Bioregional Mapping as a Participatory Tool in the Community Based Watershed Management Project in Santo André, Greater São Paulo, Brazil

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Prepared for delivery at the 2003 meeting
for the Latin American Studies Associations,
Dallas, Texas, March 27-29, 2003

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"The atlas should be used as a jumping off place for decision making about the future. From the holistic image of place that the maps collectively communicate, what actions could be adopted to achieve sustainable prosperity? What priorities emerge from a survey of damaged lands and unsolved social ills? What underutilized potentials can be put to work to help achieve sustainability? The atlas can become a focus for discussions setting a proactive plan for positive change."[1]

The CIDA-funded Community-Based Watershed Management project (CBWM) is developing a framework for effective watershed management in Santo André, São Paulo, Brazil. Unlike traditional planning approaches, which rely heavily on top-down legislative and legalistic methods, the CBWM project strives to protect and rehabilitate environmentally sensitive areas by involving people in the development process as 'stewards' of the environment. By addressing both socio-economic and environmental issues, the project addresses problems inherent in a rapidly developing metropolitan area undergoing economic restructuring and the impacts on poor residents living in informal settlements.

The formulation of the CBWM framework, structured around community participation and learning-by-doing, is shaped by residents' inputs on all related issues and enables the community to steer itself and guide the project implementers into developing appropriate community planning and information processing capacity to resolve the complex issues of watershed management in an urban and periurban context. The Santo André municipality recognizes the need for new operational tools for environmental management that move beyond traditional top-down master planning. The project implements participatory action research, social impact assessment, community economic development, gender planning and environmental education. This paper outlines key outcomes and the relevance of a particular methodology -- bioregional mapping -- to the project.

Under the larger goals of the CBWM project, the community based bioregional mapping, a powerful tool for community empowerment and for the development of technical capacity to aid in the administration of existing resources, is being implemented as a participatory means of community needs assessment and strategy formulation in the three Pilot Projects within the watershed areas. This involves a highly effective process whereby community members, local government, and planners work together to identify and understand the various biophysical and socio-cultural elements of their surroundings and develop a strategy for building locally controlled and self-reliant economies that are closely tied to the use and sustainability of the surrounding ecosystems. Generating a greater sense of community ownership, as well as an increased awareness among community members of the direct impact of their actions on their surroundings, it contributes to the overall project goals and related activities which are aimed at stimulating a sense

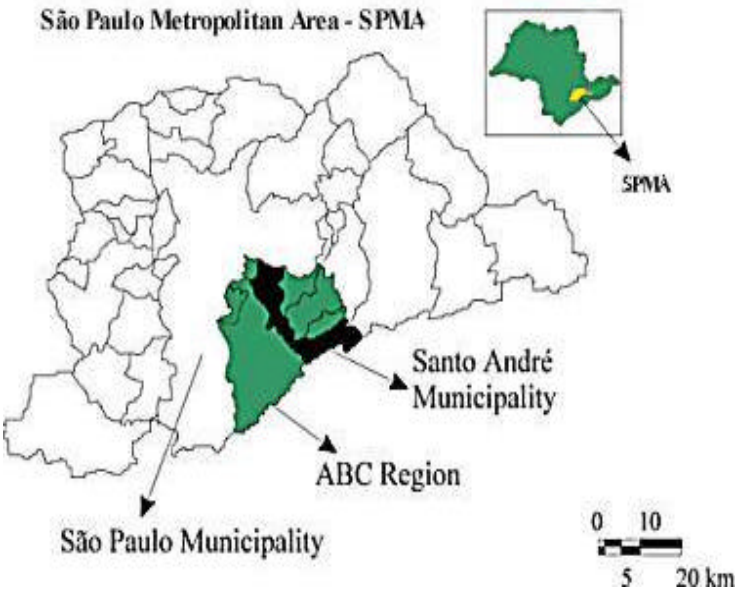
[1] From Harrington, Sheila (Ed). (1995). *Giving the Land a Voice*: *Mapping our Home Places*. Salt Spring Island Community Services Society, Salt Spring Island, B.C.

of stewardship within the community by imparting the importance of the watershed to each resident's political, social, economic and physical well being.

Introduction

Environmental degradation in cities of developing countries, such as Brazil, is threatening the availability and quality of natural resources, particularly water resources, as a result of uncontrolled development in watershed areas. While those most affected by deterioration of the physical environment are the urban poor, poverty is also itself a major factor in urban environmental degradation. It is the poor who occupy the ecologically fragile lands in exclusionary land and housing markets (Bartone, 1996).

The São Paulo Metropolitan Area (SPMA) is one of the world's largest urban agglomerations and the most urbanized, industrialized and affluent city in Brazil. It consists of 39 municipalities (see Map 1), with a population of approximately 18 million people. Although the average SPMA population density (8,482 people per km^2) is high when compared with average densities for other Brazilian cities, there are still expanses of unsettled land on the metropolitan watersheds that are the source of most of the urban water supply for the metropolitan region as well as the focus of rapid new settlement.



Map 1. Santo André and ABC within São Paulo Metropolitan Area

The occupation of the watershed areas, where outdated legislation to protect water sources made the low value of land attractive to low-income populations, is outpacing the growth of the 'formal' city. It is here that the poor have found a place for the only housing arrangements they could afford: illegal settlements and favelas, without adequate infrastructure or basic services. Wastewater, sewage, and solid waste from the surrounding areas of the reservoirs are discharged directly into the reservoirs. The main polluting source of waterways is domestic effluent, which accounts for two-thirds of contamination, as 90 per cent of sewage is not treated (Jacobi, 1997).

Several small and large projects within SPMA have already tried to address these issues and reduce pollution. However, in spite of improvements in living conditions of some settlements, most of them have largely failed. These programs and projects did not shift the region's planning focus from technical goals to a broader, more holistic approach that could address social inequalities —

the loci of urban environmental problems as well as the environmental degradation associated with poor neighbourhoods in environmentally sensitive areas.

Top-down methods such as master planning and restrictive legislation, highly centralized, with little or no public participation, shaped the SPMA from the mid 1960s until the mid 1980s when the country was ruled by a military dictatorship. However, not only did these approaches not provide a framework to adequately guide the rapid urban growth occurring throughout the metropolitan area, but they inadequately dealt with the political complexity associated with a multi-stakeholder planning process. As a consequence, none of the Master Plans formulated for São Paulo have been successfully implemented. Restrictive legislation, such as the Watershed Protection Law enacted in 1975, has also failed. Settlement continued irrespective of legal restrictions and increasing numbers of low-income families have settled in environmentally sensitive watershed areas. In the specific case of São Paulo watersheds, land policies have been used to essentially 'promote' the development of informal settlements while officially hindering it. This ambiguous approach to watershed protection has led to the deterioration of water quality for the metropolitan region and of the quality of life for low-income settlers in sensitive areas.

Two major components over the last decades have created changes in Brazilian planning. One was the democratization process and approval of the new constitution in 1988, which represented a shift away from centralized control to the decentralization of urban management functions back to the municipal level. This has led to the increasingly important role of municipal governments in providing for the welfare of citizens (Samuels 2000). Municipalities are by necessity becoming more pro-active in terms of service provision and development policy (Rodrigues-Pose, Tomaney, and Klink 2001). The other component was the increasing success of the Workers Party (PT) in the administration of Brazilian cities. This party has, at the core of its political agenda, a strong support for public participation in local decision-making processes. In the Brazilian context, participatory planning has a relatively recent history, rooted in the political movements that have brought the PT to power in many municipalities and increased their recognition at the national level. The PT supports active citizen participation in local decision-making, and is internationally recognized for its work in implementing a participatory budgeting process in many Brazilian cities. This involves a push towards greater citizen participation in local government activities. The Brazilian PT in a number of different municipal governments has been involved in the project of increasing citizen involvement in local decision-making (Abers 2000, Ostrom 1996).

Parallel to these changes, there were a number of legislative changes that are of particular relevance to environmental management and which reinforced the decentralization process.[2] The State Law of Recovery and Protection of Watersheds acknowledges the reality of settlement within the watersheds, encourages the formulation of emergency plans to provide basic services to the human settlements within respective municipalities' watersheds (most of which are "illegal" in terms of

[2] These included State Law No. 7663, passed in 1991, decentralizing policy for water resource management via the Water Basin Committees (Comitês de Bacia, comprised of representatives of state and local government as well as civil society organizations). State Law No. 9034 of 1994, in conjunction with the above mentioned legislation, requires that "emergency plans," "environmental plans" and "sustainable development plans" need to be drawn up for the water basins, which are then to be submitted to the Water Basin Committees for approval.

the 1975/1976 law) and recognizes the municipal right to enact regulations in watershed areas within municipal boundaries.[3]

Santo André

The city of Santo André, one of the SPMA municipalities, is approximately 175,000 km^2 with an estimated population of 665,000 people. Along with the other cities in the Greater ABC Region (Santo André, São Bernardo do Campo, São Caetano, Diadema, Mauá, Ribeirão Pires, Rio Grande da Serra - see Map 1), it has played an important role in the economic development of the SPMA, representing the core of industrialization, and making it one of the most important development poles in the country. Notwithstanding the strong economic base, the whole region has been under increasing industrial decentralization. Formal sector industrial employment has increasingly been diminishing, provoking changes in the whole human geography of the region. In order to develop and co-ordinate proactive strategies for the region to address negative impacts of macroeconomic restructuring, these seven municipalities under the leadership of Santo André implemented the Council of the Greater ABC Region. This consortium of political leadership aims to maintain the ABC Region's dominance as an economic centre through an integrated approach to social, economic and environmental policies.

Santo André has had rapid and unsuccessfully managed urban growth. Land use development happened in a random, chaotic way, lacking any systematic integrated planning process. Most of the new low-income housing is informal settlements and favelas that are increasingly occupying the watershed areas. Santo André has approximately 30,000 people living within its watershed. This accounts for around four per cent of its total population, the remainder of which live in the higher density northern portion of the municipality. These settlements violate municipal land use and environmental legislation, and are unhealthy living environments with non-existent or very low levels of physical and social services—particularly sewerage treatment and garbage collection. They are also poorly located in relation to urban services.

Santo André is presently governed by the Workers Party, which is committed to a high degree of public participation in the urban management process. The participatory budget ("*orçamento participativo*") process attests to this commitment. This process involves equal numbers of representatives from the municipal administration and the community, and it is the locus where socio-economically marginalized groups are able to make meaningful inputs into decisions about expenditure and investment priorities. The Municipal Councils (*conselhos municipais*) also

[3] The new legislation reinforces the process of decentralized watershed management through the tripartite water basin committees (Porto 1998). For each basin, a committee comprising representatives from state, local government and civil society organizations is to be established, and be involved in making an emergency plan for the restoration of watersheds, and an environmental plan—including a socio-economic development plan. In addition, the subcommittee of the Billings-Tamanduatei basin is also responsible for the formulation of a sustainable development plan dealing with land use, occupation and environmental protection of the Billings Reservoir. In order to avoid contradictory regulations being enacted in contiguous municipalities sharing the same water basin, any new enactment of regulations will need to be consistent with state laws that are in the process of being formulated for each water basin—which, in the case of Santo André, refers to the Alto-Tietê Basin.

demonstrate the strong relationship between the municipality and community. These councils comprise representatives from local government, community, and the private sector and are involved in the definition of sectoral policies, the implementation of urban management systems, and the monitoring and evaluation of programs and projects.

The Community Based Watershed Management Project (CBWM)

The CBWM project is a four-year CIDA-funded project that started in October 1998. It was established in order to organize a system that addresses the environmental, social and economically sustainable occupation of the watershed areas. The stated goal of the project is to make municipal watershed management in Santo André more effective, participatory and responsive to the needs of informal settlements.

CBWM is a multi-stakeholder approach to planning in environmental protection areas that represents a fundamental change in the way planning and watershed management has traditionally been conducted in Brazilian cities and states. Consequently, the process has been designed to include a wide range of stakeholders in the conceptualization, design, and implementation of planning guidelines. This includes marginalized groups such as low-income communities, women, and "illegal" residents who have traditionally been excluded from decision-making processes.

The CBWM project proposes a different approach to the environmental protection of this area that will integrate the needs of the area residents with conservation efforts. Thus, the project is making a critical contribution to rezoning by developing environmental and social analyses methods appropriate to the needs and capacities of the ABC municipalities. In addition, the project is advancing conflict resolution, public communication, community participation, gender analysis and community economic development skills, all of which are needed to ensure that the zoning and its implementation at the community (neighbourhood) level is effective and fair. Project activities have been developed around the following main areas: information collection and diagnosis; planning the formulation of the framework; pilot projects; training; and planning the planning process.

There are a number of significant issues that have contributed to the project's success:

- *Institutionalization*: Integration of CBWM principles and methods into key institutional structures and processes in the region is a central element of the project.
- *Political support*: Support from political figures – and in particular the mayor of Santo André – was crucial to ensure a serious commitment of municipal staff to project activities.
- *Community support*: The emphasis on stakeholders in the planning process ensures the involvement of key interest groups that are often marginalized in planning decision-making processes.
- *Legal mechanisms*: Some legal mechanisms have been instituted to provide support for longer-term upgrading and infrastructure implementation services.
- *Funding*: The goal of this project is to provide the main tools – policies, plans, methods, and skills – that will guide the longer-term development of the Watershed Protection Area.

Implementation of CBWM

One of the primary issues that have arisen in the CBWM project involves partners learning more about the difficulties of capacity building and learning from one another. Transferring knowledge is never straightforward; it is difficult to transform knowledge into long-term skills and concrete results. This process takes a long time to have a significant impact on changing practices and habits.

All partners need to acknowledge the importance of trust in international development projects. It is extremely difficult to build trust between institutions with different cultures and outlooks. It is essential, therefore, to have a permanent system of communication within the project itself, one that will take into account differences in institutional cultures within the country, and between countries.

There are a number of planning issues that are relevant to all partners involved:

- *Adaptability*: If a project is to be successful, it must be adaptable to the circumstances and priorities of each partner. Partners must have a clear understanding of the objectives and goals to be achieved, and these must be established through consensus. A multidisciplinary planning approach, which includes the participation of the major partners, is essential.
- *Communication*: A permanent system of communication is the basis for successful co-operation. A project must be designed and planned from the perspective of its stakeholders, which means that their key questions have to be recognized. Close relationships must be built between the executing institutions and the stakeholders.
- *Project management and teamwork*: The importance of flexibility must be recognized in terms of project management. It is not always easy to predict the dynamics of a project once it is underway, since it is subject to various external factors, and it may require changes in focus, strategy, and institutional coordination mechanisms. An important success factor for projects is to empower coordinators to play a facilitating role and to manage conflicts. In principle, coordination should be decentralized, participatory, and framework based. Effective teamwork is very important to a project's success.
- *Strong commitments*: The project's success depends on commitments from all the partners at the outset and their participation in the project's management structure in order to ensure that local characteristics and circumstances are taken into consideration.

PARTICIPATION TOOLS

There has been an ongoing movement by Brazilian municipalities, especially in Santo André, towards participatory processes and the engagement of outside experts through processes of technology transfer by international development practitioners. Approaches such as rapid rural appraisal, participatory rural appraisal, and participatory action research have been developed to take the decision-making power out of the hands of 'outsiders' and place it in the hands of local people who are the recipients of development planning and the benefits and mistakes (Chambers 1983, 1993, 1997; Fals-Borda and Rahman 1991; Kemmis and McTaggart 1988; McTaggart 1997; Rahman and Baduri 1982). These approaches aim to develop a range of practical methods and participatory tools that both open communication among various stakeholders and explain realities

from a local perspective rather than through the biased lenses of outsiders. By reducing outsider bias and grounding decisions in local knowledge and resources, more feasible locally based solutions emerge.

Within the framework described above, participation tools were explored to establish key techniques or methods, which could be used during the process of implementation and also in a follow-up process. These tools should help not only in the evaluative process of the lessons learned and sustainability of gains, but also need to be easily understood and "owned' by the communities involved. These tools are key elements of the "*adaptive planning process for watershed management*," a major output of the project (see Fig. 1).

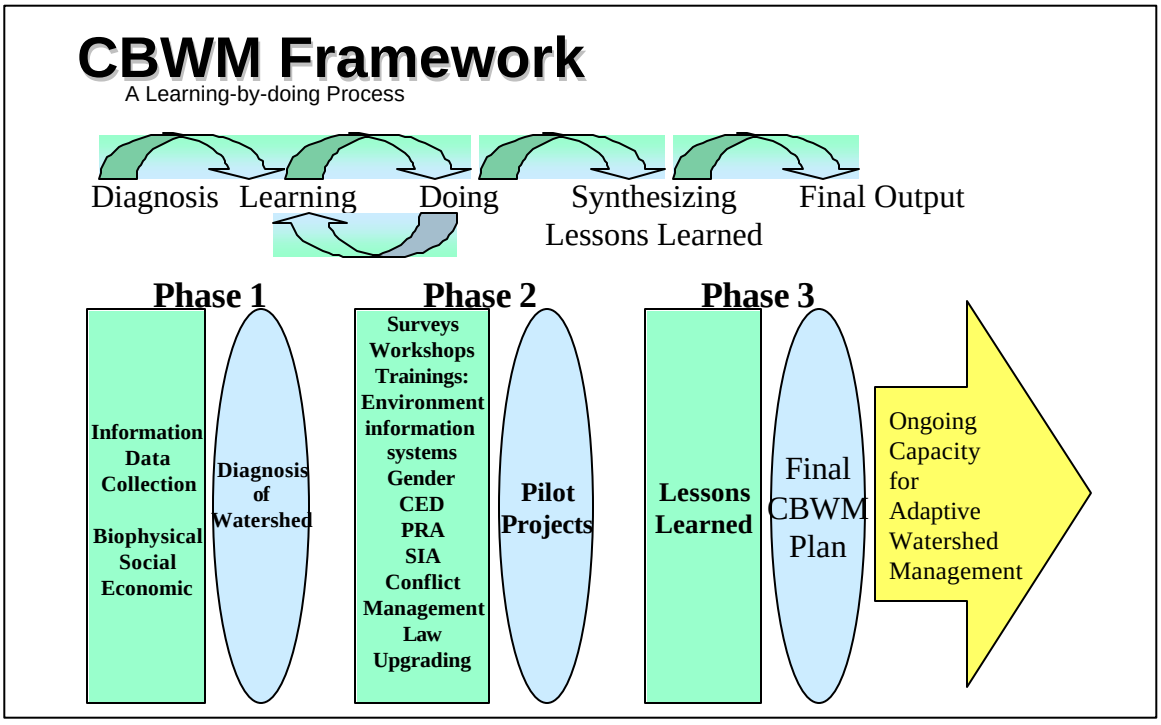


Figure 1. CBWM Framework

Three different tools have been used in the CBWM project in reference to community development and land use decision-making: Environmentally Sensitive Areas (ESA) methodology, the charrette process, and bioregional mapping. Each of these complementary tools addresses distinct requirements in different ways, but combined they create a holistic participatory process.

The ESA methodology, which was developed by UBC's Institute for Resources and the Environment (IRE-UBC), was adapted for the project as part of the diagnosis phase. An ESA is an area that requires special consideration due to its unique physical, biological, or cultural characteristics. ESAs can include a wide diversity of areas: steep slopes, areas subject to flooding, forested areas, cultural resources, etc. The purpose of an ESA analysis is to identify the many different types of sensitive areas, develop maps for each type, and then to combine the map layers in a meaningful way showing environmental restrictions. The types of sensitive areas and the way in which they are integrated reflect the interests and viewpoints of local stakeholders. Results are

used in the development of zoning maps and community development maps as well as in the screening phase of environmental impact analyses of specific project proposals.

The charrette process represents a design exercise that stresses interdisciplinary work on difficult problems in an intense setting, resulting in illustrations that show the implications of particular planning policies. In the case of CBWM, officials from the municipality, community members, and graduate students from the Faculty of Architecture and Urbanisme (FAU-USP) wrestled with the pressing and difficult problem of how to design a sustainable neighbourhood for the poorest people living in the watershed, in the favela Pintassilgo (Pilot Project 2). This exercise explored and illustrated several possibilities for upgrading and expanding the settlement. The charrette had a primary goal of illustrating compelling *visions* of what a sustainable community in the watershed areas might look like in order to inform future land use, urban design, and environmental policy for the whole area. At the same time, the direct participation of municipal staff ensured that the project was grounded in existing policy and institutional frameworks. It also ensured the direct transfer of knowledge between all participants, including municipal decision-makers, members of the community and designers. This was the initial step in the process of finding creative approaches that must be continued through further design refinement. The output of this process was a publication "*Sustainable Watersheds: Urban Landscape Design for Low-Income Settlements*" published by the Centre for Human Settlements.

A third tool to contribute to land use planning (and the main focus of this paper) is bioregional mapping. Maps, in addition to their cartographic applications, have been used in education and science to provide a visual representation of knowledge. They provide a complementary alternative to natural language as a means of communicating knowledge. In many disciplines various forms of maps are already used as knowledge representation systems. It is no coincidence that the words image and imagination have the same roots. It has been known from early times that visual imagery plays a significant role in the creative processes of many people (Arnheim 1969). Many disciplines developed visual languages for concept maps, cognitive maps in education, and Novak (1977) developed a system of concept maps that has been widely applied in the evaluation of students' learning in the school system (Novak and Gowin 1984). A wide variety of different forms of concept map have been applied in education (Lambiotte, Dansereau, Cross and Reynolds 1989). In management, Axelrod (1976) proposed cognitive maps as a means of representing the conceptual structures underlying decision-making. In the history of science, the dynamics of concept maps have been used to represent the processes of conceptual change in scientific revolutions (Nersessian 1989, Thadgard 1992).

Parallel to these developments, planning has had a long history of using maps for defining, describing, and portraying natural systems and man-made interventions. Community participatory planning is, thus, a natural area whereas visual translation of knowledge, enhanced awareness of the natural and man-made surroundings and decision-making systems could be mingled through a methodology that is easily developed and visually highly responsive to communities.

Mapping at the parcel level involves direct experience with a piece of land (surveying from measurements, observations, experiences). The purpose of this type of mapping is to better understand the interrelationships and dynamic nature of the land. Having this knowledge will enable users of the land to make better decisions, at the everyday and longer-range level, about

activities to take place on this land. Residents can be taught simple techniques for evaluating and monitoring such things as rain collection on impermeable surfaces (roofs and pavement), as well as basic techniques for measuring soil erosion, slope stability etc. Mapping at the parcel level will likely make an individual aware of the relationships with other parcels – i.e. at the larger level – that can otherwise be known as the bioregion.

Bioregional Mapping

While maps created by scientists are widely recognized as authoritative documents, they are not the only legitimate source of valuable information about a place. The creation of maps at the community level is a practice, which is currently, used among communities in England, Europe, Newly Independent States of the former Soviet Union, Australian, the United States, and Canada.

Beginning in the 1970s and continuing until the present time in North America and in Western Europe, theories and methods of social learning and communicative action have been developed as the basis of participatory planning for professional planners (Forester 1989; 2000; Friedman 1987; Habermas 1984; Healey 1997; Sager 1994). Theories and methods of social learning and communicative action start with the premise that open communication and dialogue build a more holistic array of planning options. Participatory planning has evolved from social learning ideally translating into decision-making based upon a more consensual approach where a wider range of voices is included in the final plan or decision.

Theories of bioregionalism, social ecology, and communicative action highlight the empowering effects of participatory involvement in the process of identifying and valuing one's own environmental context. Many authors identify the value of citizen participation in local resource identification and decision making as central to the project of building good civil society and effective environmental stewardship (Greenwood and Levin 1998), (Linehan and Gross 1998), (Luz 2000), (McGinnis 1999), (Plant and Plant 1992), (Slocombe 1993), (Slocum et al. 1995), (Western and Wright 1994).

Recognizing the knowledge of the people who live in a place is an essential objective of bioregional mapping. This type of mapping draws on existing knowledge among community members, as well as enabling them to collect new information, and to consolidate it with existing information to form a concise and more complete picture of their community. Community mapping can be used in support of learners and to support a wide variety of visual thought processes in individuals and groups. Mapping tools are to be used to support collaborative learning by sharing the maps, working together on linked maps, and sharing knowledge.

Bioregional mapping is a strategy for building locally controlled and self-reliant economies that are closely tied to the use and sustainability of the surrounding ecosystems. As a methodology for citizen involvement in resource identification and local decision-making, it presents a significant contribution to the Brazilian municipal context. It is an inexpensive, accessible and highly effective process whereby community members, local government, and planners work together to identify and understand the various biophysical and socio-cultural elements of their surroundings. This generates a greater sense of community ownership, as well as an increased awareness among

community members of the direct impact of their actions on their surroundings. It is a significant tool for community empowerment and for the development of technical capacity to aid in the administration of existing resources. The skills necessary for implementing a community based mapping strategy are easily transferable and can be taught through a training the trainer strategy used during the process of creating a series of maps. Maps generated through this process become accessible resources for the community that can be easily updated by community members and used for future project development (Aberley 1993).

This type of mapping is concerned with documenting the interrelationships of environment and human activity, to create a snapshot of existing conditions, a record of an extended period of time, and also possibly a tool for visions of the future. Bioregional maps can be used as a baseline of information about an area so that when change occurs, it can accurately be measured and monitored. Because bioregional maps are inexpensive to produce and easy to update, they are ideal for use in documenting change over time.

As a means of building awareness of community landscapes towards local empowerment, bioregionalism and social ecology are theories grounded in participatory methods that also incorporate a strong concern for the promotion of ecologically sustainable activities (McGinnis 1999; Linehan and Gross 1998.) Mapping practices associated with these theories have been well developed in the North American and Western European contexts and are employed by many community groups, organizations and local governments to map community environments and resources for greater local empowerment (Aberley 1998). A strong base of organizations currently using these practices exists in British Columbia, with a central focus in the lower mainland. Some organizations use the mapping process as a tool for strategic planning for community economic development (Ecotrust Canada).

Mapping as a Participatory Planning Method

By collaboratively developing maps, people strengthen their community self-identification and increase awareness of existing biophysical, socio-economic, and cultural resources and values within the community. It is a participatory process for evaluating the appropriateness and feasibility of various community development initiatives, as well as for organizing existing resources and knowledge thereof into some sort of cohesive framework. This can also be used as the groundwork for future activities like community visioning, heritage planning, eco-tourism, etc. One potential use of community based (bioregional) mapping as a participatory planning tool and process in community development in an international context is to explore the role of action research methodologies in evaluating project activities and development approaches. Or use action research as a methodology for evaluating and assessing the outputs of the mapping project. Another outcome of mapping is to gain insight into the nature of relationships. Community based mapping can contribute to positive linkages between decision makers within local management frameworks as well as with other groups (NGOs) and local community members in the context of a complex development project whose area is limited by jurisdictional boundaries, but that is impacted by or has impacts on other areas in the region.

Community based mapping as a participatory planning method also enhances capacity for communication between community members and local decision-makers regarding issues of land use, environmental awareness, education initiatives, and tourism and heritage development. This tool is beneficial in terms of meeting the project goal of making watershed management more participatory, accountable, and responsive to the needs of local citizens and to ensure ecological integrity.

In the task of implementing this tool, the objectives are four-fold:

1. To implement community based mapping as a participatory process in order to increase awareness of local issues as well as foster better communication between community members and decision makers so that community members become more involved in decision-making
2. To evaluate community based mapping processes in terms of suitability for increasing capacity for municipal decision-making that is participatory in nature, responsive to the needs of local citizens, and effective in maintaining ecological integrity within the watershed.
3. To evaluate community based mapping strategy in terms of its effectiveness in garnering and maintaining high levels of community participation, with special consideration for issues of gender and youth.
4. To provide recommendations that might aid municipal authorities and community members in developing effective strategies for future participatory processes.

Bioregional mapping is an accessible method of community empowerment. It is less about teaching skills to be an expert cartographer, and more about community building. All segments of the community can be involved in the bioregional mapping process. Though it is important that the maps are accurate, it is essential that the techniques used to create the maps involve community members so that they have a sense of ownership of the maps and of membership in their community.

The use of effective, systematic methods for community participation and the review of the facts shown on the maps before final completion will ensure that the maps are quite accurate and they will be converted easily to digital format if so desired. Also, the generation of enthusiastic and continued participation by community members will contribute to the establishment of a vision of sustainable development that the community will be interested in actively pursuing. Opportunities to implement economic, environmental, and socially just plans are facilitated by community buy-in.

Bioregional mapping is relatively straightforward and creates a tool with a great deal of organizing potential. By consolidating a wide range of information about biophysical and cultural features together in one place, both community and planners awareness can be raised towards the possible directions for the future. Bioregional mapping is not intended to raise expectations of community members for certain actions to take place, but rather to raise awareness of existing conditions, and highlight areas where positive change might be facilitated. This can often include areas where greater community participation in stewardship activities is highlighted as beneficial to the community in bringing about positive change. This also means that options for change and development that can be led by community members themselves can also be highlighted, as opposed to simply highlighting areas that require assistance from external planners and experts.

Bioregional Mapping Methods

There are several different ways in which the bioregional mapping process can be implemented. Participation by community members can range from consultative to fully active in creation of maps. The following are several suggestions for different mapping processes to involve community members in different capacities:

- *Consultative:* The maps are created by specialists, either alone or in cooperation with other experts. Community members are involved in consultation with experts for sharing information, but do not actively participate in the creation of the maps.
- *Cooperative Participatory*: The maps are created by specialists in cooperation with community members. Both community members and the specialists participate in the collection of data, and its representation on the maps. A specialist often directs this process, although a more facilitatory role is desirable.
- *Self-Directed Participatory*: The maps are created by community members who consult specialists, but are not directed by them. Community members are often involved in decisions about what features to map, and will ultimately decide what information is of great enough value to be included on the maps. This method is the most representative of community members' feelings about a place, but may not provide all information desired if the maps have been commissioned for a specific purpose.

In the case of CBWM, it is very important that community members feel that they are actively involved in the creation of the atlas, including participating in decisions about what features are to be mapped, in order to build community stewardship. It is understood also, that the maps are to provide information regarding a specific purpose; therefore, some direction from specialists is considered valuable. Since specialists have a great deal of existing knowledge and information about certain aspects of the area, they can be of great benefit to the mapping process by providing information and knowledge to community members. In this way, relationships between specialists and members of the community can be strengthened and more informed decision-making that is supported by the community can occur.

Environmental protection as a development priority has a relatively recent history in Brazil. Most environmental legislation to date is top-down, regulatory and difficult to enforce in light of extreme pressure from urbanizing areas. The development of the community based watershed management approach is a major contributor to greater awareness building and stewardship among local citizens. The incorporation of an accessible, comprehensive technique for spatially identifying resources and issues at the local level that could contribute to or create barriers to development is paramount to success (CHS 1998; 2002; Rodriguez-Pose et al. 2001). While the existing literature on participatory planning in Brazil is very rich, little mention of community based mapping techniques is made. Bioregional mapping offers a unique advantage to resource gathering for equitable awareness building and inclusive participatory planning in the Brazilian municipal context.

Another positive element of the biomapping process involves the capacity to deal with the conflict between uses and users within watersheds. Community mapping provides a forum for the expression of diverging opinions. Because people from varying backgrounds are working together to create the maps, an accurate and realistic portrait of the community can be created that allows room for dissent, and also provides a space for dialogue, and hopefully by extension, conflict

resolution. Also, the different values that determine various visions can be identified and dealt with. Currently, in North American planning, various participatory techniques are being used to enable group members to resolve conflicts by extrapolating their original purposes from their perceived needs. When people go back to thinking about what essential things they need or desire, it becomes easier to realize that other solutions might exist that can be compatible with various groups.

Biomapping Outcomes

The following section outlines the development process, immediate outputs, and forecasted outcomes, as well as replicability to other projects.

Through the use of various participatory methods and tools informed by such theories, the central purpose of the community-based mapping project was to engage local residents and officials in the process of identifying together the biophysical, social, cultural, and economic factors relevant to their community. Partners in the implementation of the project included staff from the local municipality and from neighbouring municipalities, as well as leaders from community based organizations and NGOs. Contact with representatives from these organizations was previously established through earlier phases of the CBWM project.

The project activities were divided into several phases, namely: preparation, presentations, workshops, group mapping sessions, and continuing evaluation. Preparation involved the gathering of background resources from various municipal departments and the preparation of materials and base maps for the workshops, meetings with Brazilian partners to discuss the scope of the mapping to be undertaken and future potential applications, as well as briefing sessions to ensure that the principles underlying and practical steps of the mapping process were clearly understood by those who would be involved in the training. The presentation and workshop phase included a public lecture and one-day introductory workshop with a Canadian bioregional mapping consultant, as well as several smaller training the trainer workshops in community and institutional settings.

The group mapping sessions included a series of 12 weekly sessions with mapping participants and trainers in the village of Paranapiacaba. Following this, the products of the mapping activities were presented at a regional community meeting and discussed by participants, local planners and members of visiting communities. Continuing monitoring and evaluation is underway with those participants and trainers involved in the initial sessions, to develop next steps in the strategy. It has been recognized that perceptions of participants about specific community needs and dynamics will influence the application of these tools and will in turn be influenced by their use. Identifying and mapping the various features of their community, quality of life and relationships with other communities has and will continue to inform participants and planners, enabling them to contribute valuable knowledge to the local decision-making process that better reflects the situation and needs of local residents, positively affecting their quality of life.

The products generated, including maps, a collection of reference materials and reports relating information about the community's circumstances, have informed community members and local decision makers. Continuing evaluation of the effectiveness of participatory methods in furthering understanding of community circumstances will help community members and local officials adapt

future processes to better meet their needs. The awareness of the importance of transparency in planner/community interactions and the increased awareness of the value of participatory processes for assessment of needs, based on the information gathered, will help municipal officials structure processes and service delivery to better meet the needs of local residents.

The more comprehensive and integrated understanding of the watershed area and the surrounding region stemming from the mapping process contributes to a basis for development that is sensitive to community needs and ecosystem limits, while also being realistic and appropriate to community resources and economic development objectives. The knowledge generated will also contribute to the existing literature on participatory planning tools and theories, and will be used in informing other communities regarding potential technology transfers.

This approach focused on gathering contextual information to meet community needs rather than simply extracting information. This was to include the collection and analysis of data with a focus on understanding the roles of participatory approaches to landscape appraisal and environmental stewardship in the context of the CBWM project in the watershed settlement of Paranapiacaba, Brazil.

In order to explicate the process, the following provides a step-by-step description of the various phases in project development and implementation, with reflections on the process.

Phase One: data gathering

A review of available base maps and secondary sources of biophysical and cultural information about Paranapiacaba was completed. Topographic base maps for the project area exist at scales of 1:10,000 and 1:2,000 for the village site. These maps were created from planimetric aerial photos taken in 1990. Many other sources of biophysical data were found to exist at the local government office of environmental management, located at the site of Pilot Project 2 in Parque Andreense. These included expert-oriented data surrounding geological features, land use designations and regulatory zoning, location of high sensitivity to geomorphologic change (unstable slopes), data from discharge stations in the watershed protection area, general books on plant and animal species of the area, and local climatology, history of the railway company and the development of the town of Paranapiacaba. Also available were many earlier research projects that had been completed with relevance to Paranapiacaba, its socio-historic importance and the ecological value of the surrounding area. These included various proposals for heritage preservation and tourism development plans, a good amount of relatively recent census data gathered from the population and a study of local attitudes towards tourism development.

A great deal of current information (that made use of much of this earlier data) related to ongoing strategic eco and heritage tourism development exists at the Santo André municipal office in Paranapiacaba and was in use by local planners for the creation of possible future visions for the town. Local government employees, including biologists and planners, proved to be an invaluable source of information in terms of understanding of complex information and awareness of relationships between the various sources of data and actual ongoing planning and development activities. It was recognized that in order for the data available to be incorporated into the community based mapping process in such a way that it could be useful, shared learning and decision making was required between planners, community members, and the various local

government employees with expertise in a particular field. It was anticipated that this would occur through the weekly mapping workshop process.

Phase II: Interviews and Workshops

Openly structured interviews between key informants and mapping coordinators included discussions with Brazilian and Canadian project partners and participants. It was hoped that these discussions would help guide the project towards addressing the most relevant issues for the local community, as well as highlight potential strategies for adapting project methodologies to make them as useful as possible. From discussions with Canadian project partners and previous project participants, it was noted that maintaining participation by locals and government officials, and ensuring that project outputs would be valued and utilized in future planning initiatives so that outcomes could contribute to community involvement in decision making would be the two biggest challenges, and potentially two of the most important factors in project success.

A one-day workshop involving municipal partners, community leaders, NGO representatives and community members was organized to discuss the application of the mapping tool and the roles and responsibilities to be assumed by project participants. Background materials about the theoretical underpinnings of the bioregional mapping tool, and strategies and a step-by-step implementation guide as well as suggestions for basic mapping categories were prepared and translated for the Brazilian team. A list of materials was developed, responsibilities for various preparations for the workshops were decided, and other logistics were worked out. It was decided that the most effective way to introduce the technique to the communities and to a wider public would be to host a public lecture, followed by a one-day participatory workshop with a Canadian bioregional mapping expert, UBC Professor Douglas Aberley.

The public presentation focused on the theory and value of bioregional mapping strategies and was attended by members of local communities, government, university students, and public. The one-day workshop following this was also attended by local planners and community members, who received a hands-on introduction to some of the aspects of bioregional mapping including the creation of maps of home places (cognitive mapping), as well as learning to identify features and local issues on a community scale map. During the one-day workshop, participants discussed issues of concern in the local community and brainstormed about potential mapping subjects. Dates were also determined for the start of the weekly mapping workshop series.

Phase III: Mapping process

Data collection, analysis and representation of information on maps were undertaken in cooperation with community members over a series of 12 one-day sessions. Major participatory elements of the mapping process included: initial community visioning workshop to generate community interest, and weekly mapping sessions.

In the town of Paranapiacaba, these were intended to include training workshops on various data gathering and assessment techniques, data gathering by community members about specific community resources and features, compilation and analysis of data, and representation of data on maps. Over a series of 12 weeks, it was projected that participants would be able to learn the advanced bioregional mapping method and produce a series of approximately 10 bioregional maps relevant to specific issues of concern.

In order to begin to address the issues of immediate importance to planners and local participants, the mapping strategy was re-evaluated. It was determined that greater connection with those members of the community who were not participating was needed, as well as greater connection between the mapping process and participants' everyday lives. Less complicated, more relevant maps were needed. Beginning with a simplified 1:2000 base map of the village of Paranapiacaba, mapping participants were asked to identify areas of local importance in terms of perceived environmental problems, appealing locations, locations of services, etc. Participants used a 35 mm camera to document these things in the community. This served as a mechanism for interacting with other community members, and for facilitating discussion of local issues in a concrete visual sense. The photos were later used to demonstrate issues and locate important features on the maps of the community. The photo-documenting strategy was extremely effective in generating greater awareness of the project among other community members.

Short mapping workshops

Several short mapping workshops were undertaken in the community of Parque Andreense. These included four-hour local orientation sessions where community members joined government officials in touring the local area, pointing out features of interest and photographing them for use on maps. This session was also intended to generate interest and awareness of the project among local community members. Following this initial orientation, participants from Parque Andreense and planners collaborated to create one bioregional map of Parque Andreense, which demonstrated home places, favourite places, past community improvements and current areas of concern. This short mapping exercise was intended to teach the techniques of bioregional mapping to the planners, as well as the community members from Parque Andreense in order that they might continue to work on more projects in the future. The participants in Parque Andreense expressed interest in continuing the mapping process in their community, specifically in areas related to health services, and identification of community needs. The planners will likely use the techniques in other communities for participatory needs identification and other related activities.

Phase IV: Presentation of initial results

Research findings of the initial pilot processes and the bioregional atlas created in cooperation with the communities were presented at a community event, as well as at a regional workshop involving municipal partners and representatives from other municipalities. A final report was submitted to the municipality, to CIDA, and to the School of Community and Regional Planning at UBC. Outcomes of the mapping process continue to be discussed and future plans for project activities are under development.

Phase V: Ongoing partnerships

Since the initial series of mapping workshops in Paranapiacaba and Parque Andreense, communications with project partners in Brazil have been maintained and the mapping process continues to develop and grow. In Paranapiacaba, plans are underway to map the surrounding forest as part of the development of a participatory parks management program, while in Parque Andreense, youth mapping of critical health and local environment issues will form part of an upcoming regional conference. Discussion around the idea of inserting oral history processes into bioregional mapping techniques and drawing from the results to produce works with the Theatre of the Oppressed is also underway. Spin offs, and adaptations of the technique are already

blossoming, both in nearby communities, and farther away in related programs and initiatives. Several municipalities that attended the initial workshops requested more information about the mapping process. Potential for future regional collaboration in all of the ABC regions and Billings Reservoir basin has been evolving. Also, the project "Cidades Saudáveis" by CEPEDOC– School of Public Health USP, has undertaken mapping processes in several cities in São Paulo state and has produced a book of outcomes in one community and is working on processes in other communities.

Conclusion

The partner teams are jointly creating a framework for community-based watershed management by promoting a comprehensive and participatory environmental, social, and economic assessment of the watershed area. Project sustainability depends on the ability to recognize and map the interests of stakeholders, partners, and beneficiaries from the planning stage. Therefore, it is very important to identify strong partners with a common commitment and to establish an effective internal communications system throughout the life of the project. The knowledge exchange involved in the project must be understood as a two-way process, during which new information will emerge.

This project offers important opportunities to refocus the nature of water resource management and community involvement in this issue. Having identified a range of concerns, including gender and youth, tenure regularization, preservation, income-generation alternatives, and environmental education as important issues to be addressed, the project was embraced by the residents of the affected communities. Equally important has been the manner in which the municipality has approached this project based on a commitment to partnership with the communities and the Canadian team, which has led to a more dynamic and responsive project.

Identifying and measuring the indirect impacts and unexpected results must be part of any project analysis. As well, an assessment of the development process must extend beyond the time frame of project implementation. It is difficult to capture the indirect results of a project, since there are no specific instruments for this purpose. However, a range of information has been generated that can serve as the basis for analyzing indirect results, primarily in qualitative terms. It is essential that qualitative analysis is part of the project cycle, and that a mechanism or tool be established for communicating those results to cooperating agencies to ensure that the performance and scope of projects are properly assessed.

Projects should be understood not only in terms of transferring technical and technological information, but also as having a broader role in changing attitudes in terms of increasing equity, reducing poverty, improving quality of life, and preserving the environment. Similarly, projects should also promote local know-how and "citizenship education." Approaches that could be adopted to maximize results include encouraging a decentralized and participatory strategy based on partnerships, adopting pilot projects or demonstration models, using creative and innovative principles and mechanisms, and defining an outreach strategy that will make the project more visible and assist with its replicability

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ANNEX 1

The Seven Step Planning Method

At the initial mapping session, we recommend using a technique called the seven-step method of planning to start the process. This method was developed by Professor Peter Boothroyd from the Centre for Human Settlements and School of Community and Regional Planning at the University of British Columbia, a planner with considerable experience working with communities. The power of this model, as described by Boothroyd, lies in its ability to make the planning process more accessible to community members, and to increase the ability of community groups to effectively identify and achieve goals. It is recommended that the technique be used not only at the level of planning direct actions, but also at recursive levels of planning how to plan the actions, and how to implement the chosen actions. Some of the steps have also been adapted from *Giving the Land a Voice*: *Mapping our Home Places* (Harrington 1995).

1. IDENTIFYING THE TASK - All people interested in participating in the maps will work together to identify first the essential purpose of the project. This may be to create a consolidated record of information about a community, to improve community-planner relations, or improve community quality of life, etc.

2. STATING GOALS - Participants will identify various goals related to the task. These can be different for different parties involved, and it is acceptable if they conflict. Goals are what different individuals hope to achieve through the process of the task. Examples might be to "have an inclusive process," "achieve tangible results," "create a visual record," "allow room for dissent," etc.

3. REVEALING FACTS - Facts are all existing and possible strengths, weaknesses, opportunities, and threats to the task. It is important to note at this stage, that facts are identified after the task, so that relevance to it can be established.

4. BRAINSTORMING POSSIBILITIES - Any possible actions that might be used to reach the diverse goals. Ideas should be offered without fear of criticism, the purpose of this stage is simply to become aware of the diverse range of existing possible actions.

5. ORGANIZING AND IDENTIFYING OPTIONS - At this stage, possibilities are organized into categories of choices of possible actions.

6. EVALUATING THE OPTIONS - Participants evaluate possibilities in terms of how well they achieve stated goals. This can be achieved through listing pros and cons, or through using matrices, etc.

7. MAKING THE DECISION - Finally a decision is made using whatever procedure has been agreed upon, as to which option to pursue.

*It is important to note that, in the use of this model, the order of the steps is not rigid, and the recursive nature of the model should enable participants to revisit earlier steps at various stages of the process both as a way of ensuring that they are staying on track with the stated task and goals, and also as a means of checking that this task and these goals are appropriate.

ANNEX 2

Project Description and Terms of Reference Map

The following is a general guide to be used when creating a biomapping atlas and lists the contents, as well as the purpose and the acknowledgements.

Biophysical series:

Location key – this map is designed to give the reader an idea of how the area fits into the local, regional, national and global contexts. It can also demonstrate population, and area.

Geology – this can demonstrate surficial or bedrock features, depending on local importance

Soils – this can show types, distribution, agricultural potential, etc.

Topography – this demonstrates the physical profile of the area, elevations and interesting landforms

Hydrology – this can demonstrate such features as rivers, lakes, storm rivers, flooding areas, stations for monitoring flow, average discharges, rainfall, origins of river/lake names, etc.

Hydrology/human intervention – this would demonstrate how hydrological features are modified by people. This includes reservoirs, dams, hydro-electric stations, wells, contamination, etc.

Climate – this demonstrates local variations, information about seasonal variations, global climate change, etc.

Terrestrial and freshwater vegetation – this demonstrates major species, species at risk, historic and present extent (if known), endangered/extinct species, etc.

Terrestrial and freshwater wildlife – this demonstrates major species, species at risk, migration patterns, habitat and foodchain, historic and present extent (if known), endangered/extinct species, etc.

Avifauna – Birds - this demonstrates major species, species at risk, migration patterns, habitat and foodchain, historic and present extent (if known), endangered/extinct species, etc.

Insects - this demonstrates major species, species at risk, migration patterns, habitat and foodchain, historic and present extent (if known), endangered/extinct species, etc.

Ecosystems – this demonstrates any variations in ecosystems within the area,

Potential Natural Disasters – demonstrates different types (earthquake, volcano, flood, fire, etc) and shows historical occurrence, as well as future risks

Environmental Quality Hotspots – this demonstrates types and locations of point source and non-point source pollution. It also describes existing environmental disputes, denotes degraded habitats, etc.

Socio-cultural series:

Known archaeological sites – this demonstrates any known indigenous settlements, areas where archaeological evidence has been discovered, etc.

History and Culture – this can be a series of maps demonstrating different periods in the history of the area and of the town. The maps would discuss important personalities, historic roles, events, places, development of economic activity, trade, agriculture, change over time, building of infrastructure, etc.

Political Boundaries – this would delineate existing political boundaries including municipal, state, etc. It might also demonstrate voting trends, etc.

Demographics (general) – this would demonstrate present and historic population, age/sex ratios, income, education, other population related statistics including health, immigration, emigration, comparison of statistics to other areas, etc.

Demographics (gender issues) – this would demonstrate present and historic trends in gender specific issues, including issues important to men or women specifically. This could relate to income, hours of work per day, existing services, health, domestic violence, etc.

Major Economic and Cultural Developments – this would demonstrate past, existing and future economic and cultural issues. It would include the locations of industry, establishment of institutions like schools and cultural centres, festivals, important historical figures, etc.

Key Power holders – this map can demonstrate patterns of property ownership or employment historic or current, public and private service jurisdictions, and any other relevant issues.

Economy – this can be a series of maps specific to the range of economic activities important in the area. It can represent both the formal and the informal economy and can highlight exchanges with other areas, influx of employees, major employers, etc.

Infrastructure/transport – This map would demonstrate existing transport linkages, communications, types of transport and goods transported, etc.

Infrastructure/energy – this map would show transmission lines, types of energy used and consumption patterns (gas, etc) as well as any relevant conservation issues.

Infrastructure/water, liquid and solid waste – this map would show sewerage, waste and water treatment plants, water sources and lines, landfills, recycling initiatives.

Infrastructure/parks and protected areas – this map demonstrates locations of parks and protected areas, trends in use, candidate areas for future designation. It could also show trails, trail use and areas where restoration is underway or needed, etc.

Conclusion – this map would provide a brief summary of the atlas findings, as well as of participants' feelings about the process and suggestions for further research or use of the atlas.

*The above map topics are intended as a guide only. Choose the topics that are most appropriate to the purpose of the maps. Although the choice of map topics will be somewhat restricted by the information available, a potential topic should not be eliminated based on lack of resources. It is important also to map where information is missing, to demonstrate the need for further documentation, and to provide whatever information is available in a clear manner.

Creating the groups for each map

Map groups can be created in various ways, based on interest, time availability or random choice. In order that participants learn as much as possible from the process, it is suggested that each group have people with a range of ages, genders and abilities.

Group strategizing

When creating maps within a group, it may be wise to have a group discussion about the purpose of the particular map, as well as what elements are important, and a brainstorming session about ideas for styles, etc. (You could use the seven-step model here.) Equality in group participation should be stressed, and efforts should be made not to categorize participants according to abilities, but rather to ensure that all participants get an equal chance to contribute to all aspects of the map. Participants may agree, however, to take on certain roles and responsibilities.

Data gathering
This can be accomplished through various means. A wide range of information will be made available in the mapping resource room, but groups can or should seek out other information where possible. Information about the topics can range from the general to the very site specific and both are very valuable. In addition to existing sources, data can be gathered from observation, from primary research (such as the use of GPS for trail mapping or asking residents about history, etc.). Participants should not worry if the same data is used for different maps. Overlapping is common, as all things are essentially related, and things that appear more than once in the atlas will only be further highlighted, which is to the benefit of the maps. Also, this overlapping stresses the interrelated nature of all things, and highlights how various factors affect each other.

Visual representation
There are many ways to represent data on the maps including text, graphs, charts, symbols, pictures, art, etc. Many different techniques can be used together on one single map to produce outstanding results. Participants should worry less about how professional the maps appear, and more about how well they tell the story of the particular topic, and how easy they will be for others to understand, to learn something from.

Reviewing and editing
This is the stage at which groups share their maps with each other, give comments and feedback, check facts, and make final decisions about the layout and design of their maps. Until now, all elements should be only temporarily affixed to the maps, and removable to view different options of presentation.

Final presentation of maps
This step is very important as it represents the culmination of all of the hard work and learning achieved by the mapping groups. At this point, participants will share their knowledge and understanding of the issues they studied with a wider audience. They will tell the story of how they researched and made the maps, as well as the story of place that they are representing in the maps.

Universal Design Parameters
In order to ensure that all maps are somewhat consistent and will fit together nicely into the final atlas, the following design parameters are suggested. These can be modified as desired to meet the needs of the particular atlas.

An introductory essay, or introduction to the topic to be discussed will be located directly beneath each map title box in the upper left corner of each map. This essay should introduce the topic and summarize the story told in the particular map.

Sources of information used in the map should be quoted within each text box, or in a separate text box somewhere on the map so that people can easily learn where to find more information about a topic.

All text for the maps should be created on a computer using a minimum 18 point font so that it will be easily legible when the maps are reduced.

The atlas will have a title page and a standardized title block with map number which will appear in the upper portion of each map produced.

A universal format for referencing information must be decided upon.

General tips for mapping

It is easy to get bogged down in too many details and facts. Try to tell a story with your map, and highlight information that will draw attention to this. Charts and graphs are a good way to show a lot of information in a small space, as is the use of patterns and symbols on the maps. Text fills up space quickly, so be careful with the words that you choose. Imagine that you are looking at the map for the first time and what would you want to know about the topic.

Map outputs will vary with time committed to mapping as well as with number of active participants. It is reasonable to expect that a group of 4-5 participants could produce a map (if information was already available) in 2-3 sessions of 4 hours. More time spent will, of course, mean more detailed maps.