



CENTER FOR TRANSITIONAL and POST-CONFLICT GOVERNANCE

Delimitation Equity Project

Case Study: Yemen

Dr. Lisa Handley
January 2004



Prepared by IFES for the Delimitation Equity Project
with funding from the United States Agency for
International Development



USAID
FROM THE AMERICAN PEOPLE

The findings and conclusions in this paper are those of the author and do not necessarily represent the views of USAID or the United States government.

Case Study: Yemen

Assessing the Feasibility of Computer-Assisted Constituency Delimitation

Dr. Lisa Handley • January 2004

The Yemeni Supreme Commission for Elections and Referendum (SCER) is considering the use of Geographic Information Systems (GIS) computer technology for constituency delimitation prior to the 2006 elections. Because the Central Statistics Office (CSO) is in the process of producing the necessary electronic database for Yemen, utilizing GIS for delimitation is feasible. If GIS is to be employed for delimiting constituency boundaries in 2005, however, plans for its use must begin immediately.

Background

The Republic of Yemen has a First-Past-the-Post electoral system with a bicameral legislature consisting of the Shura Council (a consultative body with 111 members appointed by the President) and a House of Representatives. The 301 members of the House of Representatives are elected from single-member constituencies in plurality elections. The most recent parliamentary elections were held in April 2003.¹

According to official 2003 results, the ruling General People's Congress (GPC) received 58.2 percent of the vote, and won 230 (76.4 percent) of the 301 seats.² In addition to the disparate seats-to-votes ratio, an examination of the election results indicates that, despite a population quota of slightly over 60,000 persons per constituency – the equivalent of approximately 26,700 eligible voters per constituency in Yemen – some constituencies were found to contain more than 50,000 voters.³

Among the recommendations offered by such international non-governmental organizations as National Democratic Institute (NDI) and IFES following the 2003

¹ The 2003 elections were the third parliamentary elections held since the unification of Yemen in 1990; previous parliamentary elections were held in 1993 and 1997.

² The General People's Congress (GPC) holds 240 seats (79.7%) in total because ten of the independents who ran and won in 2003 later affiliated themselves with the GPC.

³ See "IFES Post-Electoral Assessment: Yemen April 27, 2003 Parliamentary Elections," prepared by the IFES office in Yemen. Later figures from the Supreme Commission for Elections and Referendum (SCER) show ten constituencies had 40-50,000 registered voters, seven had 50-60,000 and one had 70,109. The lowest number of registered voters in a constituency was 9,980. The SCER's official estimate of the population in 2002 (based on a projection of the 1994 census) was 18,192,000; therefore, the population quota was 60,439 (18,192,000 ÷ 301). The average number of eligible voters per constituency should have been much less: the percentage of the population 18 years and older, according to UNICEF, was approximately 44% in 2002; hence, the average number of eligible voters per constituency was about 26,700. [UNICEF reports that 55.8% of the Yemeni population was less than 18 years of age in 2002; therefore, somewhat less than 44.2% of the total population should have been eligible to vote (assuming there are some non-citizens included in the population count). On the other hand, UNICEF estimates a total population of 19,315,000 in Yemen in 2002; if this estimate is more accurate than the population estimate employed by the SCER, then the number of eligible voters per constituency could be as high as 28,400 – still nowhere near the number of registered voters in some constituencies.]

parliamentary elections was that constituency boundaries be redrawn following the 2004 Yemeni census. This is necessary to bring constituency populations into compliance with Yemeni constitutional and electoral law.⁴

The 2002 Delimitation Process

In May and June of 2002 (in anticipation of the 2003 parliamentary elections), the Supreme Commission for Elections and Referendum (SCER) delimited Yemen into the requisite 301 parliamentary constituencies.⁵ The Constitution (Article 63) requires constituencies “equal in number of population with a variation of not more than five percent plus or minus.”⁶ In addition, the electoral law obliges the SCER to take into account “geographic and social considerations” when creating parliamentary constituencies.⁷

According to the SCER, the factors considered during the 2002 delimitation – besides population – included geographical features that formed natural barriers, such as mountains and rivers, and the following social factors:

- administrative subdivisions referred to as *ozal* (singular: *ozla*) were not divided between constituencies, if possible;⁸
- villages with an historical animosity towards one another (*tha’ar*) were not included in the same constituency, if possible.

The SCER began the delimitation process by dividing each of the 332 administrative divisions (*modiriya*) into local constituencies.⁹ The only established legal criterion for the

⁴ See “April 27, 2003 Parliamentary Elections in Yemen: Final Report” prepared by the National Democratic Institute for International Affairs and “IFES Post-Electoral Assessment: Yemen April 27, 2003 Parliamentary Elections,” prepared by the IFES office in Yemen.

⁵ Article 24 of the General Elections and Referendum Law (2001) assigns the responsibility for determining the boundaries of electoral constituencies – both the parliamentary constituencies and the local constituencies – to the Supreme Commission for Elections and Referendum.

⁶ The Constitution requires equality of total population rather than, for example, equality of voting age population or registered voters.

⁷ Article 24 (a) of the General Elections Law provides that constituencies shall be “based on the principle of equal population and taking into consideration social and geographic factors.”

[Unofficial English translation]

⁸ Although *ozal* are not necessarily unified by tribal/clan ties, if an *ozla* was united in this manner, the SCER attempted to keep the *ozla* intact within a single constituency.

⁹ The 20 governorates of Yemen are divided into 332 administrative divisions. According to the local authority law passed in 2000, the number of local constituencies per administrative division is to range from 18 to 30, depending on the total population of the administrative division:

<i>population of administrative division</i>	<i>number of constituencies</i>
35,000 or less	18
35,000 – 75,000	20
75,000 – 150,000	26
150,000 or more	30

It appears, however, that the number of constituencies allocated to administrative divisions is substantially less than the minimum requirement of 18 local constituencies in many instances: if

delimitation of local constituencies is that the populations of the constituencies within an administrative district should not vary by more than plus or minus five percent from the population quota for that district.¹⁰

The local constituencies usually perform the dual purpose of electing representatives to the local government councils (there are 332 local government councils – one for each administrative division) and serving as voting centers for casting and counting ballots. However, it appears that in some administrative divisions, local constituencies have been combined to create a single voting center, while in other administrative divisions local constituencies have been divided into more than one voting center.¹¹ See Table 16.1 below for the number of local constituencies and the number of voting centers by governorate.

Table 16.1: Number of Administrative Divisions, Parliamentary and Local Constituencies, and Voting Centers by Governorate

Governorate	Number of Administrative Divisions	Number of Parliamentary Constituencies	Number of Local Constituencies	Number of Voting Centers
Sana'a City	10	19	179	179
Aden	8	10	130	130
Taiz	23	39	494	488
Lahj	15	12	280	282
Ibb	20	36	488	490
Abyan	11	7	197	194
Al-Baidha'a	20	10	285	291
Shabwa	17	6	211	199
Al-Mahra	9	2	74	74
Hadhrmout	30	18	365	365
Al-Hodeida	26	34	515	515
Thamar	12	21	297	297
Sana'a	21	20	423	414
Al-Mahweet	9	8	167	167
Hajja	30	20	521	515
Sa'ada	15	9	181	181
Al-Jawf	12	5	160	160
Amran	20	15	354	369
Al-Dhale'a	9	7	161	172
TOTAL	332	301	5,620	5,620

all 332 administrative divisions had been assigned even the minimum number of constituencies (18), there would have to be at least 5,976 local constituencies created. In fact, however, only 5,620 local constituencies currently exist.

¹⁰ Article 24 (b) of the General Elections Law requires a population variation of not more than plus or minus 5 percent.

¹¹ The number of voting centers is less than the number of local constituencies in the governorates of Taiz, Abyan, Shabwa, Sana'a, and Hajja; and the number of voting centers exceeds the number of local constituencies in Lahj, Ibb, Al-Baidha'a, Amran, and Al-Dhale'a.

The 5,620 local constituencies/voting centers created by the SCER were then used as building blocks for drawing the 301 parliamentary constituencies. These 301 single-member constituencies were used to elect representatives to Parliament in April 2003.

The SCER used paper maps (topographical maps of the administrative divisions) with acetate overlays to draw the local and parliamentary constituency boundaries. Estimates of constituency populations were based on projections of the 1994 census. As a result of employing these manual techniques, the only maps that exist of the current local constituency boundaries are the acetate overlay maps that are housed at SCER headquarters. Moreover, the population estimates for the constituencies are only rough approximations of the actual population contained within the constituency boundaries.¹²

Once provisional maps of the constituencies were completed, field work was conducted to ensure that the constituency boundaries took into account local geographic and social considerations. Local officials were asked to review the maps, solicit comments and offer suggestions if the boundaries were problematic. As a result of this field work, some changes were made to the provisional constituency boundaries. The final constituency boundaries were established by the SCER in the summer of 2002.

The entire delimitation process took approximately three months and involved about 60 SCER staff members and as many as 900 officials in the field. The cost of the 2002 delimitation was estimated by the SCER to be approximately US\$2 million.

The 2005 Delimitation Process

The SCER anticipates redrawing constituency boundaries following the release of new census data in mid-2005.¹³ Local elections are to be held in September 2006; therefore the delimitation process must be completed by the end of 2005 (before voter registration for the 2006 election commences).

The SCER hopes to have to make only “minor” or “technical” adjustments to the 2002 constituency boundaries to comply with the requirement that constituency populations deviate no more than plus or minus five percent. Assuming only minor adjustments, the SCER has indicated that it does not plan to go back into the field to solicit comments on the constituency boundaries.

There are at least two reasons to be skeptical about only minor adjustments to constituency boundaries being required: First, relating the 2004 census data to the 2002 constituency boundaries is liable to uncover substantial population deviations across constituencies since the SCER had to use less-than-reliable (especially at lower levels of geography) projections of the 1994 census for their population data. Second, if the

¹² Constituency population estimates often had to rely on projections of the 1994 census to the local (i.e., village) level – projections that are particularly likely to be unreliable, especially given the lack of data on population migration.

¹³ A census of the population is conducted every ten years in Yemen. The last census was done in 1994; the next census is scheduled for December 2004. The Central Statistics Office (CSO) anticipates releasing the census data in mid-2005, assuming they are successful in obtaining the updated versions of the software (ESRI ArcView and Oracle) they are currently seeking.

Ministry of Local Authorities revises the boundaries of the 332 existing administrative divisions, at minimum, local constituencies will have to be redrawn for any reconfigured administrative divisions.¹⁴

The SCER would like to utilize GIS for the upcoming delimitation process. There are a number of reasons for supporting the SCER in this effort:

- GIS technology could generate a more efficient, accurate, and cost-effective (at least in the long term) delimitation process.
- GIS technology could assist the SCER in meeting such constitutional and legal delimitation requirements as equal population and consideration for geographic and social factors when drawing constituency boundaries.
- GIS technology could foster greater transparency in the delimitation process by permitting the easy production of maps and reports that can be used by interested stakeholders to evaluate and comment on proposed constituency plans.
- GIS offers the potential for producing a “fairer” constituency plan – one that optimizes established delimitation criteria such as population equality and consideration of geographic and social factors at the expense of other, less appropriate, factors such as the potential political consequences of the plan.
- GIS may have additional uses in election administration: for example, GIS can be used to assign eligible voters to the correct voting center.

Using GIS for Delimiting Constituencies in Yemen

The SCER utilized manual techniques – paper maps with acetate overlays, colored markers, and calculating machines – for the 2002 delimitation exercise. Although the process was completed in a timely manner, it required a very large staff to accomplish this. Furthermore, very little information about the constituencies was produced, and even less information was made available to interested stakeholders (i.e., members of Parliament, political parties, NGOs and interested voters).

Adopting GIS technology would expand the information available to the SCER. It would allow the SCER to:

- create constituency plans much more rapidly: a plan would be created interactively by assigning geography to constituencies piece by piece and seeing the results of the assignment displayed on the computer screen immediately;

¹⁴ Information on the possible redrawing of administrative boundaries (i.e., the number of divisions likely to be affected and the time table for the project) was not available at the time this report was prepared. The SCER should keep in mind that a revision of administrative district boundaries could impact on the delimitation process.

- produce maps – both on the screen and, if desired, on paper – of the constituency plan as each piece of geography is assigned and, of course, once a plan is completed;
- generate statistical reports summarizing delimitation plans for evaluation purposes.

Creating an Electronic Database If GIS technology is to be used for drawing district lines, an electronic database must be created. This database must include, at a minimum, population data (i.e., census enumeration data or voter registration data) and the maps associated with the geographic units for which the population is reported. As the Yemeni constitution requires the “population” of constituencies to be equal (and not, for example, the number of voters or registered voters), census data and maps of the census enumeration areas will have to be included in the electronic delimitation database.

The most common obstacle to using GIS for delimitation purposes is the lack of computerized maps for the relevant geographic units. This will not pose a problem in Yemen, however: the Central Statistics Office (CSO) is currently in the process of digitizing census geography down to the smallest unit for which census data will be reported, the census enumeration area. If the SCER is willing to use enumeration areas as the building blocks for creating constituencies, then computerized maps and the associated population data will presumably be available from the CSO for use by the SCER.

In addition to maps of the census enumeration areas, other maps that would prove useful in delimiting constituencies in Yemen include: administrative boundaries (such as governorate boundaries, administrative division and subdivision boundaries), major physical features such as mountain ranges and rivers, and existing constituency boundaries.

Some of the administrative boundaries have been embedded in the CSO database; for example, governorate and administrative division boundaries can be found within the database.¹⁵ In addition, some physical features will be demarcated in the CSO database.

Incorporating existing constituency boundaries into the delimitation database, however, will be one of the most challenging tasks facing the SCER. The boundaries of the current local constituencies can be added to the electronic CSO database by either (1) assigning entire census enumeration areas to constituencies in a manner that approximates current local constituency boundaries but does not follow the constituency boundaries exactly, or by (2) re-creating the local constituency boundaries precisely by electronically “splitting” census enumeration areas and estimating the associated population for the split portions of the census enumeration area.¹⁶ The latter approach is more time-consuming, and will produce only estimates of the population encompassed

¹⁵ However, other boundaries (such as administrative subdivision boundaries) would have to be digitized if they are to be included in the delimitation database.

¹⁶ The boundaries of the census enumeration areas are unlikely to follow the boundaries of the currently existing constituencies since no reference was made to the electoral constituency boundaries when the CSO established the census enumeration areas.

within a constituency. On the other hand, only the latter approach will produce an exact delineation of the current constituency boundaries.

Drawing New Constituency Boundaries Once the electronic delimitation database has been prepared, including the delineation of the current constituency boundaries by one of the means described above, a new delimitation plan can be drawn. This is accomplished by moving geographic units (census enumeration areas) from one constituency to another until all of the constituencies in the plan meet the predetermined districting criteria. GIS technology would speed up this process enormously by re-tabulating the population automatically, and instantly, each time a new assignment of territory is made and by displaying the results of the tabulation, along with the new constituency map, on the computer screen.

Evaluating Constituency Plans If the SCER employs GIS to delimit constituencies, the software will facilitate the production of maps and reports, which can then be used to determine compliance with such criteria as:

- population equality;
- geographic considerations such as mountains, rivers and other physical features that form natural barriers;
- respect for existing governmental units such as administrative divisions, as well as administrative subdivisions if these are digitized.

If GIS software is used to create a constituency plan, then producing a statistical report listing the population of each constituency, as well as the percent by which that constituency's population deviates from the population quota, is a very simple matter. GIS technology also permits the overlay of maps displaying administrative division boundaries and physical features such as mountain ranges and rivers on the map of the constituency boundaries. These reports and maps could serve as tools for the SCER to evaluate any proposed constituency plans. Furthermore, if the SCER released these reports and maps, interested stakeholders could also evaluate proposed constituency plans.

Advantages and Disadvantages of Using GIS Using GIS offers a number of important benefits, all of which have been discussed above. But there are drawbacks to using GIS – and it is important to consider both the advantages and the disadvantages of GIS when contemplating using GIS for delimitation. The table below lists some of the major advantages and disadvantages associated with GIS:

Table 16.2 : Advantages and Disadvantages of GIS

Advantages of GIS	Disadvantages of GIS
<ul style="list-style-type: none"> • GIS technology may produce a more efficient, accurate, and more cost-effective delimitation process. • GIS technology could assist the SCER in meeting such constitutional and legal delimitation requirements as equal population and consideration for geographic and social factors when drawing constituency boundaries. • GIS technology could foster greater transparency in the delimitation process by permitting the easy production of maps and reports that can be used by interested stakeholders to evaluate and comment on proposed constituency plans. • There is potential for producing a “fairer” constituency plan – one that optimizes established criteria such as population equality – by using the evaluation tools found in most GIS packages. • GIS may have additional uses in election administration: for example, GIS can be used to assign eligible voters to the correct voting center. 	<ul style="list-style-type: none"> • The financial cost associated with acquiring GIS capabilities for delimitation may be prohibitively high. • It may be difficult to find and train qualified personnel to operate the GIS software – which has important implications not only for setting up the system but for sustaining it as well. • Poorly managed GIS could result in a delimitation process that is actually <i>less</i> efficient, <i>less</i> effective and <i>less</i> timely than a process employing manual techniques (at least in the short run). • Improperly used, GIS could allow users to manipulate the delimitation process, and ultimately, the outcome of elections.

Cost of Using GIS: Hardware, Software and Staffing The cost of using GIS for delimitation varies dramatically depending on the availability of electronic maps and the associated population data. If electronic data and digitized maps of the entire country are available – as they are in Yemen – the costs associated with adopting GIS are much lower. In fact, it is only because the CSO is in the process of creating the necessary database that the SCER can even contemplate using GIS technology for the upcoming delimitation exercise.

The SCER must still purchase the necessary hardware and software, and train qualified staff to use the GIS system, however – and this will not be inexpensive. The SCER should plan on spending in the neighborhood of US\$150,000 to \$200,000 for hardware, software (including license) and training.¹⁷

Potential Mismanagement of GIS GIS technology can be mismanaged, resulting in a disorganized, inefficient and delayed delimitation process. Detailed planning, adequate

¹⁷ If the SCER works cooperatively with the CSO to purchase the required GIS software and training, the overall financial cost is likely to be higher (i.e., the software license will be more expensive), but the cost, as well as the benefit accrued, will be shared by both agencies. Furthermore, cooperation with the CSO is likely to yield additional benefits – at a minimum it is likely to provide the SCER with access to the GIS expertise the CSO has already developed.

training and ample time and resources must be devoted to the endeavor if GIS is to be successfully incorporated into the delimitation process.

Potential Misuse of GIS Not only can GIS software be mismanaged, it can be misused: GIS technology could, at least in theory, make it easier for a ruling party to manipulate constituency boundaries so as to retain control of the Parliament even after the majority of the voters have ceased to support the party. In the United States, for instance, state legislatures assigned the responsibility for redrawing constituency boundaries often include political data (i.e., election results) in the delimitation database so that the political implications of proposed constituency configurations can be taken into account when drawing constituency boundaries.¹⁸

However, political considerations are not included among the factors which the law requires the SCER to consider in drawing constituency boundaries. Moreover, including political data in the GIS database in Yemen would be very difficult because the units for which political data are available (election results are reported for voting centers) are not the same geographic units that would be employed for delimitation (census enumeration areas will have to be used to draw constituencies). But to ensure that the insertion of political data is not even contemplated, the electoral law could be revised to expressly prohibit the use of political data during delimitation. Yemen would not be unique in adopting this approach; many countries have expressly forbidden boundary authorities from considering political data when drawing constituency boundaries.¹⁹

Article 159 of Yemen's Constitution establishes the SCER as an 'independent and neutral' body. GIS would assist the SCER to demonstrate that it undertook boundary delimitations in a non-partisan manner if it:

- made the GIS-produced maps and statistical reports associated with provisional constituency plans readily available;
- instituted a public hearing process to allow interested stakeholders to comment on provisional plans; and
- took stakeholders' comments into account when modifying provisional plans to produce a final constituency plan, and published its reasons for modifying the provisional plans.

¹⁸ In the United States, the constituency plans for most states are drawn by state legislatures despite a very clear conflict of interest. Moreover, the inclusion of political data in the delimitation database, and even the outright manipulation of boundaries for political benefit, has been deemed legal by the U.S. courts.

¹⁹ For example, boundary commissions in the United Kingdom (England, Northern Ireland, Scotland and Wales), Canada, and Australia have all been prohibited from considering political factors when promulgating a constituency plan.

Conclusion

GIS technology offers the SCER a tool for implementing a more efficient, accurate and cost-effective delimitation process in 2005. GIS technology will produce a constituency plan that is far more likely to meet such constitutional and legal delimitation requirements as equal population and consideration for geographic and social factors; furthermore, this technology could be used to promote greater transparency in the delimitation process. The extent to which GIS technology can “democratize” the delimitation process, however, depends on how much information the SCER is willing to share with interested stakeholders and how open the delimitation process will be to public input.

If GIS is to be utilized for the 2005 delimitation, then plans for its use must begin immediately. The Appendix outlines, in very broad strokes, the steps that would have to be taken to implement GIS and proposes a tentative schedule. At least two possible impediments to the schedule have been identified, however:

1. If the Ministry of Local Authorities redefines the 332 administrative divisions for which local constituencies are devised, and if this process is not completed by mid-2005, then proceeding with delimitation on schedule would be impossible. (Also, if administrative division boundaries were to change substantially, the delimitation process would take longer because the SCER would, in essence, have to begin from a blank slate, rather than simply modifying existing local constituency boundaries).
2. The Central Statistics Office must be willing and able to release the digitized census enumeration area maps by April 2005, and the population data associated with these enumeration areas no later than July 2005. The failure of the CSO to release this information in a timely manner would make proceeding on schedule difficult, if not impossible. It should be noted that the CSO considers it essential to have updated versions of the Oracle and ESRI ArcView software currently being used to meet its proposed release dates; if the CSO is unable to acquire these updates, the release date could be moved back several months.

Recommendations

- The SCER should be supported in its effort to employ GIS technology in the upcoming delimitation exercise. Utilizing GIS in conjunction with the electronic database currently being constructed by the Central Statistics Office offers the SCER an opportunity to delimit constituencies more efficiently and more accurately. As a result, the process is likely to produce a constituency plan that meets such constitutional and legal delimitation requirements as equal population and consideration for geographic and social factors.
- The SCER should be strongly encouraged to use GIS technology to generate a more transparent delimitation process. The SCER should release statistical reports and maps associated with any provisional plans and should hold public hearings to solicit comments on the provisional plans. The process could be managed by permitting only comments directly related to the

established delimitation criteria (population equality, geographic and social considerations).

- Consideration should be given to expanding the electoral law on constituency delimitation. In particular, a stipulation that delimitation occur on a regular schedule and that census data be utilized for the task would be appropriate (i.e., a delimitation of constituency boundaries should follow every decennial census and should rely on census enumeration counts for population data). Other supplements to the electoral law might include an express prohibition against incorporating political/partisan information in the delimitation database, and a requirement that the SCER consider stakeholders' comments on provisional boundaries before producing the final delimitation.

Appendix: Yemen

Appendix: Proposed Stages for Implementing GIS and Delimiting Local Constituencies

Activity	Proposed Schedule
Planning Stage	<i>September – December 2004</i>
<ul style="list-style-type: none"> Assess hardware/software/training needs Prepare budget and schedule 	
Acquisition and Training Stage	<i>January – March 2005</i>
<ul style="list-style-type: none"> Acquire necessary hardware/software Train staff on GIS (possibly hire additional staff) 	
Database Development Stage	
<ul style="list-style-type: none"> Phase I: obtain electronic census enumeration area maps from Central Statistics Office 	<i>April 2005</i>
<ul style="list-style-type: none"> Phase II: draw boundaries of current local constituencies using census enumeration areas 	<i>April – June 2005</i>
<ul style="list-style-type: none"> Phase III: obtain population data associated with census enumeration areas from Central Statistics Office 	<i>July 2005</i>
Provisional Map Drawing Stage	<i>August – September 2005</i>
<ul style="list-style-type: none"> Modify current constituency boundaries to create provisional map that meets established criteria Produce paper maps and statistical reports for provisional map 	
Public Hearing Stage	<i>October 2005</i>
<ul style="list-style-type: none"> Organize public hearing schedule (locations, dates) Disseminate maps and statistical reports (provisional map) Hold public hearings to solicit comments 	
Final Map Drawing Stage	<i>November – December 2005</i>
<ul style="list-style-type: none"> Modify provisional map based on public hearing comments 	

• Create final map of local constituency boundaries	
• Produce written report, with maps and statistics	

