BOUNDARY CONFLICT RESOLUTION THROUGH THE SPATIAL ANALYSIS OF SOCIAL, COMMERCIAL AND CULTURAL INTERACTION OF PEOPLE LEAVING ALONG BOUNDARY AREA

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Key words:

ABSTRACT

Most of the time, boundary conflicts have been solved by identifying some natural features as a means of landmark, in some other cases however, large beacons which are of geodetic accuracy are set out for boundary demarcation which have so far not solve all the boundary conflict problems.

But in present days, in spite of the presence of visible landmarks, conflicts still arise as to who owns a part of a landmass. This kind of problems are usually noticed between large geographical settlement e.g. cities, countries, state etc. Recently, Nigeria has experienced a lot problem on boundary conflicts even in some cases where there are visible landmarks. For example a case of Bakassi peninsula which is a boundary conflict between Nigeria and Cameroon. In this case, in spite the presence of visible landmark, there is a conflict to who owns the peninsula.

This paper has however explain and analyze how this kind of problem can be solved through the spatial analysis of the extent of interaction of people leaving along the boundary region in terms of language, social life, commerce and culture. This is achieved by super imposing themes of overlapping area of relationships along the boundary area. After which analysis that involves extent of belongings in terms of land area are measured and compared in order to get the best demarcation line for such conflicting area. Fuzzy techniques were also used to support the decision-making.

This approach if used will solve most of the problems arising in these present days Africa due to unsatisfactory use of visible landmarks.

INTRODUCTION

Boundary conflicts in most part of the world develop most of the time to endless war that only time could solve. The case of boundary conflict between Eritrea and Ethiopia still looms and several lives have been lost. A case could also be sited of the boundary conflict between Nigeria and Cameroon. This problem still remains unsolved and seeking for attention from interested people or body.

By using the area of intersection as the guidance for routing boundary lines, the problems associated with boundary conflicts arising as a result of visible natural or man made features could be avoided.

For several years people living in the same geographic area had lived without demarcation of boundaries and they were satisfied. But with the advent of colonialism, especially in Africa, land demarcation now brings about disorderliness in the existing land identification format. This format most of the time was due to the extent of some abstract factors like the social relationships, cultural relationships, extent of spread of language and commercial interaction.

Base on the factors listed in the previous paragraph, a more acceptable landmark can be created by either using positional data collected from the field or by using already existing data. This data includes; the GPS position of the center point of villages under consideration, the extent to which various abstract factors mentioned above are noticed. In order to derive the extent of relationship there is a need to identify the villages surrounding the village under consideration, which have the factors.

Fuzzy arithmetic is now used to get the best radius, which represents the various extents shown by the villages around the village under consideration. The operation of determining the best radius of extent is repeated for all the villages on either side of the boundary line. The criteria for determining which village to choose depend on the extent to which the conflict spread. Case of boundary conflict between Akwa-Ibom and Cross River, Nigeria is used as illustration.

The intersection of the themes of abstract factors shows area with common interest base on the factor. A lot of geo-processing was carried out. This geo-processing was carried out mainly to determine intersection between themes of the same and of different factors. The result of this intersection was now used to generate a new boundary line for the conflicting states.

Representation of Social, Cultural or Commercial Relationship with Buffer Zone

The relationship or extent of inter-relationship within or between village(s) along the border lines are definite with respect to villages a specific factor, the extent can be measured in terms of linear distances. These distances can later be used to generate the area covered by the radius of extent.
In this paper, a buffer zone whose radius, r, from the center of the village is related to the extent of spread of the relationship, $R_{E,}$ (i.e. cultural, commercial or social relationship) are used to represent the area covered by a factor.

That is;
$R_E = f(r)$ (i.e. Extent of spread of relationship is a function of radius of extent)
where R_E = Extent of relationship
r = maximum distance of relationship away from the center of the village

Fig. 1 shows a central village, which represent a village whose extent of spread of a factor like language is being considered. If a, b and c are neighboring villages where the language spoken in the central village is noticed, then there is a need to get a common distance (or average) distance to represent a buffer of spread of the Language factor. For areas with equal spread or constant radius of spread of the relationship, the radius, r can easily be adopted.

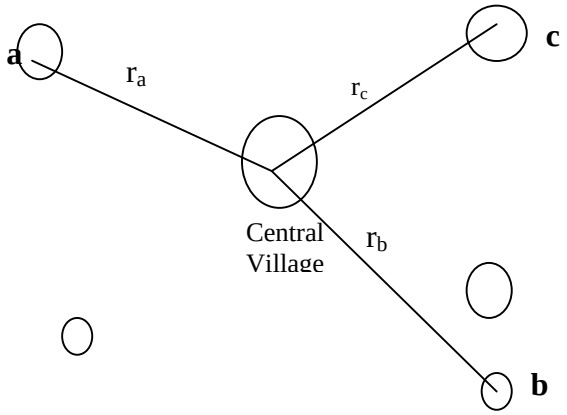


Fig: 1

a, b and c are villages around the central village which is the village under consideration. If r_a , r_b and r_c are equal, then $r = r_a = r_b = r_a$ can be used in the estimation of the extent of cover of relationship.

In some other the situations, a constant radius, r, cannot be used to represent the buffer for a particular factor. For cases like this, the a common radius of the extent of a factor is gotten by simply defining the arithmetic addition of the finite interval of the buffer zones of adjacent villages (e.g. A and B as shown in Fig: 2) on opposite side of the central village. For a better analysis, the selection of adjacent villages must be based on polar distribution of radius around the location under consideration.

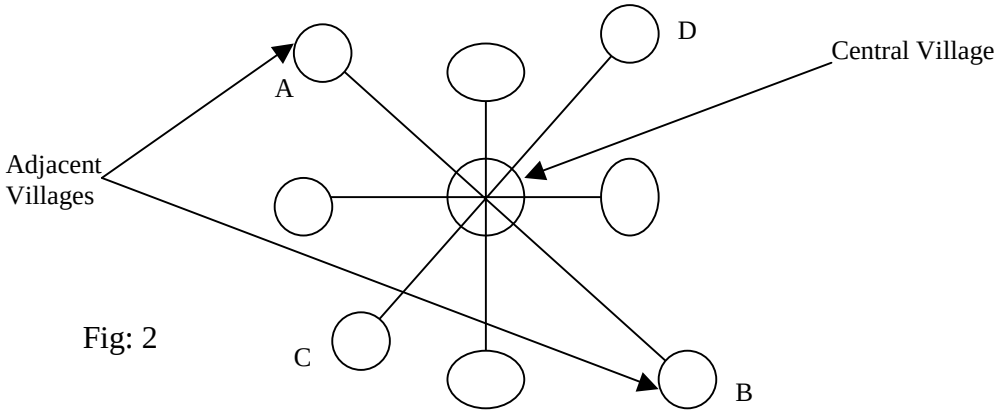


Fig: 2

A, B, C, and D are villages separated by varying distance r_a, r_b, r_c and r_d respectively from the settlement under consideration.

The extent of spread of relationship R_E, which is a function of the radius of extent, can be expressed for individual neighboring villages as follows:

And R_E for a = f (r_a) Buffer zone due to village a

R_E for b = f (r_b) Buffer zone due to village b

R_E for n = f (r_n) Buffer zone due to village n

The center of the villages' represents the origin of set of real numbers (distances), which extends outwards in all direction to the centers of the neighboring villages. The activities spread out from the center outward. The relationship away from the center of the village can be represented thus:

$$R_E(r) = \begin{cases} (a-c)e/(a-b) & \text{when } a \leq x \leq b \\ e & \text{when } b \leq x \leq c \\ (d-x)e/(a-c) & \text{when } c \leq x \leq d \\ 0 & \text{ortherwise} \end{cases}$$

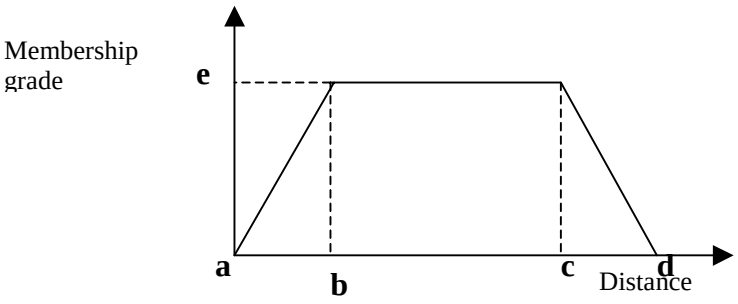


Fig: 3

The fig: 3 above show a trapezoidal membership function where distance ab, may be equal or may not be equal to the distance, cd, in this consideration. The distance ab and cd represent the distance of the farthest and closest village in which the cultural, social or commercial activity in the village under consideration is noticed. 'bc' represents the average diameter of the village under consideration (as shown in Fig: 4 below).

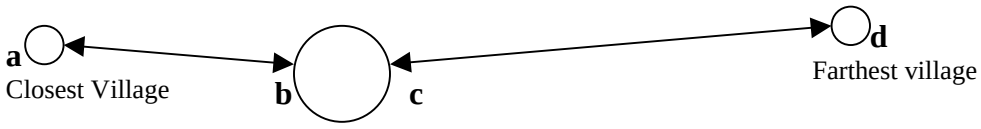


Fig: 4

But since the radius of interaction varies around the settlement, it would be better to define the villages around the settlement in a regular order.

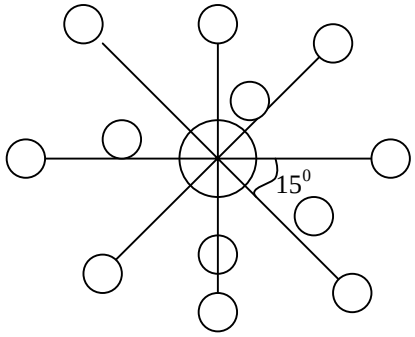


Fig: 5

Assuming we have scattered relationship about the village as shown in the diagram above (the circles represent settlement around one of the border village under consideration), then there will be more trapezoidal representation of membership function (i.e. Fig: 3) to be analyzed. But for the purpose of simplicity, an angle of 15, 30 or 45 degrees could be define between the radial lines (shown in Fig: 5) depending on how critical the boundary conflict is.

If diameter is classified into 12 intervals of 15^0 there will be 12 diameters to consider. That is there will be 12 membership functions to make decision on.

i.e. R^{E0} , R^{E15}, R^{E45},…….. , R^{E360}

Now to get the closest and the farthest distance from the village or location, consider villages A, B, C and D; there distances in kilometers or meters can be represented on a number line as follows;

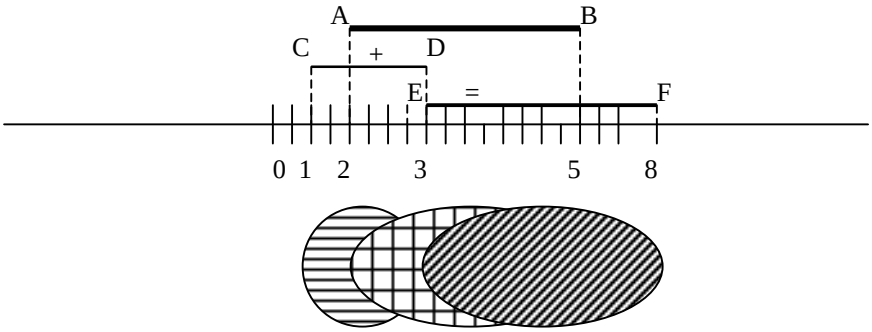


Fig: 6

The Fuzzy arithmetic of addition can now be performed on the sets. Using Fig: 6,

AB + CD = EF

[2,5] + [1,3] = [3,8]

R_E (r) = [3,8] - the new diameter of relationship extent

Therefore if we have n numbers of diameters, the new fuzzy boundary (i.e. extent of spread of relationship) will be:

R_E (r) = R_E (r 1) + R_E (r 2) + R_E (r 3) + ……..+ R_E (r n)

Once the buffer zones of relationship has been gotten for each village along the borderline, on both sides of the borderline, then their common area of interest can be derived by finding the intersection of themes of buffer zones (i.e. the extent of spread of relationship R_E), along the borderline.

Creation of Themes

The themes could best be created by firstly, classifying the buffers of relationship along the boundary line into two themes: the theme of village at one side of the borderline and the theme of villages at the other side of the borderline. Secondly, the cultural, commercial and social relationships should be classified into their individual themes. The creation of the buffer zone and the themes representing them will be done in ArcView GIS 3.1.

These processes would be illustrated by taking the case of the boundary dispute between Cross- River and Akwa-Ibom States in Nigeria. These two states were together as a single state before the last creation of more states. The conflict between these two states arose as a result of oil discovery in a small border town situated along the boundary line of the states. This conflict has taken many lives and had left a lot of houses burnt.

The case of these two states will be used as illustration. Cross-River and Akwa-Ibom states are located in the southeastern part of Nigeria. Most of the dwellers work as either civil servant, subsistence farming or trading in goods. The major river through the states is the Calabar River, which serves as means of transportation for the states.

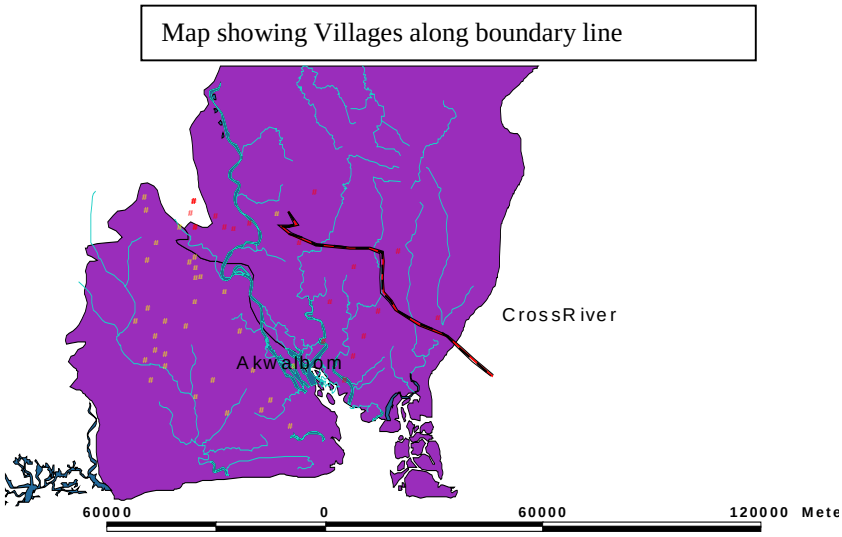


Fig: 7

The buffers of each theme are generated using radius derived from fuzzy analysis explained earlier.

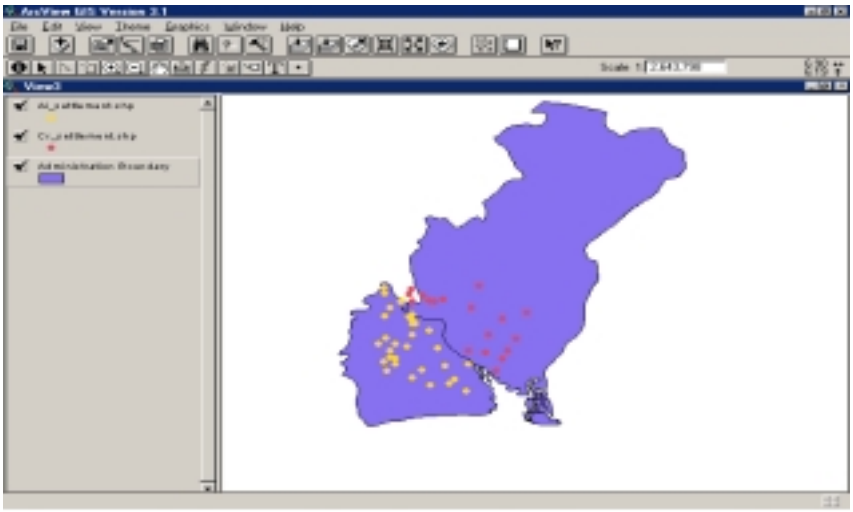


Fig. 8 Administrative boundary of the states and the villages along their boundary.

Creation of buffer themes for boundary towns

Using ArcView 3.1, the location of boundary town is plotted either by digitizing the position of the towns or by plotting the coordinates of the points from a database file containing the coordinates of the town. If the map showing the location of the town along boundary area does not exist, GPS could be used to pick the position of such towns. This position of towns should be classified as themes with towns on each side of borderlines standing for a theme each.

Once the point relating to towns along the borderline as been classified to themes, then the creation of buffer zone can now begins base on the factor under consideration. The factor under consideration could either be the social, cultural, language or the commercial activities. To start with, let us consider the extent of language spoken in each town. It should be beard in mind that the radius of extent can be gotten from the method specified above. An extra field is added to the attribute table of the boundary towns of Akwa-Ibom State. This added field contains the radius of extent of language relationship.

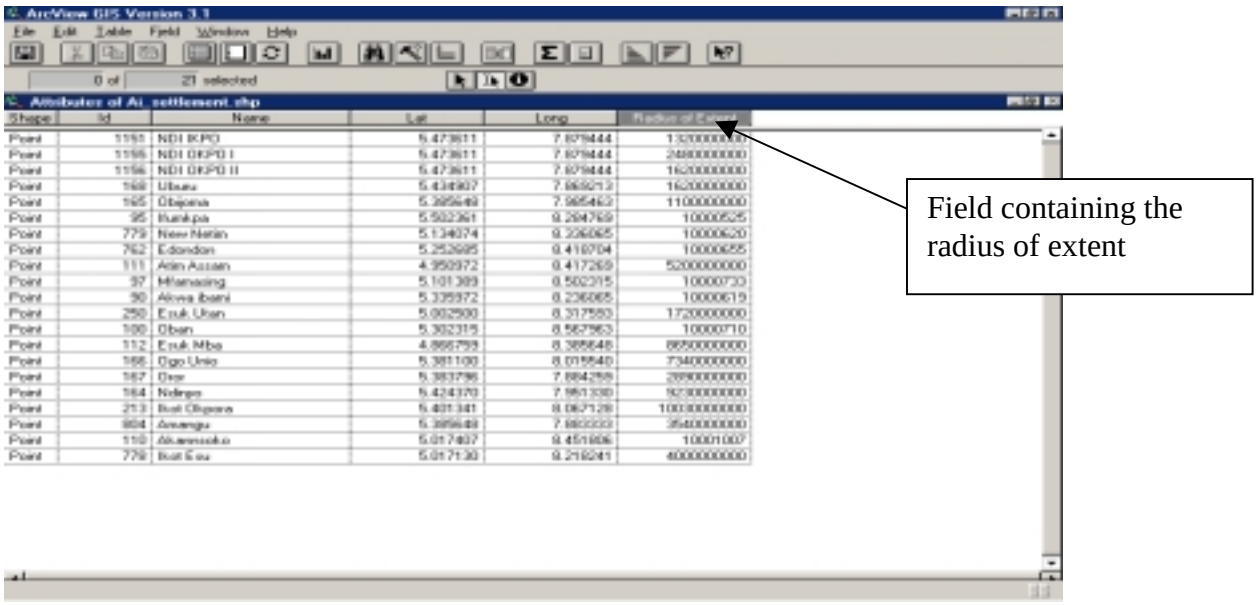
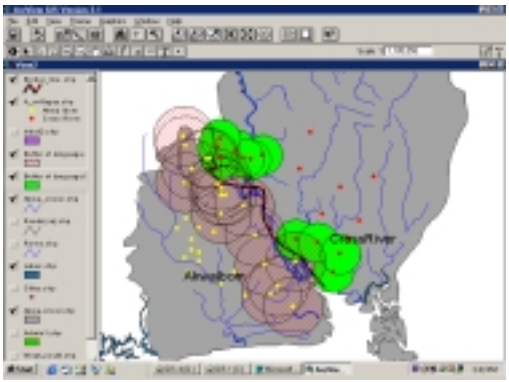


Figure 9.

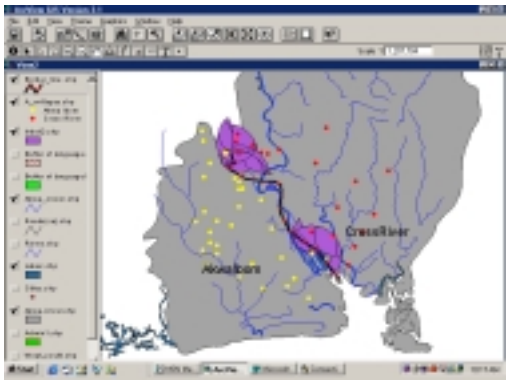
In creating the buffer, the field that contains the radius of extent of towns where the language of this town is spoken is used as the field for the buffer. This procedure is repeated for the social, commercial and cultural relationship for towns on either side of the boundary line. Now in order to get the area of relationship between the towns along the borderline, the intersection of the buffer of activities along the boundary line will have to be determined.

Determination of intersecting area

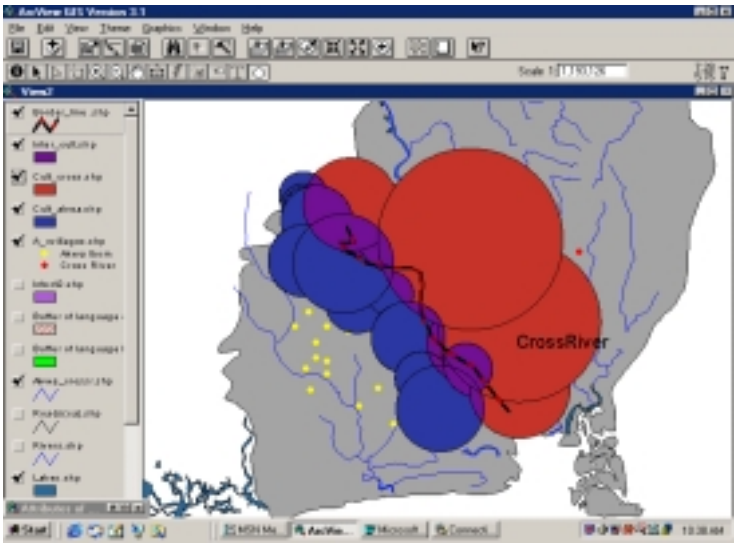
In Arc View 3.1, to get the intersecting area, the geo-processing wizard is used; the aim of this geo-processing is to get the area of common interest firstly between the buffers of similar relationship e.g. cultural buffer of Cross River state and Akwa-Ibom state. This geo-processing will result to creation of a single theme, which will stand for area of interrelationship between the two borderline states. This similar operation should be repeated for the other activities (i.e. language, commercial and social).



Buffer of Language themes



Area of intersection of Buffer of language themes



Buffer of Cultural extent

To determine the area of overall relationship based on the intersection of relationships derived from the various factors, the intersection of the area of intersection of the all the factors is needed. This is done by finding sequentially the intersection of theme of cultural relationship with that of the commercial relationship the resulting theme is then intersected with the theme of social and later with that of Language.

The figure below shows the result of the intersection of the all the factors of relationship considered.

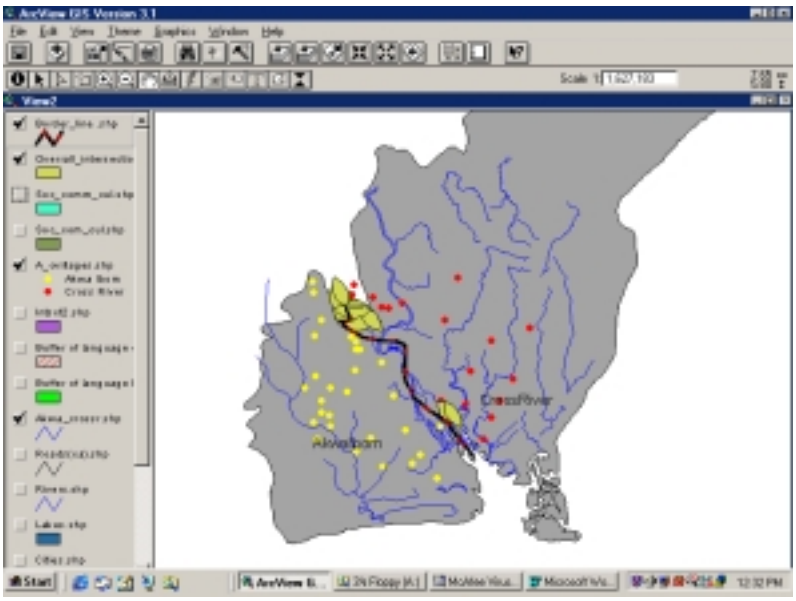
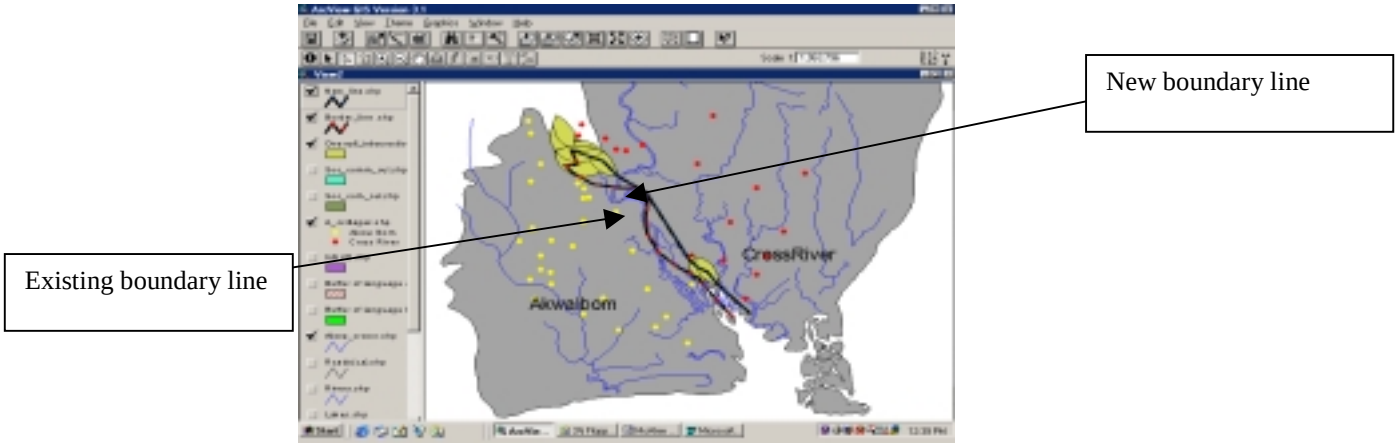


Figure showing the resulting area of relationship from all the factors considered

The mathematical center of the buffer generated is then adopted as the nodes for new boundary lines. This is shown in the figure below.



CONCLUSION

The new boundary lines established will bring about lasting peace in the conflicting area. Also, according, to interview with people leaving along where new boundary line passes, it could be concluded that this is a suitable approach for solving related problems.

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BIOGRAPHICAL NOTES

O. R. Sodeinde is a final year student in the department of Surveying and Geo-informatics, University of Lagos having experience in the development of Water Management Information System for Benin and Calabar cities in Nigeria. O. R. Sodeinde is currently working on software for management of Land use Information Management.

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