GIS AS A TOOL FOR TERRITORIAL NEGOTIATIONS
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INTRODUCTION

A map of the new world is a picture of one of the most important results of the war. Most people think of a map as a fixed thing. On the contrary, it is almost as changeful as mankind itself.

(Isaiah Bowman 1922).

State sovereignty is defined as the internationally recognised authority of a government over the territory and people it claims to control. Within the United Nations (UN) system, sovereignty controls are recognised most explicitly in the creation and maintenance of international boundaries. International boundaries, though, have multiple functions – economic, cultural, and political – that directly affect international relations. This paper looks at how data relating to boundary functions might be collected, organised, analysed and displayed within a geographic information system (GIS) as part of territorial negotiations. As the political map of the world continues to change, GIS tools could be used to make decision-making more transparent, analysis of options more thorough and the presentation of results more convincing – factors that could affect the future stability of those living in border regions.

BOUNDARIES, FRONTIERS, AND REGIONAL STABILITY

…a snapshot of an imposed spatial pattern that hides as much as it reveals.

International boundaries are the "*lines on the map*" that distinguish State-defined territorial sovereignties, but each one also represents a snapshot of an imposed spatial pattern that hides as much as it reveals (Prescott, 1987). An international boundary line lies within a border area (or borderland) that is often perceived as a zone of transition or frontier. The worldwide system of boundaries as the primary political division of the earth's surface is relatively recent (within the last 150 years for most of the world). The maintenance of that system – no matter how flawed in its imposition (especially in colonial Africa) and how problematic it has become for "*globalised*" economic transactions – has broad recognition as a fundamental means of preserving regional peace and stability (Thomas, 1999). The number of sovereign States has grown rapidly (from 70 before WWII to over 190 sixty years later), with a corresponding rise in land boundaries – now about 310. For each one, there are at least two "*interpretations of their meanings – one on either side*" (Paasi, 1998:14).

Since the end of World War Two, the number of maritime boundaries has increased significantly. The 1982 UN Convention on Law of the Sea (UNCLOS) established a mechanism for the creation of different types of internationally recognised maritime zones – territorial sea, contiguous zone, exclusive economic zone (EEZ) and the continental shelf. While these relatively new maritime zones encompass a larger area of the earth's surface than land border zones and disputes over oceanic resources could potentially rival land resource conflicts, the latter historically have been more likely to result in violent inter-State clashes.

Following the break-up of the former Soviet Union in 1989, international boundaries – until then a dormant topic for most political and social scientists – garnered renewed interest as boundary changes in central and eastern Europe were viewed as a key factor in geopolitical instability along national frontiers (Anderson and Bort, 1998). Historically, though, modern boundaries, especially in Europe (1815, 1918-21, and 1945), have been radically and repeatedly redrawn (Waterman, 1994). With "*critical*" geopolitical views of boundaries as more than just "*political-physical*" divisions, they have become intertwined in broader theoretical debates over "*de/re territorialisation*," "*nationalisation*," and "*globalisation*." While the State as a

political entity appears to be enduring, if not thriving, the boundaries that continue to define them are taking on new "*multidimensional*" economic, cultural, and symbolic functions (Paasi, 1998).

Frontier dynamics are at the heart of many international relations and conflicts…

Boundaries run through borderland frontiers. Unlike boundaries, which are often precisely described, frontiers are more ambiguously conceived. As Anderson (1996) notes, frontiers are areas in which State's exercise their policies to demonstrate their exclusive *de facto* control and to stake out territorial dimensions of their national identity. While each social science discipline carries its own definition of 'frontier', most recognise that there is both a spatial and a psychological element to them. Frontier dynamics are at the heart of many international relations and conflicts – and yet the spatial dimensions of these frontiers remain ill-defined. Comprehensive analysis of boundaries – for either academic or arbitration purposes – demands their meaningful incorporation within the broader set of interactions that take place within and across national frontiers.

Even with potential borderland flashpoints in the former Soviet Union (particularly in the Caucasus), diplomats have paid less attention to boundary disputes as a source of regional destabilisation, focusing instead on ethnic conflict as the overriding threat to international peace and security (Carnegie Commission on Preventing Deadly Conflict). The key causal factor in recent wars is not either ethnic tension or arbitrary colonial boundaries, but the adverse interaction between mistreated ethnic groups and the imposed boundaries that divide them; these problems are compounded by repressive regimes that deny minority groups basic human rights and constitutional protections. Territorial nationalism – the attempt by nationalists, from the Balkans to Central Africa, to carve out 'pure' homelands – has led to brutal crimes against humanity, including 'ethnic cleansing' and, in extreme cases, genocide (Wood, forthcoming).

Whether dynamic or static, boundaries impose an overwhelming influence on bilateral relations, irredentist movements, migration flows (legal and illegal), economic activity, and even environmental protection. When enforced, an international boundary can serve as a filter to regulate economic, cultural, political, and environmental networks. A boundary can be closed or otherwise manipulated to hinder diffusion of people, things, and ideas and thereby undermine the achievement of development goals. Poor, landlocked countries, especially in Africa, are particularly vulnerable to such boundary closures. (Reitsma, 1983). In contrast, an open boundary should facilitate cross-border interactions. The reality is often in between the two extremes of 'open' and 'closed'. Europe in particular is engaged in a bold continental experiment in loosening border controls. The opening of the 'Oresund Fixed Link' bridge between Denmark and Sweden on 1 July 2000 symbolises some of the contending issues, as described by Lund University historian Anders Linde-Laursen:

> *The bridge is a symbol of Europe's new attitude toward borders. We want to connect across them. Ignore them. That's true for political borders like the Berlin Wall and for water borders like the Oresund* (Reid, 2000).

The challenge for those working on such multifaceted boundaries is how to more accurately describe them and their relative value to those living on both sides, be they separated by a wall or connected by a bridge.

Although international boundaries are ubiquitous in international relations, their functions and the lives of the 'borderlanders' who live along them are not well understood. The role of a complex, heterogeneous "*borderland milieu*" in inter-State relations can be viewed through the transnational interactions that occur across international boundaries (Martinez, 1994). For example, a boundary with active

checkpoints and a relatively large volume of cross-border trade suggests an 'integrated borderland' of vital importance to governments on both sides and with dynamic exchanges between 'national' and 'transnational' groups. In contrast, an isolated boundary with few government-to-government interactions might indicate little strategic value or weak governmental control over an 'alienated borderland' (which might be managed on a daily basis by such non-governmental actors as smugglers or militias). Alternatively, in Kaplan's (2000) pessimistic portrayal, international boundaries have become almost irrelevant in regions where chronic conditions of lawlessness, poverty, and administrative neglect define cross-border interactions.

CONFLICTED BOUNDARIES – INTERNATIONAL AND SUBNATIONAL

Boundaries can symbolise the volatile tension between minority group aspirations for self-determination on one hand and internationally recognised territorial sovereignty on the other.

Boundaries, then, have multiple meanings, depending on their context, function, and the perceptions of those who live near them. They are formally depicted in documents, on maps, and on the ground through the placement of markers, pillars, buoys, or immigration and customs checkpoints. Boundary disputes are manifested in broken treaties, cartographic representations of overlapping territorial claims, and militarised zones along the disputed border. Boundary conflicts and resulting spatial changes are inherently linked to broader processes affecting divided territories and peoples. Boundaries can symbolise the volatile tension between minority group aspirations for self-determination on one hand and internationally recognised territorial sovereignty on the other.

In contrast to Bowman's (1922) bold attempt to provide a comprehensive political geographic overview of worldwide territorial transformations following World War One, most post World War Two boundary research (with the exception of a handful of political geographers) has not addressed underlying ethnic conflicts. The US Department of State's long-running International Boundaries Studies series, for example, focused more on the narrow problems relating to historical disputes over treaty language, specific incursions across disputed borders, and placement of the boundary line itself. Similarly, political geographic aspects of territory as the cause and focus of intra-regional wars – as well as the spatial diffusion of violent conflict within and beyond the region – have been downplayed by those involved in conflict research (Diehl, 1999; Goertz and Diehl, 1992).

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While much of the literature has focused on international boundaries, recent crises resulting from ethnic violence, secessionist movements, and separation of belligerent forces argue for more research on subnational boundaries. Subnational boundaries in many poor countries, however, are usually ill-defined and poorly mapped at a large scale, making systematic and comparative analysis difficult. Governments can and do make changes to subnational entities, including place name changes and shifts in political jurisdiction, that are not well documented. If the most pressing threats to international peace and stability are no longer inter-State wars, but intra-State violence, boundary analysis also needs to shift from a field preoccupied primarily by international boundary studies to one that also grapples with the messy reality of subnational administrative divisions. Research on subnational political divisions (and levels of representation within these divisions) and their role in reducing future ethnic conflicts will be most difficult where it is most needed. A first step, though, might be made at the first order-administrative level (provinces, subnational states as in the USA, and republics) which are often the level claimed by secessionist movements (Kosovo, Kashmir, etc.).

CONTESTED TERRITORIES

A defined territory, like a boundary, has multiple values to the populations affected by its parameters (Newman, 1999). Territory can be an explicit cause of violence within and between States based on the intrinsic, relational, and symbolic value it holds to each party claiming parts of the contested area (Goertz and Diehl, 1992). Intrinsic value might include natural resources (oil, fertile land, or water) within the territory, its physical characteristics (a deep water port or a defensible ridge line), or

its strategic location (a crossroads of a major trading route). Relational value of a disputed territory (and its occupants) might be determined in terms of each state's overall national strategic goals or how it might affect the ethnic composition of the State. Symbolic value may be a reflection of historical events, cultural landmarks, or other aspects that bind territory to nationalistic aspirations. Generally, the closer and more contiguous the disputed territory is to the cultural core of a state, the higher its relative national value and the more likely it is to be intensively defended.

Much of the literature on international conflict has viewed territorial factors as a *"facilitating"* rather than *"causal"* factor, but a study of territorial conflicts suggests they are quite different than non-territorial conflicts. While less than a third of all inter-State *"militarised disputes"* between 1816 and 1992 were driven primarily by territorial factors, the chances of a dispute escalating into a war are nearly three times greater when territory is at stake (Hensel, 1999: 128). Militarised disputes over contested territory can thus vary in severity, outcome, and likelihood of recurrence, but they set a dangerous threshold that can easily escalate into lengthy and costly wars.

Conflict resolution over a disputed borderland territory can range from the relatively simple to the extremely difficult, depending in part on the definitions attached to it (Diehl, 1999: xii). At one extreme would be the slight adjustment of an international boundary line between otherwise friendly States. A more challenging exercise is the resolution of a territorial dispute over a resource highly valued by both sides (oil or water). Even more difficult are territorial disputes involving the displacement or elimination of large numbers of people – especially where systematic ethnic cleansing has been carried out, such as in the Balkans.

GIS AND TERRITORIAL INFORMATION

A geographic information system (GIS) organises data spatially. The premise is simply that natural features (a mountain range or river) and events (an earthquake or flood), as well as human activities can be linked by their location. Such data can be georeferenced through a set of common place or area names, or through locational coordinates. Geographic names are now available through various online databases. Field data can also be accurately and automatically georeferenced via Global Positions System (GPS) triangulations. Once such georeferenced data are spatially organised, they can be used to study patterns of human activities and their impacts on the physical landscape, or vice versa in the case of natural disaster planning and response. Georeferenced observations of such activities – fertility, mortality, disease, crop yields, roads, towns, administrative divisions, or a whole country – can be 'layered' and used to study patterns of human activities and their consequences. In the Balkans, GIS was used to document the horrific results of a systematic pattern of destruction and 'ethnic cleansing' (Wood and Smith, 1997; Dziedzic and Wood, 2000).

GIS tools have already been applied to studying territorial changes. Vanzo (1999) used GIS-based analysis to compare Israeli and German boundary configurations to examine "*compactness strategies*" in territorial acquisitions. Geographical compactness can be measured as to the degree the occupied territory conforms to a circle (the most efficient space for a military force to protect itself). Vanzo calculated compactness by collecting historical maps and digitising the changing boundary lines for Germany (pre-WWI to the east-west unification in 1990) and Israel (1947-82). He then measured resulting vector lines with a MapInfo GIS package, concluding that in both cases compactness was an important strategic element in territorial expansion and retraction (e.g. Israel's withdrawal from the Sinai).

Measuring intrinsic, relational, or even symbolic value of territory within a linked set of databases is difficult because of the different types of quantitative measures

used. The intrinsic value of a territory might be measured in various ways, such as land unit costs or foreign exchange earnings generated by natural resource extraction. Territorial negotiations could include such quantifiable data as boundary segment lengths, number of border crossing points, and notable natural features (rivers and mountain ranges). Census or other basic demographic data could be used to clarify many territorial issues, but other cultural, historical, or strategic values are much harder to quantify. While qualitative factors may involve ephemeral and subjective perceptions of the areas in dispute (perhaps measured by opinion polls), popular views can result in political pressures that override 'rational' economic arguments over the costs and benefits of retaining, acquiring, or conceding a given disputed area. Relational value is also difficult to measure because it can only be analysed within the context of each State's strategic goals, which are often ambiguously defined.

THE GIS ADVANTAGE

…GIS by itself cannot resolve any territorial problems.

Territory is often just one aspect of a bilateral dispute and GIS by itself cannot resolve any territorial problems. GIS tools can only be useful if implemented in a political atmosphere of good-faith negotiations. GIS-organised data can help clarify the spatial elements of a territorial dispute and its socio-economic and military implications. GIS software can apply remote sensing imagery, terrain elevation models, and other digital data layers to visualise the extent of the area in dispute, the types of resources at stake, populations who might be affected, and other considerations. GIS is also a proven means for exploring 'what if' scenarios for proposed territorial changes. The parties can view each territorial change proposal in light of how it might affect their strategic and national goals.

During the Dayton Peace negotiations in the Fall of 1995, the US Army Topographic Engineering Center and the US Defense Mapping Agency (later to become the National Imagery and Mapping Agency) contributed over 100,000 map sheets, as well as the impressive on-site capability to digitise and display numerous data layers over war-ravaged Bosnia and Herzegovina. Real time manipulation of imagery and digital elevation data, plus quick turn around production of proposed territorial divisions and buffers were critical to achieving the goal of an agreed-upon inter-entity boundary line. Of particular note was the use of terrain visualisation software and remote sensing imagery with varied resolutions that allowed negotiators to virtually 'fly through' areas to be partitioned (Johnson, 1999).

Territorial negotiators can use GIS tools to search, analyse, and display data quickly, which can help them to better understand the extent of proposed changes, as well as local and regional implications. Effective GIS use in any mediation, though, requires that both sides commit to the transparent development of data bases relevant to the dispute. Preliminary confidence building measures might include joint training in use of GIS tools and data base management, as well as a sustained collaborative effort to construct accessible and reliable data layers for the disputed area. Such steps would establish a knowledge base that would enable future discussions of possible territorial options.

An important lesson learned from Dayton was that mapping support for negotiations be derived from a single, accurate source that both sides perceive to be unbiased (Johnson 1999:9). Innovative use of GIS tools and close coordination with the negotiators were also important for a successful outcome. In the five years since Dayton, GIS-based data management tools have become more powerful and easier to use, which should make them even more applicable to the difficult task of resolving complicated and high stakes territorial disputes.

DATA LAYERS

While sophisticated GIS software can now handle most of the territorial queries made by negotiators, the major hurdle – assuming both sides are acting in good faith – is to obtain relevant and accurate georeferenced data. Such data are frequently

non-existent, out-of-date, poorly organised, classified, and/or hotly contested by one side or the other. The *"base map"* or *"geospatial foundation"* for such an effort would consist of physical geographic data, particularly topography and natural features that would affect delimitation. Commonly, digital terrain elevation data are employed as base map layers, but increasingly orthophoto maps are being used as a key foundation layer, especially in areas without up-to-date, large scale maps (1:25,000 and better) because they are a relatively quick and accurate means to portray land features. Imagery use, though, is constrained by limited public accessibility, still high acquisition costs, and large data storage demands.

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Politically, the base map should represent for negotiators the least problematic data layers within the GIS because these layers largely reflect 'objective' landscape features. Nonetheless, both parties in a dispute must have confidence that the base map is accurate and does not favour one side at the expense of the other. Beyond the geospatial foundation layer, data availability, source, and currency can become a major source of contention between the disputing parties. An important mediation role would be to work with the parties prior to the onset of formal negotiations to identify, collect, organise, and georeference data layers that would be acceptable to both sides. Data layer customisation, in turn, requires that both sides develop mutually acceptable and shareable information about the key negotiating issues. Indeed, 'technical' agreement on the geospatial foundation could be a critical confidence-building measure prior to the onset of formal negotiations.

Even with firm support by both disputants, development of an accurate base map may take weeks to develop, depending on the size of the area in question, the scale required, and the detailed accuracy desired. Technical difficulties include digitising large amounts of disparate data (if standard commercial products are unavailable) and formatting data to common geodetic references. With the GIS industry moving toward greater data interoperability and with growing acceptance of metadata and cartographic standards, accurate geospatial foundation data should become more widely accessible, even for isolated and disputed areas of the earth's surface.

Determination of which GIS-generated data sets will be useful and which ones will not is not always apparent and is a function of negotiation strategies. A careful review of data layers will likely reveal devilish details, which could help resolve some points of contention, but also raise new ones. GIS-enhanced data sets could be divided between those that are accepted at face value (the 'geospatial foundation') and those that are likely to be contentious. For the latter, negotiating parties might wish to provide their own interpretation of a particular data layer – in that case the GIS might serve as a means to explore variances in data, as opposed to the data serving only to visualise territorial aspects of the negotiations. Indeed, agreement on acceptable data layers and resolution of those over which there is disagreement may be another critical step in productive territorial negotiations.

IMAGERY AND NEGOTIATIONS

While commercial remote sensing has long been used to detect environmental changes on the earth's surface, it is playing an increasingly important role in territorial negotiations. Already, aerial photography is used as part of the documentation process for delimitation accords. In addition aerial photography can be used to assist in the placement of boundary pillars and the formal record of completed demarcation. Such aerial surveys can provide high resolution images that provide boundary negotiators with a means to better assess on-the-ground conditions that could affect delimitation (such as avoidance of bisecting properties) and demarcation (such as determining the thalweg of a river course). Finally, imagery could be used as part of a regular program to determine changes that might affect the boundary line (the changing course of a river) or the physical condition and placement of boundary pillars.

Commercial remote sensing imagery can and should emerge as a key data layer for all boundary disputes, especially for areas where accurate, up-to-date, large scale maps are unavailable – in other words, for most of the world. The resolution of commercial imagery has become more precise and flexible, offering a number of different applications that could be incorporated within a GIS-based boundary analysis process. At the lower resolution end, LandSat and RadarSat (greater than 15m resolution) offer powerful multispectral and radar-based imaging tools to assess land changes that could affect boundary negotiations – particularly for territorial sea calculations and other measures requiring the viewing of large areas of the earth's surface. At the medium resolution level, satellites such as the Indian IRES and the European SPOT (greater than 5m resolution) offer panchromatic imagery at a scale that can be used to determine boundary delimitations. At the higher resolution level, traditional aerial photography and Space Imaging's IKONOS satellite offer one meter resolution and better imagery that, if orthorectified accurately, could be used for specific delimitation adjustments and demarcation documentation.

The use of commercial imagery for boundary negotiations has several important considerations. The first consideration is availability and consent, which are sometimes not easily answered.   While there are growing inventories of imagery for developed countries, complete and uniform coverage at the appropriate resolution is often lacking for much of the developing world. Given military concerns over border regions, are both parties willing to use imagery as part of their negotiations? The second set of consideration is cost and analysis. Imagery is becoming less expensive, but full coverage of a long boundary can still cost millions of dollars, especially if it is to be fully orthorectified and analysed for possible conflicting land uses or impediments caused by land features. "Who will pay?" and "who will analyse?" could thus become major problems. The third set of considerations is how the imagery is to be used in the boundary negotiations and as a permanent record for the delimitation/demarcation process, as well as its use as part of a boundary monitoring regime. How will the imagery be organised, stored, accessed, marked-up, and up-dated?

SUMMARY

This paper is a broad overview of potential GIS applications for analysing frontier and cross border dynamics in general and territorial negotiations in particular.   Like all other 'technical' tools, a properly implemented GIS can go far beyond a paper map and pencil to assist in the resolution of complex boundary problems. The full use of a GIS as part of the diplomatic and mediation toolkit will only come when negotiators realise that in an increasingly congested world, with crowded borders and scarce natural resources, problem resolution is more than a two dimensional exercise.

Territorial negotiations are fundamentally a political process that involves a potentially broad range of data, some of obvious importance and others less so. Once the underlying data layers are agreed-upon, negotiators will be in a position to employ GIS as a powerful tool for territorial analysis and mediation decision-making. Whether that GIS-enabled capability results in a secure and mutually beneficial border transcends the technical aspects of negotiations and enters the more nebulous world of geopolitics.

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References

Anderson, M. (1996) *Frontiers – Territory and State Formation in the Modern World* , Cambridge: Polity Press.

Anderson, M. and Bort, E. (1998) *The Frontiers of Europe,* London: Pinter.

Bowman, I. (1922) *The New World – Problems in Political Geography,* Yonders-on-Hudson: World Book Company.

Carnegie Commission on Preventing Deadly Conflict (1997) *Preventing Deadly Conflict*, Carnegie Corporation of New York.

Dziedzic, M. and Wood, W. (2000) *Kosovo Brief – Information Management Offers a New Opportunity for Cooperation between Civilian and Military Entities.* Virtual Diplomacy Series, United States Institute for Peace.

Goertz, G, and Diehl, P. (1992) *Territorial Changes and International Conflict,* London and New York: Routledge.

Hensel, P. (1999) 'Charting a Course to Conflict: Territorial Issues and Interstate Conflict, 1816-1992', in Diehl, P. (ed.) *A Road Map to War – Territorial Dimensions of Conflict,* Nashville and London: Vanderbilt University Press.

Johnson, R. (1999) *Negotiating the Dayton Peace Accords through Digital Maps*, United States Institute of Peace (USIP) Virtual Diplomacy Report, 25 February (www.uisp.org/oc/vd/vdr/rjohnsonisa99.html).

Kaplan, R. (2000) *The Coming Anarchy: Shattering the Dreams of the Post Cold War Period*, Random House.

Martinez, O. (1994) 'The Dynamics of Border Interaction', pp.1-14 in Schofield, C.H. (ed.) *Global Boundaries, World Boundaries*, Vol. 1, London and New York: Routledge.

Newman, D. (1999) 'Real Spaces, Symbolic Spaces: Interrelated Notions of Territory in the Arab-Israeli Conflict', pp.3-36 in Diehl, P. (ed.) *In A Road Map to War – Territorial Dimensions of Conflict*, Nashville and London: Vanderbilt University Press.

Paasi, A. (1998) 'The Political Geography of Boundaries at the End of the Millennium: Challenges of the De-territorializing World', in Eskelinen, H., Liikanen, I. and J Oksa, J. (eds) *Curtains of Iron and Gold – Reconstructing Borders and Scales of Interaction,* Ashgate Publishing.

Prescott, J.R.V. (1987) *Political Frontiers and Boundaries*, London: Unwin Hyman.

Reid, T. (2000) 'Bridging a Continental Divide', *The Washington Post*, (2 July): A18.

Reitsma, H-J. (1983) 'Boundaries as barriers – the predicament of land-locked countries', in Kliot, N. and Waterman, S., (eds) *Pluralism and Political Geography – People, Territory and State*, London and Canberra: Croom Helm.

Starr, H. (1999) *Using Geographic Information System To Revisit Enduring Rivalries: The Case of Israel*, University of South Carolina, unpublished paper.

_____ (2000) 'Opportunity, Willingness and Geographic Information Systems (GIS): Reconceptualizing Borders in International Relations', paper prepared for the conference *New Methodologies for the Social Sciences: The Development and Application of Spatial Analysis for Political Methodology*, Institute of Behavioral Sciences, University of Colorado, Boulder, 10-12 March.

Thomas, B. (1999) 'International Boundaries: Lines in the Sand (and the Sea)', pp.192-208 in Demko, G. and Wood, W. (eds) *Reordering the World Geopolitical Perspectives on the 21ˢᵗ Century*, Boulder: Westview Press.

Waterman, S. (1994) 'Boundaries and the Changing World Political Order', pp.25-35 in Schofield, C.H. (ed.) *Global Boundaries, World Boundaries*, Vol. 1, London and New York: Routledge.

Wood, W. (forthcoming) 'Geographic Aspects of Genocide: A Comparison of Bosnia and Rwanda', *Transactions of the British Institute of Geographers.*

Wood, W. and Smith, D. (1997) 'Mapping War Crimes, a GIS-based Analysis of Bosnia's Ethnic Cleansing', *GIS World*, September: 56-58.