul style="list-style-type: none"> - Local elected authorities - Prefectures (prefect and under-prefect) 	<ul style="list-style-type: none"> - Fight against poverty - Maintain social balance - Maintain the flow of goods and services to Conakry - Attract funding to develop the area 	<ul style="list-style-type: none"> - Local - Regional
Research Groups	<ul style="list-style-type: none"> - Technical government services - Research institutes - NGOs - Project organizations 	<ul style="list-style-type: none"> - Protect natural resources - Find alternative solutions - Provide technical support - Help to use resources in a sustainable way - Find funding - Increase knowledge of the area 	<ul style="list-style-type: none"> - Local - Regional
Environmental Services	<ul style="list-style-type: none"> - Tourist services - International Institutions - NGOs - Environmental departments 	<ul style="list-style-type: none"> - Decrease human pressure on the environment - Protect rare species in their natural habitats - Bring awareness to the population about environmental issues 	<ul style="list-style-type: none"> - Local - Regional - International

Table 5.2 shows the criteria included in each category.

Table 2
List of the Criteria Used for the Comparative Assessment

Category	Criteria
Environmental Criteria (ENV)	<ul style="list-style-type: none"> • Threat to the spawning areas and decrease of the fishing stocks (ENV 1) • Decrease in water quality (ENV 2) • Deterioration of the fauna and the flora (ENV 3)
Political and Institutional Criteria (POL)	<ul style="list-style-type: none"> • Reinforcement of the organizational abilities and dynamics (POL 1) • Land regime and zoning plan (POL 2) • Changes to the institutional and regulatory framework (POL 3)
Socio-Economic Criteria (SOC)	<ul style="list-style-type: none"> • Production increase (SOC 1) • Decrease in farmable land (SOC 2) • Population displacement (SOC 3) • Improvement of local living conditions (SOC 4)

between the criteria depending on their importance. Table 3 summarizes the distribution.

Assessing the Actions. This is a comparative assessment of the actions according to the criteria. Since we did not have any quantitative data, we assessed the actions qualitatively. Nevertheless, the assessment was still based on knowing both the positive and negative impacts of the activities planned in each scenario.

Ranking the Actions with PROMETHEE I and II: Individual Ranking

For this study, we will limit ourselves to the ranking with PROMETHEE I because it shows when two actions are not comparable. The analysis with PROMETHEE of the ranking made by the social actors confirms a clear dominance of the action of “integrated management”; the actions “mangrove management system” and “status quo” are at the second and third place. The least desirable option is “Completely protected area.” For the political actors, the action “integrated management” is at the top of the list as well. This time around, the action “Completely protected area” is ranked second, before the “status quo” at the bottom of the list.

Unlike the other actors, environmental services give much more weight to the action “completely protected area.” This action is at the top of their list. Then comes the action “Integrated management.”

For the Research groups the action “integrated management” is favored as well. The action “completely protected area” comes second.

Table 3
Weighting of the Criteria According to the Information about the Actors

Actor Category	Environmental Criteria			Socioeconomic Criteria				Institutional Criteria		
	ENV 1	ENV 2	ENV 3	SOC 1	SOC 2	SOC 3	SOC 4	POL 1	POL 2	POL 3
Social Actors	15	5	10	15	10	10	15	8	7	5
Economic Actors	4	2	4	30	20	10	10	6	7	7
Political and Institutional Actors	10	5	10	5	5	10	15	10	15	15
Research Groups	15	15	20	10	10	3	7	10	5	5
Environmental Services	20	20	30	2	6	4	8	4	3	3
Total	64	47	74	62	51	37	55	38	37	35

Multi-Scenario Analysis: Group Ranking

Decision lab gives us several options to present the results, which facilitate the understanding of the links between the scenarios. Here, we will use the analysis of PROMETHEE I, GAIA mapping and the comparison of rankings when comparing two actors to each other. For that one, we limit ourselves to comparing the social actors with the economic actors on the one hand; and the economic actors with the environmental services on the other hand.

The analysis of PROMETHEE I (Figure 3) show that the actions “Completely protected area” and “mangrove management system” are incompatible. The action “status quo” comes last.

As far as GAIA mapping goes, Figures 4 and 6 show an important gap between the choice of the local actors (economic and social actors) and the environmental services. The two other categories of actors are in agreement with each other. On Figure 5, it appears that the major criteria are the environmental criteria and the socioeconomic criteria. We can see a certain opposition between them simultaneously as shown by their location in comparison to the -axis. The action “Integrated management” gives high scores with both sets of criteria as well as for the institutional criteria (public participation), which would explain why all the actors prefer it. The actions “Completely protected area” and “Mangrove management system” have high scores respectively for the environmental criteria and for the socioeconomic criteria, which oppose each other.

Finally, the multi-scenario comparison between the social actors and the economic actors shows how they produce the same ranking. This tendency can be explained by the fact that they are both local actors, with similar interests. The social actors seem to be in opposition with the environmental services, which consider the “Completely protected area” action to be more desirable while it is the least desirable for the social actors.

Figure 4
Group Ranking with PROMOETHEE I

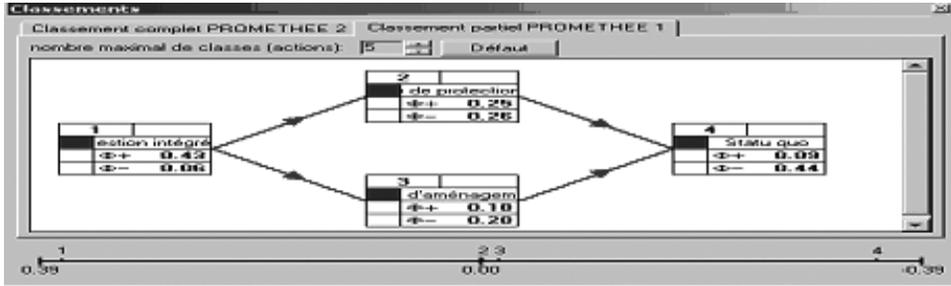


Figure 5
Gaia Mapping—The Scenarios

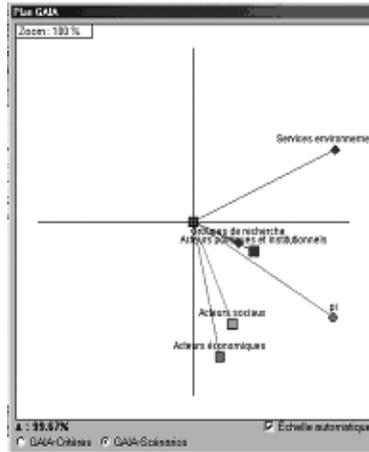


Figure 6
Gaia Mapping—The Criteria

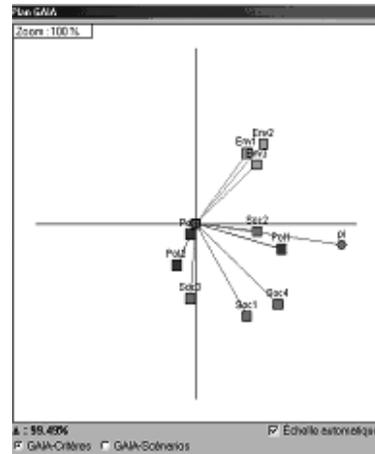
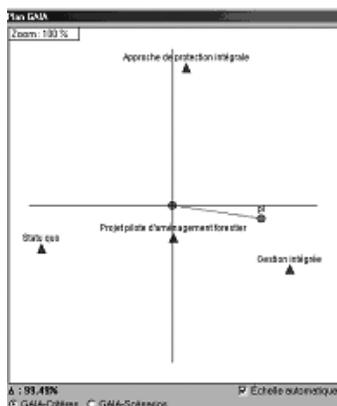


Figure 7
Presenting the Actions



Discussion of the Results of the Simulation

The sensitivity analysis allows us to see how we can change the ranking of the actions by changing the weights given to the criteria. It is a way to materialize the negotiations that would take place between actors to reach a consensus.

Consequently, the more we increase the weight of the environmental criteria, the more desirable becomes the action “completely protected area.” On the contrary, increasing the weight of the socioeconomic criteria makes the actions “integrated management” and “mangrove management system” more desirable (first and second place). This could explain why taking into account the main preoccupation of the local actors i.e., increasing production, would happen more through “integrated management” than through the other types of management. If we increase the weight of the criteria “Population displacement” and “Land tenure,” the action “status quo” becomes more desirable compared to the other ones for the social, socioeconomic actors and the research groups. Finally, increasing the weight of the single criteria “Reinforcement of the organizational abilities and dynamic” favors “Integrated management.”

The conflicting characteristics between the environmental and the socioeconomic criteria could be explained by the fact that on the one hand exploiting natural resources is vital for the local population and on the other, preserving the environment is essential due to its growing vulnerability to that population use.

The ranking reveals that the actors as a group prefer “Integrated management.” We must admit that this action still shows limitations since it is based on a representative democracy, and such element may not always be present or realistic, especially in the African context.

Generally, the action we chose remains a subjective choice considering the fact that the study was not done directly by the actors. These actions might not be that appropriate in the real situation. We could make up another action combining “integrated management” with “completely protected area.” It would be interesting to confront the results of the simulation with the ones obtained in the real situation in order to see the usefulness of such a tool when there is no possibility to go in the field for example.

Besides, we have to keep in mind that these results are not the final decision but only one of the elements used by the decision-makers.

One of the caveats against this study is the representativeness of the actors. It is difficult to know whether the people participating in the process truly give the value of the people they represent. This is only more so since the existence of a democratic process is not always evident, especially in the African context.

We should finally note that multi-criteria analyses are difficult to establish with local populations since such processes last long and people involved have to ensure all participants understand the process, criteria and actions.

Reactions

Methodological Steps for Providing Feedback to the Actors

As we mentioned earlier, the results from this simulation were given to the actors in the field in order to get some feedback. This was done in the following fashion.

In Guinea, some of our researchers presented the results. All the actors were invited to a three-day workshop during which we explained to them the methodology used and the case study. We split them up in working groups to get their inputs on what we did “on their behalf.”

Each of these subgroups made an inventory of the actors they thought were involved in the area as well as the major issues at stake. All the results were brought together and discussed by all the actors back together.

The objective of this inventory was to compare the results from the actors in the field to the results the researchers came up in their simulation.

Table 4 indicates the category and the role of the actors present for the workshop.

Feedbacks of the Actors during the Workshop

Positive Feedback. The actors in the field found that they as well as the issues at stake were well represented and well defined in this research.

The actors liked the fact that AMCD included public participation and a systemic perception (ecological, economic, social etc.). Moreover, they believed it allowed for a more global thinking on the issue at stake and gave results which were visually easier to understand facilitating the generation of consensus.

They thought it would be interesting to explore further the various scenario alternatives proposed in the research in order to find an appropriate management of the area. The results well reflect the conflict of interest existing between local actors and the organizations aiming at protecting the environment. To the actors present, it is a fact that local populations depend entirely on environmental resources. These same resources are vulnerable and overexploited. Such conflict explains the opposition between the criteria “income increase” and “environmental degradation.”

Negative Feedback. The study lacked cultural criteria including elements such as traditional ecological knowledge, and their possible loss within the framework of some of the scenarios.

Similarly, there should have been a better focus on the ‘cultural heritage’ of the forests, especially regarding their importance in traditions and the consequences

Table 4
Actors Present at the Workshop in Conakry (Guinea)

Actor	Category	Role
Representative of the Ministry of the Environment	Environmental services	Management and conservation of the environment
Agritage	NGO	Work on the management of natural resources in coastal areas
Centre d'étude de recherche en environnement de l'université Conakry (CÉRE)	Environmental experts	Institution dedicated to environmental teaching and research
Projet Mangrove de Dubréka	Environmental services	In charge of establishing and applying the mangrove management system
Technical advisor of the union of the producers of Dubréka	Economic actor (local)	Peasant organization in charge of coordinating natural resources users in the bay
Univers-Sel	International NGO	In charge of spreading alternative methods of salt extraction and rice cultivation.
Direction nationale de la conservation et de la nature	Government (political actor)	In charge of managing mangroves
Centre nationale des sciences halieutiques de Boussoura (CNSHAB)	Environmental experts	Research on fishery and peasant organization in the Dubréka area
Électricité de Guinée	Economic actors (regional)	In charge of producing electricity, and of hydroelectric dams upstream from the bay

of their loss to the cultural heritage of the area. Moreover, the people representing the actors can bias the results. Finally, the research team and the actors themselves found it difficult to properly categorize the actors since some of them can fit into several categories simultaneously. Hence, that could have led to certain confusion among the actors.

Suggestions of the Actors. There must be a homogenous understanding of all the criteria on a semantic level, since each actor can understand them differently. Hence, an information session regrouping all the actors should be included in order for them to discuss and define a common meaning for the criteria.

This method requires all the actors to receive a previous course on how the process works and on how to include their inputs.

In order to improve the representiveness of actors, they suggest having a focus group to identify the concerns linked to the category of the actors. The person

representing them thereafter would then put such concerns forward. They further propose a negotiation table. This was done in other studies funded by the IUCN in which negotiation was combined with multi-criteria analysis. This study took place in a similar, in the countries of Burkina Faso, Niger, and Benin for a similar type of environmental related project. This research was very useful because it led the negotiation table to help design another scenario including all the strong points from the other scenario they had seen. Hence the suggestion from the actors, coupled by empirical evidence demonstrating that this is definitely a viable solution.

Conclusion

This analysis brings out a major element, the general consensus towards the action “integrated management.” We can also see that the action “mangrove management system” would have not been the actors’ first choice had they been involved in the decision-making process. Hence, the results show the failure of the *top down* decision-making approach. It shows the importance of public participation in the choice of the resource management options and in the conservation of the mangrove ecosystem, because in the field, the population would decide on what to implement.

The fact that “Forest planning project” and “completely protected area” are not compatible, illustrates the contradiction between local actors (social and economic actors) and environmental services. In practice, it means that local populations do not really want to have limited access to resources or to be forced to move. Nevertheless, we can mention that the institutional and political actors tend to be more moderate on the subject.

The objective of the MCDA is not to find the ideal solution. It is more about giving a maximum of information to the decision-maker to help him in making his choice. Finding the best management option could then be to combine the strong points of the actions analyzed. For that, including economic, social, and ecological elements allows for an increased set of choices. In this case, the actors suggested a negotiation table. Despite that, MCDA still has its limitations, such as the fact that it may be too difficult to properly represent actors, or to weigh criteria. These two aspects are inherently subjective, in the absence of specific quantitative data, and that may give rise to numerous conflicts. These difficulties can be reduced to some extent by insuring the presence of the actors and their approval of the people representing them. The actors suggested having even more than one representative for one category to reduce such bias. The follow-up with the actors showed that they were all very interested in multi-criteria analysis. However, efforts are definitely necessary to include this tool better in the reality of the field. Such necessities came out during that same follow-up. The results pointed to the complexity linked with resource management in the Sangarea Bay and the potential use of multi-criteria analysis to find solutions.

The intercultural issue was omnipresent and implicit throughout the research due to the fact that the research was mostly a western-based tool applied to the African context. The results from the research as well as the feedback from the actors reveal that it was feasible. Besides, the suggestions from the actors were very appropriate to reduce the difficulties linked to participatory democracy in Africa, like the difficulty for the people with power to share it. It shows their awareness of the problem and

the willingness to resolve it.

On a different note, the primary results from this research will be used to carry out a project using the same approach in the Nimba Mountains in Guinea. That project will be done within the framework of the Biodiversity Convention. Part of our research team will take part to it in order to increase the potential use of multi-criteria analysis.

As we tried to remind all along this paper, the research was based on researchers' input followed by feedback from the actors in the field. Despite the constraints of multi-criteria analysis, the results obtained were very encouraging to pursue this approach in Africa. The research in the Nimba Mountains will certainly be a step forward to increase the suitability of MCDA in this part of the world.

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