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## Finding common ground in land use conflicts using PGIS: lessons from Ghana

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### Introduction

Participatory Geographic Information System (PGIS) applications can equip community-based organisations with tools for structuring resource management practice to make it open and iterative. However, the support for public involvement has opened up the process to conflicts. The participatory approach makes it possible for conflicting perspectives to be integrated.

As communities come together to try to pursue common goals, conflict over resources has greatly increased. This is partly because with forest-based resources, the actions of one group (e.g. farmers) can create unforeseen impacts on other groups (e.g. loggers). Resource scarcity caused by a rapid environmental change or unequal resource allocation can increase demand and so create conflicts. As PGIS applications become more widespread in rural development, the effective and peaceful management of local resources depends on the ability to identify conflicts and adopt strategies that prevent disagreements from becoming intractable disputes.

But can the interests that drive resource conflicts be addressed by PGIS applications? Can Geographic Information Systems (GIS) and related spatial technologies help stakeholders resolve resource conflicts? This article describes a GIS-based strategy for managing land use conflicts using a

case study from Ghana to illustrate the methodology. It includes practical ways that PGIS applications can be adopted to promote consensus building.

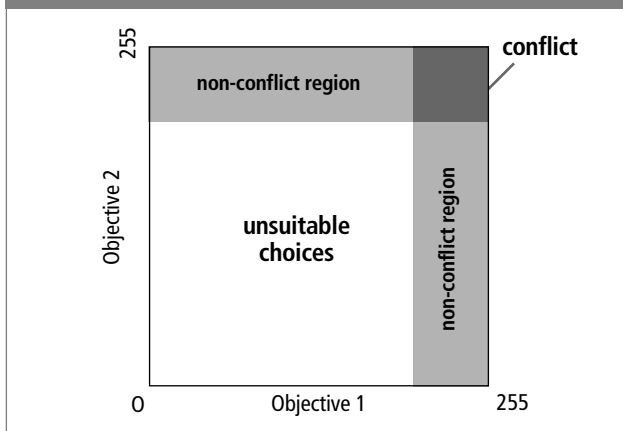
### Conflict and social interaction

A conflict involves at least two parties who have a mutual problem of (e.g. resource scarcity). Often in a conflict there is behaviour (or a threat of action) designed to control or gain at another party's expense (Steele, 1976). If left unresolved, the disagreement can generate disharmony and in extreme cases, cause a complete breakdown of the social organisation. But if the conflict is managed in a timely way, it can lead to long-term peace and cooperation among the disputants.

In a non-violent situation, conflict can be a positive force for social change. The absence of conflict in a local organisation would probably suggest that some members are being suppressed, or subordinating their views or wishes to others.

A conflict can reveal potential disagreements amongst members of a local PGIS organisation. But it can also be used to encourage amicable resolution. Conflicts have additional benefits for group cohesion. Resolving disputes can give rise to new rules of engagement and institutions that might not only help govern group behaviour, but could also be used to resolve further conflicts. Group cohesion is often strengthened when a conflict provides a safety valve to clear pent up feelings – in a less destructive manner than might otherwise

**Figure 1: The multi-dimensional decision space of a land use conflict**



have occurred without the conflict. So conflict is not always the opposite of cooperation: a conflict can be transformed into a positive force to assist mediation efforts.

### GIS and conflict management

The need for GIS capabilities to develop strategies for managing land use conflicts has arguably never been greater than today. Conflicts of interests threaten resource institutions throughout the developing world. But the use of maps to facilitate consensus building is not new. Community development shows a long history of using maps in negotiations and in resolving conflicts. When the making of community maps is automated as is done in a GIS, one is able to create more complex maps and also update existing maps more rapidly and consistently than before. If it is applied creatively, the GIS technology can facilitate the resolution of resource conflicts. PGIS applications can support cooperative approaches to conflict through the analysis of maps and by emphasising mutual relationships and common interests, and cultivating shared interests between parties.

At times, parties take a more competitive approach to using PGIS. For example, a resource shortage can compel groups in a community to focus entirely on their own means of survival and their own self-interests and values. But in many communities, opposing groups often find it necessary to make adjustments in their values to maintain cordial relationships between them. So conflict management can be seen as an effort to manage a tension between the move to create joint values and find middle ground, and the urge to claim independent rewards. When conflict is seen in this light, communication between stakeholders becomes necessary for

### Box 1: Using GIS to create multi-dimensional decision spaces

Explaining the educational role of GIS in decision-making, Eastman and others (1993) describe a multi-dimensional decision space. This is where two conflicting interests form opposite axes (see Figure 1). To resolve conflicting interests, the authors rank criterion scores in two suitability maps and then allocate them according to an objective scale ranging from 0-255. As the figure shows, dividing up the decision space among the two competing objectives produces four main regions. These include:

- an area selected for objective one only and hence **non-conflicting**;
- an area selected for objective two only and hence **non-conflicting**;
- a sizeable area not selected by either objective (**unsuitable choice**); and
- an area selected by both objectives one and hence in dispute (**conflict zone**).

negotiating joint values. GIS applications can help to facilitate the formation of strategic alliances that could help resolve disagreements.

### Practical GIS contributions to mediation

A mediator can use GIS to help change different stakeholders' attitudes towards each other. This might pave the way for conflict resolution. A PGIS application can help break down communication barriers and minimise the psychological and emotional pressures that hinder stakeholders' free expression of their viewpoints. For example, the technology can be applied to create opportunities for stakeholders to jointly collect and analyse data, share resources, and exchange ideas about a conflict condition. PGIS applications have the added advantage of providing a record of the mediation process that can be conveniently replicated, stored and shared with all stakeholders. So, if used effectively in the mediation process, GIS technology and applications can promote discussions that may lead to a deeper understanding of the conflict situation and help prepare stakeholders for a mutual agreement.

A PGIS expert might use the technology to influence stakeholders' attitudes and behaviour in different ways. For example:

- an educational tool to show how the technology can help stakeholders learn about the conflict;
- to motivate the parties to consider each others' demands more favourably;
- undertake an institution building process intended to foster cooperation between stakeholders; and
- by helping to transform stakeholders' interests into values that support the final resolution of the dispute.

### Experiences from Kofiase, Southern Ghana

Here I describe how GIS was adopted to mediate a conflict between local groups competing for access to local forest resources in Ghana.

#### Using GIS as an educational tool

PGIS can be used to create awareness about a conflict situation. The GIS applications can help stakeholders get past the preconceptions they bring to a mediation process, and learn to understand each other's perspectives to facilitate consensus building. This was the case in a conflict management project which I organised among groups competing for forest resources in a village in Southern Ghana (Kyem, 2003).

Ghana's forests were originally preserved to meet the future demand for wood in the country. But the forest later became the main source of capital for economic development. Recently, dwindling food resources in the forest communities has increased competition for the scarce forest resources. One area is Kofiase in the Ashanti Region. When a local businessman attempted to log the timber in a local forest, some inhabitants of the community opposed him. Sustained opposition to the logging caused a rift between the town's inhabitants. Some supported the venture and some wanted to preserve the partly degraded forest to protect the resources that formed the backbone of the local economy.

While working on ways to facilitate collaboration between forestry officials and the people of Kofiase to prepare them for joint rehabilitation of the local Aboma forest, I became aware of the disagreement and decided to attempt a resolution of the conflict using GIS (see Box 1 and Figure 1).

After meeting representatives of the two sides to secure their consent for the project, I organised a meeting for the parties. At this meeting, representatives of the two interest groups articulated their demands and decided on conditions that would fulfil their goals in the mediation. Two competing demands were outlined:

- a request to preserve the partly degraded Aboma forest reserve and its resources; and
- a demand to log the timber that remained in the forest.

After further discussions with the parties, we identified some criterion factors for generating maps. The factors included:

- roads that led to the forest;
- towns and villages near the forest;
- a slope map of the forest land;
- a land cover map of the forest;
- a map of the timber resources;
- a map of the forest showing streams; and

Figure 2: Best 350 hectares for logging in the Aboma Forest Reserve

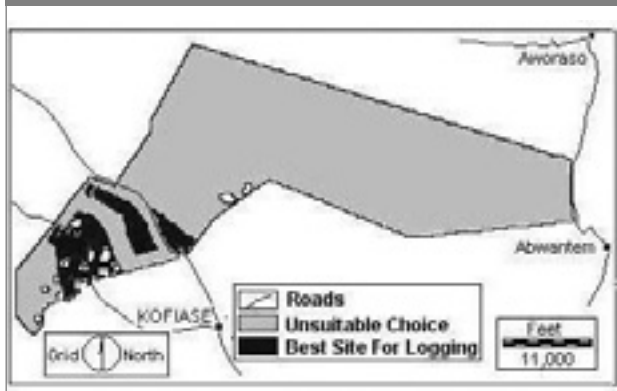


Figure 3: Best 400 Hectares for Preservation in the Aboma Forest Reserve

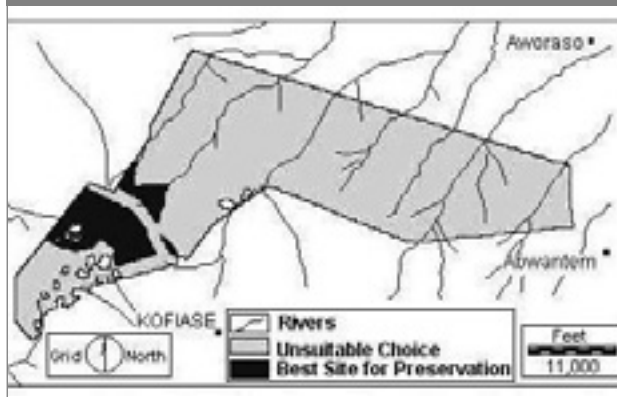
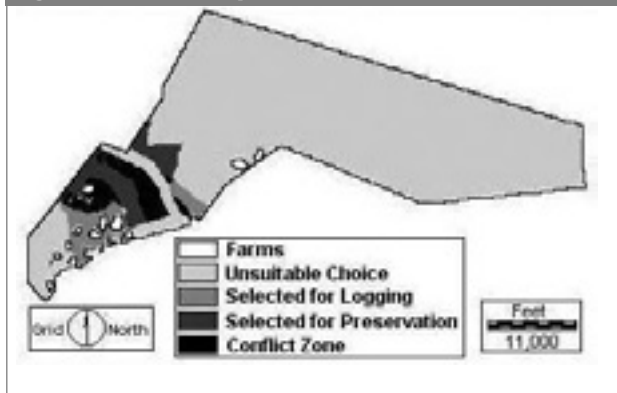


Figure 4: Conflict Map; Aboma Forest Reserve



- a map of private farms within the forest reserve.

The factors were digitised from official maps of the forest and processed in the GIS to produce the criterion maps. We then analysed the criterion maps using GIS to create suit-

ability maps for logging (Figure 2) and forest preservation (Figure 3).

The two suitability maps represented demands to log and preserve the local forest. Borrowing from the multi-dimensional decision space concept explained in Figure 1, we ranked the criterion scores in the two suitability maps and then combined the two maps to create a conflict map (Figure 4).

After that I used the conflict map to facilitate discussions between the stakeholders. First, we used the conflict map to identify the conflict zone as well as areas of opportunity for maximising joint gains within the forest. We visited the forest to confirm the divisions revealed in the conflict map. As shown in Figure 4, a large portion of the forest was out of the competition because it was unsuitable for the two preferred activities. The parties' interests rather overlapped at the southwestern portion where timber (as well as several non-timber forest products) was found. Often in land use conflicts, only a small portion of the land will be involved in a dispute. Yet this is rarely recognised and might hardly ever be noticed in a non-GIS environment.

In further discussions using the conflict map, I was able to shift the stakeholders' attention from deadlocked positions onto specific zones in the forest where their interests overlapped. The stakeholders were also able to find out on their own the impact that their demands on the forest had on each other's interests. Finally, I took the parties through a mapping exercise that focused on different scenarios for resolving the conflict through trade offs. The trade off was done by combining the two suitability maps in different ways to create new conflict maps in which some high criterion scores in one map were substituted for some low scores in the other suitability map. This exercise presented different ways for resolving the conflict through consensus. It also opened new paths for the amicable resolution of the dispute.

### Using GIS as a motivational tool

The right motivation can prompt stakeholders to take actions that can facilitate the resolution of a conflict. In Kofiase, I realised from the beginning that the disputed forest resources were threatened by wildfire and by chainsaw operators in the area. So I worked with the parties to create a risk map that revealed potential hazards that could strike the forest resources if they prolonged the conflict. This revelation, coupled with memories of previous wildfire damages to the forest, caused some stakeholders to reconsider their demands and to agree to work to protect the forest.

Later, we used GIS to create maps that revealed the

impact that each group's demand could have on the livelihood needs of the other group and on the forest resources in general. The parties also worked on the potential impacts that wildfires and the activities of chainsaw operators could have on resources being demanded by the stakeholders.

Through such GIS analyses and map displays, the stakeholders were able to recognise for themselves how a prolonged conflict could jeopardise the interests of their opponents as well as their own long-term interests in the forest. It was clear from the degree of cooperation between the parties after the project that the PGIS applications had a great impact on stakeholders' understanding of the conflict situation. As such the parties agreed to compromise on some issues that divided them. Soon after the project therefore, the chief and elders of the town were able to bring the parties together for the final resolution of the conflict even though their earlier attempts failed to end the dispute.

### Institution building using GIS

GIS-based conflict management strategies bring different groups together to collect data and process them. Joint visits to sites and group participation in PGIS exercises encourages stakeholders to develop trust, cordial relations and friendships between them. In Kofiase, I observed that the GIS applications promoted mutual trust and the open exchange of ideas. These friendships can later become the building blocks for collaboration and a foundation for building compromise solutions.

### Realigning interests that sustain conflict

The most promising – and very difficult – task I encountered in Kofiase was resolving the basic value differences that sustained the dispute. Although stakeholders retained different views about the conflict, their varied perspectives had to be reconciled before the dispute could finally be resolved. It took a long time for the disagreement between the parties in Kofiase to be resolved completely. The GIS applications were important but several other factors also contributed. For example, advice and exhortations by the local chief and heads of the various clans in the town played a very important role. Also, the town's inhabitants realised that the conflict was making it difficult for them to cooperate and work together on development projects that benefited all of them.

### Conclusion and ways forward

In matters of land use conflicts, the cooperative and competitive forces that drive a conflict are present and intertwined. When we see a conflict from this perspective, GIS applications can help stakeholders explore the conflict situation, by

learning more about the conflict, building respect and cooperation between them, and preparing them for a mutual agreement.

PGIS applications can be beneficial in mediation but there is a need for caution about the limitations of GIS. Far from being a perfect interventionist tool, GIS technology is subject to some restraining factors. For example, the brightly coloured GIS maps produced for group discussions can distract stakeholders' values. They can obscure, rather than illuminate, the true basis of their decisions. Unfamiliarity with computers (as we observed in Kofiase) can also restrict fair and open discussions. As a result, PGIS applications alone might not bring a conflict to a final resolution. Several factors unrelated to the PGIS applications also exert an influence on the choices stakeholders make to resolve or intensify a conflict. For example, in Kofiase, the advice and exhortations from leaders in the community played an important role in the final resolution of the conflict. As a result, if the conflict resolution is based entirely on PGIS applications, some valuable voices may be filtered out. Or alternative representations that might be crucial for a successful outcome might be excluded.

But these problems with PGIS applications do not have to limit the proven capabilities of the technology in facilitating mediation efforts. Practitioners should be vigilant, resourceful and innovative in their use of GIS as a tool for intervention.

As land use conflicts intensify and demands for participatory decision-making in resource management increases, many resource managers will resort to PGIS applications for solutions. Unfortunately, many of today's GIS software applications are not suitable for use in conflict management projects. In part, this is because they do not have procedures for handling the subjective preferences of stakeholders. Creating a supportive environment for managing resource conflicts does not only require funds and computer hardware enhancements. Most importantly, simple GIS procedures are needed to effectively involve all stakeholders in the decision-making process. To make such decision support tools effective and easy to use by resource managers in communities throughout the developing world, the procedures must be iterative, simple, and easy to use. Appropriate GIS procedures can be designed to support the drive to create opportunities for public participation and the management of resource conflicts in local communities.

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