

## **CARTOGRAPHY AND INDIGENOUS POPULATIONS: A CASE STUDY WITH BRAZILIAN INDIANS FROM THE AMAZON REGION**

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*The paper presents the initial results of a research project, which the main goal was to evaluate the introduction of cartography to Amazonian Indians from the State of Acre in Brazil. This study focuses on how Indians perceive space, represent their lands and can take advantage of cartography in several ways. A course was prepared and introduced to the Indians, including exercises designed to check the ability of these populations to make and read maps of their environment. Selected basic concepts, e.g. point of view, scale, distance, location and orientation, were presented to two different groups during the year 2000: teachers from schools located at villages and local environmental agents. This second group, called agro-forestry Indian agents need cartography the most since they are responsible for environment assessment, land management and sustainability of natural resources. Indigenous populations, as a new group of mapmakers and users, have a great potential to learn and to promote innovative ways of approaching cartography.*

### **Introduction**

Cartography faces great challenges at the beginning of this millenium, mainly related to innovative methods and technologies, and the emergence of new map producers and users driven by a variety of needs and interests. Different views were introduced to the discipline, e.g. Harley & Woodward [1987], Harley [1989, 1990], Turnbull [1989] and Woodward & Lewis [1998], arousing interest in maps from all cultures, including historical maps. All the technological innovations with theoretical framework brought important changes to the field of cartography with different procedures and new terms such as visualization and GIS. These changes have broaden the concept of mapping as discussed by cartographers during the last ten years [Taylor 1991, 1996; Wood, 1992; Hall, 1992; Kanakubo 1993; MacEachren & Taylor, 94; Dorling & Fairbairn, 1997].

Cartography has to move beyond the new technologies of the information era. It has to pay more attention to subjectivity, cultural variety and the social context as Harley [1989, 1990] argued. Not enough research has been done on those topics. Cartography remains with the challenge of increasing the use of maps in society, accepting new producers and users, and offering training to improve their cartographic knowledge, mainly in developing nations and places with pressing problems (as environment and social issues).

Cartographers have to be creative and open, presenting and using maps in new ways. Indigenous mapping fit with these goals, because this population need cartography to survive, to defend their lands, and to protect the environment. For indigenous people, maps are also expressions of art, historical documents, and visions of the future. They need GPS, GIS and remote sensing technology as much as the mental maps of their dreams and everyday lives. The author's experience with teaching cartography to Indians from Acre, Brazil shows that they cherish imagination as much as cartographers from ancient times or the ones living at the Discovery Age, as described by Cowan [1996] in *A Mapmaker's Dream*.

### **Brazilian Indians as a Unique Group of Map Makers and Users**

Initially, the elderly population has been selected by the author to complement previous results achieved with children and the visually impaired user. Although elderly people have mental images of geographical space together with memories of places and past events, they do not draw maps and resist working with cartography. For these reasons, the study was directed to Brazilian Indians mainly from the Amazon Region. One needs to apply new approaches for indigenous populations, as their reality is totally different from other groups. This study focuses on how Indians perceive and represent their lands, learn about the world and gather useful geographic information in general. Empirical research is being used to investigate the role of maps in their culture, including discussions related to political, social and ecological issues. Brazilian Indians are a unique group to work with cartography because they have an ability to combine art and science in their work. Cartography can play an important role in their survival, helping to define the land and to protect borders.

There are in Brazil over 320,000 Indians (around 2% of Brazilian population) living in villages. Brazil's area is 851,196,500 hectares and 12.26% of all Brazilian lands are reserved for Indian people, divided in 568 areas. Contemporary indigenous peoples are scattered throughout the Brazilian territory, 60% located in the Legal Amazon area, representing 98.75% of all Indian lands in this country. The remaining 1.25% are

scattered throughout the nation, and it hosts the remaining 40% of the Indian population (Figure 1 – Indigenous Territories in Brazil).

Indigenous communities live in collective lands, federally declared for their own exclusive use. These indigenous lands have different degrees of recognition by the state. Some are demarcated and have been notarized. Others are in their recognition stage and there are also indigenous areas without any regularization whatsoever. Most of these lands, however, are invaded by prospectors, mining concerns, loggers or squatters. Roads, highways, and transmission lines, areas flooded by hydroelectric power plants, cross either that or them [ISA, 2000].

There are 210 Indian nations in Brazil already contacted today, who live in thousands of villages throughout the country, speaking 170 native tongues. Despite contacts with segments of Brazilian society, these peoples uphold their own identity, establish themselves as groups of differentiated ethnicity and carry their own culture and traditions. Some have forgotten their native tongues and speak only Portuguese. Others have already incorporated industrialized goods and services to their daily lives. The indigenous universe in point contemplates those communities settled in indigenous lands, as there is no data on the indigenous population living outside reserved areas. An estimated of over 50 groups still live in isolation, far from the permanent or regular contact with non-Indians. The Brazilian Federal Agency for Indian Affairs (FUNAI) confirmed the existence of only 12 of these groups, but it is not easy to have precise data on how many they are (for more information see the URL: [www.socioambiental.org](http://www.socioambiental.org)).

### **Special Needs Cartography**

In the past decade, the author conducted research on tactile mapping for visually impaired children [Vasconcellos, 1991, 1992, and 1993]. The study concentrated attention on two areas: 1. Tactile graphic design and production - analysis, construction and tests of various techniques and cartographic products, with special attention to the use of tactile variables applying graphic semiology; 2. Tactile graphics use – evaluation of the process of communication and development of training programs for teachers and visually impaired students.

In general, maps for and by children have been extensively studied in a few countries, such as Brazil where many publications are available and national conferences organized. From 1991, the author has participated in the creation of the ICA Working Group on Maps and Children, formally established in 1995, under the coordination of Jacqueline Anderson (Concordia University, Canada), and turned to an ICA Commission in 1999. There have been several international seminars and meetings (Spain, 1995; Japan, 1996; Sweden, 1997; Poland, 1998, Canada, 1999; Hungary, 2000) and many with others at the national level, such as Brazil with five national meetings held at different cities.

Special needs mapping could be a general theme to bring together previous studies done within cartography, including the ones on children [Almeida, 1999]. Lessons learned with the design and use of tactile maps [Vasconcellos, 96] can bring light to this new study with indigenous populations as mapmakers and users. Work with new groups of users will lead to an evaluation of maps as a means of communication. Conventional approaches and previous studies on cartographic design such as presented by Wood & Keeler [1996] do not fully apply to special needs cartography, particularly indigenous users.

Space perception and mental maps have been discussed inside cartography for many years (e.g. Fremont, 1973; Gould, 1974; Tuan, 1975; Downs & Stea, 1977; André, 1989; Bailly, 1989). These studies on cognitive issues related to mapping can be applied to research on special needs users; the same for more recent articles developed within cartographic visualization, as it is the case of Peterson [1994].

In Brazil, special needs users include all traditional population groups such as old farmers and fishermen, also people of African origin who came to the country as slaves, rubber collectors usually living in isolated areas in the Amazon, besides native people which were in Brazil before the arrival of the Portuguese. The author's research is focusing on children and the visually impaired people as test groups to be compared to Brazilian Indians as mapmakers and users. This last group requires adaptation and previous analysis of their existing knowledge and exposure to maps and geography. The initial idea of including the elderly will be postponed to future phases. The same program designed for the visually impaired and tested in São Paulo [Vasconcellos, 1995, 1996] was chosen to introduce basic concepts to the Amazonian Indians.

Although modern technologies have introduced great changes and improvements in cartography, little attention has been given to most groups of special needs users, and they could certainly bring light to the discussion of relevant issues in cartography, as the cultural and social contexts. Most native people transform mental images of their space in very interesting graphic representations, and their maps depict not only places, but also history, culture, memories and visions. There are other users with special needs, as slow learners and physically impaired people, who could be addressed by cartographers in the future.

They always require cartographic training and availability of maps with special features, in terms of design and production.

### **Mapping Experiences with Indigenous Population in the Amazon Region**

In Brazil, most villages have bilingual Indian teachers and schools. There is a national curriculum for indigenous education with rules, techniques and contents adapted to their needs. These guidelines are published in a book with the suggested curriculum with several disciplines, including geography and cartography. The idea of introducing maps to indigenous population is a very interesting one. In Brazil, there have been experiences in this direction, while several initiatives in the Amazon Region worked with geography and cartography to Indians.

One important research was developed in the State of Amapá with the Waiãpis Indians (north of Brazil). The purpose was to teach cartography to this group, in order to make them able to understand conventional maps and to review the borders of their land, which were being marked by the federal government. They published the Book of Maps [Gallois, 1992], with maps made by Indians and conventional cartographers. The Waiãpis maps have more than just places because they represent their territory together with their history. The researchers told us how surprised they were by the ability of a group of 10 Indians to make maps. These Indians became "cartographers" with great interest and joy in carrying out this new activity. This group did not have the word north in their language but they had a very good knowledge of space and all its physical features and they were delighted to learn scale, location, orientation and even how to understand remote sensing images [Almeida, 99].

The organization called *Comissão Pró-Índio do Acre-CPI* is responsible for the oldest and most unique project related to indigenous education. The State of Acre has 27 Indian reserves (Figure 2 – The State of Acre in Brazil), 87 Indian schools with almost 100 Indian teachers and over 2,500 students. They have a special curriculum and all teaching materials are written by native teachers with the help of consultants and produced by CPI. They already prepared eight geography textbooks and published the Indian Geographic Atlas of Acre (Figure 3 – Atlas from the State of Acre) with maps drawn by Indian teachers, and organized by Gavazzi and Rezende [1996, 1998]. Maps can be seen in most of their textbooks. These actions transformed their knowledge and, after having mainly an oral tradition, those books and their teachers brought new dimensions to their lives.

A training program that was used with visually impaired children was adapted and introduced to the Indians during three teaching experiences. Exercises were designed to check the ability of these populations to make and read maps, such as to draw mental maps of their environment, to use maps at school and everyday life. All the activities were documented in a collection of drawings, photos and videos. The selected basic concepts, e.g. point of view, scale, distance, location and orientation, were presented to two different groups during the year 2000: a) teachers from schools located at villages; b) local environmental agents. The proposed course content and exercises was re-tested in January/February 2001, and it is planned to happen again in June of this current year.

The second group, called agro-forestry Indian agents, are persons who need cartography the most, since they are stewards of the land having several duties, such as invasion recognizance, water pollution prevention, and biodiversity preservation which is synergistic with their cultural and physical survival. In this way, they are responsible for environment assessment, land management and sustainability of natural resources.

In both of these projects in the Amazon Region, Indians evaluated our maps as incomplete representations of their space, missing important features and details. Historical landmarks, which are gone for decades might be included in a map. They used a lot of pictorial symbols and their maps resemble those made by children. In some cases, they got together to decide which symbol or color to use, as the example of depicting all rivers in yellow. Those Indians are also being exposed to convention cartography, in different ways. They enjoy maps as works of art, and at the same time, they recognize the need for cartographic products, including in digital form. Unfortunately, there are no equipment available and neither electricity in their villages.

Their knowledge of the environment is remarkable, mainly in the case of men who usually have better ability to draw maps. The women stay around the houses and rarely are allowed to go inside the forest and walk in the outskirts of their lands. Although, the only three female teachers participating at the 2001 course, when asked, were able to make a map of their village and truly enjoyed the task. In the case of the environmental agents, there are only male representatives.

An interesting feature which can be observed in maps and written texts, is their ability of mixing science, art and magic, knowledge and intuition, facts and visions. They see time and space in much closer

connections than us and they were very pleased to hear about the history of cartography. Perhaps they kept a form of wisdom and open mind, which we lost so long ago.

### Final Remarks and Future Research

Experiences collected during courses given in Rio Branco, State of Acre, to Indian teachers and environmental agents allowed the author to review the initial results gathered previously. The performance of the several participating groups went far beyond the expectations. Many issues were defined for further research and will be included in future investigations. Some of these topics are the following:

1. Functions of a map for indigenous people, based on their answers: expressions of art; location and orientation; support to travel in space; definition of Indian lands and their borders; natural resources inventory and management; environment assessment and protection; awareness and actions towards nature preservation, and education.

2. Issues related to gender and age, making connections with map functions. The need for cartography and the ability to draw maps together with the knowledge of space varies greatly between sexes and ages, as culture and ancient costumes define their tasks. Just men can hunt and enter the forest, so they know the land very well, all rivers and geographical features. For women, maps have the function of presenting the geographical space they do not know, same as for the visually impaired, maps can bring reality to their eyes, while for men, they are graphic representations of mental images and thus abstractions of real space.

3. Communication and cognitive issues can give the theoretical framework for the evaluation of indigenous people as mapmakers and users, providing evidence and practical examples of whole cartographic process. Usually special needs users are very good to achieve those results, as they do not fit the conventional procedures and rules.

4. Ways to introduce digital technologies such as GIS, remote sensing, and digital cartography in the training courses for Indian environmental agents. They are in charge of promoting sustainability of their natural resources, in a time of population growth and constant invasion of their lands. Satellite images and digital maps can help them in this task of controlling remote areas.

Although new technologies have introduced enormous changes and improvements in the field of cartography, very little attention has been given to special needs users, such as the elderly and the indigenous populations which have a great potential to learn and to present innovative ways to use maps. Findings from previous research on the visually impaired user can be applied to this group, but tests and evaluation must be done to understand them as mapmakers and users, persons who need mental maps as much as the ones in digital format.

Thinking about Turnbull's words [1989 p.42], we reach the conclusion that Amazonian Indians are unique cartographers and map users: *...In the light of these considerations we should perhaps recognize that all maps, and indeed all representations, can be related to experience and that instead of rating them in terms of accuracy or scientificity we should consider only their "workability" – how successful are they in achieving the aims for which they were drawn – and what is their range of application.*

### References

- Almeida, A. Regina (1999). Mapping Memories and Places: A Cartography for and by the Elderly. Proceedings, 19th International Cartographic Conference – ICA. Ottawa, Canada.
- André, Y. (1989). Lire et dire l'espace. In: Représenter L'Espace. Anthopos, Paris.
- Bailly, A. (1989). Enseigner les représentations régionales, géographie régionale, images mentales et cartes mentales. In: Représenter L'Espace. Anthopos, Paris.
- Downs, R. & Stea, D. (1977). Maps in Minds – Reflections on Cognitive Mapping. Harper & Row, N.York.
- Dorling, D. & Fairbairn, D. (1997). Mapping – Ways of Representing the World. Longman, London.
- Cowan, J. (1996). A Mapmaker's Dream – The Meditations of Fra Mauro, Cartographer to the Court of Venice. Warner Books, New York.
- Frémont, A. (1973). La Région, Espace Vécu. Presses Universitaires de France, Paris.
- Gallois, D. (1992). Livro de Mapas: Território Waiãpi. Centro de Trabalho Indigenista, São Paulo.
- Gavazzi, R.A. & Rezende M.S. (org.) (1996, 98). Atlas Geográfico do Indígena do Acre. CPI, Rio Branco.
- Gavazzi, R.A. (org.) (1996) Geografia Indígena. Instituto Socioambiental/MEC/PNUD, Brasília.
- Gould, P. & White, R. (1974). Mental Maps. Pelican Books, Great Britain.
- Hall, S.S. (1992). Mapping the Next Millenium: the Discovery of New Geographies. Random House, NY.
- Harley, J.B. (1989). Deconstructing the Map. Cartographica, 26(2), 1-20.
- Harley, J.B. (1990). Cartography, Ethics and Social Theory. Cartographica, 27(2), 1-23.
- Instituto Socioambiental (2000). Povos Indígenas no Brasil – 1996/2000. ISA, São Paulo.

Kanakubo, T. (Coord.) (1993). The Selected Main Theoretical Issues Facing Cartography. The ICA-Working Group "Main Theoretical Issues on Cartography" . The 16th ICA Conference, Japan.

MacEachren, A. M. & Taylor, D.R.Fraser (Eds.) (1994). Visualization in Modern Cartography. Elsevier, Great Britain.

Peterson, M.P. (1994). Cognitive Issues in Cartographic Visualization. In: MacEachren, A. M. & Taylor, D.R.Fraser (Eds.) Visualization in Modern Cartography. Elsevier, Great Britain.

Taylor, D.R. Fraser (Ed.) (1986). Graphic Communication and Design in Contemporary Cartography. John Wiley & Sons, USA.

Taylor, D.R. Fraser (1991). A Conceptual Basis for Cartography: new directions for the information era. Cartographica, Canada, University of Toronto Press, 28 (4), 1-8.

Taylor, D.R. Fraser (1996). Challenge and Response in Cartographic Design. In: Wood, C. & Keller, P. (Eds.) Cartographic Design: Theoretical and Practical Perspectives. John Wiley & Sons, England.

Tuan, Y. (1975). Images and Mental maps. Annals of the Association of American Geographers. 65(2).

Turnbull, D. (1989). Maps as Territories, Science in an Atlas. University of Chicago Press, Chicago.

Vasconcellos, R. (1991). Knowing the Amazon through Tactual Graphics. In: Proceedings 15th International Conference - ICA. Bournemouth, Great Britain, 1, 206-210.

Vasconcellos, R. (1993). Representing the geographical space for visually handicapped students: a case study on map use. In: Proceedings 16th International Conference - ICA. Cologne, Germany, 2, 993-1004.

Vasconcellos, R. (1995). Tactile Mapping for the Visually Impaired Children. Proceedings 17th International Conference - ICA. Barcelona, Spain, 2, 1755-1764.

Vasconcellos, R. (1996). Tactile Mapping Design and the Visually Impaired User. In: Wood, C. & Keller, P. (Eds.) Cartographic Design: Theoretical and Practical Perspectives. John Wiley & Sons, England.

Wood, Clifford & Keller, Peter. (Eds.) (1996). Cartographic Design: Theoretical and Practical Perspectives. John Wiley & Sons, England.

Wood, Denis. (1992). The Power of Maps. The Guilford Press, New York.

Woodward, David (1992). Representations of the World. In: Abler, R.; Marcus, M & Olson, J. (Eds.). Geography's Inner Worlds. Rutgers University Press, The State University, USA.

Woodward, D. & Lewis G.M. (1998). The History of Cartography, Vol.2, book 3. University of Chicago Press, Chicago and London.

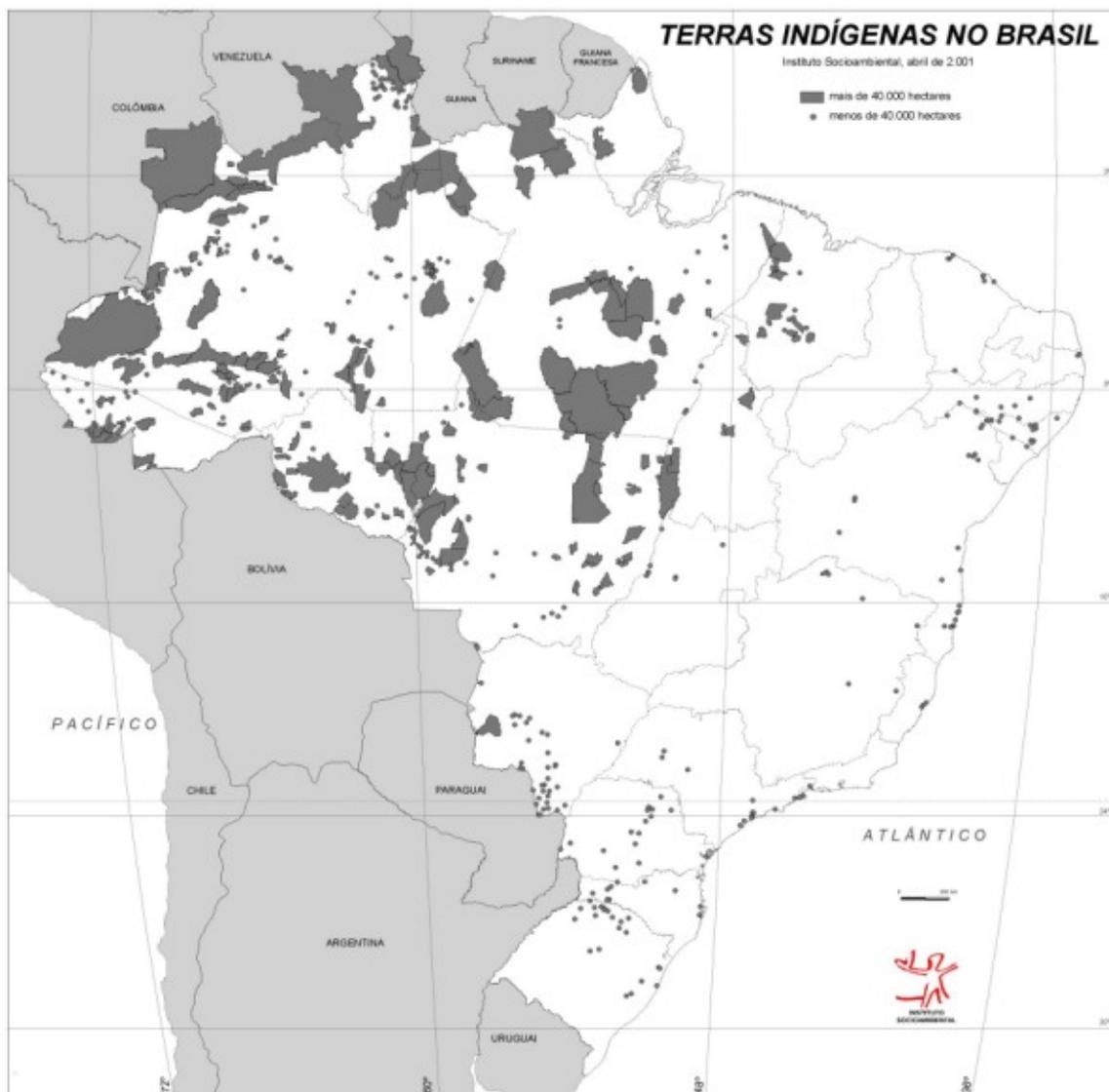


Figure 1 - Indigenous Territories in Brazil (ISA, 2000)

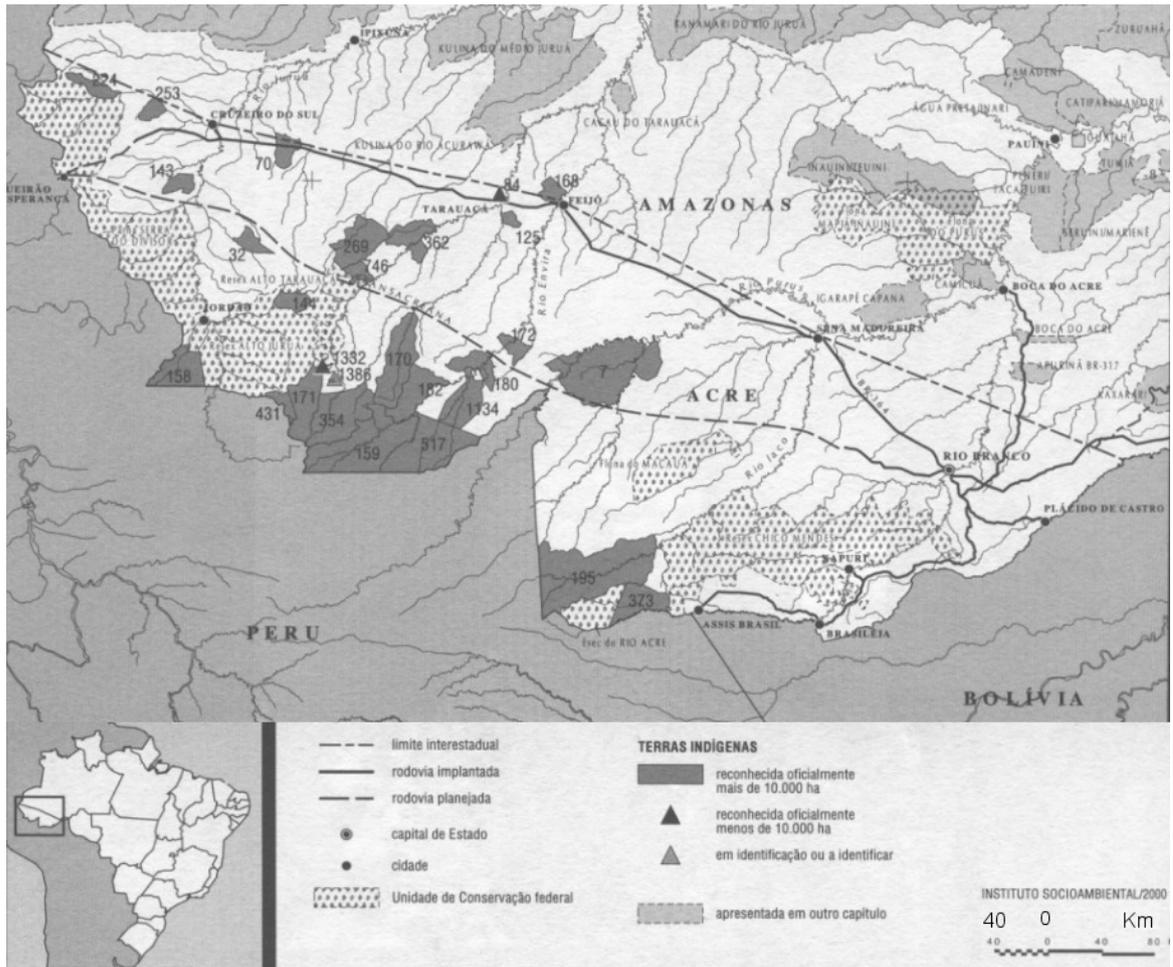


Figure 2 - The State of Acre in Brazil (ISA, 2000)

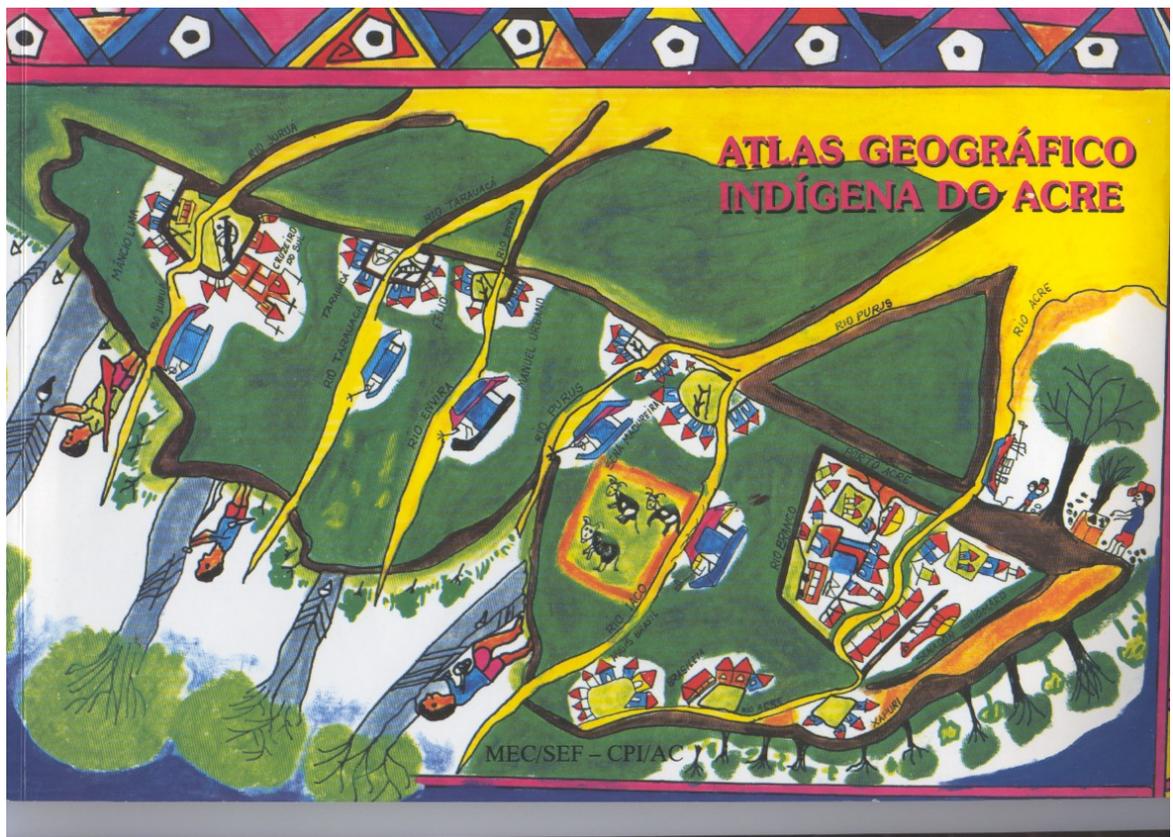


Figure 3 – State of Acre Atlas (ISA, 2000)