MAPPING THE PAST AND THE FUTURE: GEOMATICS AND INDIGENOUS TERRITORIES IN THE PERUVIAN AMAZON

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Abstract

Since the early 1970's, indigenous Amazonians of Peru have received property title or other forms of government recognition to over 10 million hectares of tropical forested land. The largest single area is found in the Río Galvez Basin, east of Iquitos near the Brazilian border, where a 400,000-hectare native community was titled to the Matsés peoples in the 1990's. Developing and implementing management plans and related economic initiatives for these areas is the next urgent chapter in the long history of their struggle for survival and recognition..

The authors examine both conceptual and methodological steps to establish a map-based Native Communities Information System (SICNA) as the foundation for future land use planning activities in Peru's indigenous territories. The Information

System includes two types of data for Peru's native communities: geographic data that includes the hydrographic system with community boundaries among other elements, and tabular data on demography, ethnic affiliation, legal-administrative status, housing, education, and resource use. The two data types are interconnected digitally through a geographic information system (GIS).

The authors describe two case in which these mapping and data-gathering techniques are put to use: 1. for delimiting a proposed Communal Reserve to protect currently untitled resources vital to the survival of 23 communities in a large area in the northern Peruvian Amazon; and 2. for reaffirming historical and cultural links of the Amuesha people to a territory lost to colonists over the past century in Peru's Central Jungle region.

Authors' Statement

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I A Secure Future for Indigenous Amazonians

In the Peruvian Amazon, there are more than fifty different indigenous peoples, representing 12 major linguistic families. Following a long history of violence, forced migration, and invasion of traditional homelands, these groups vary in size today from a few remnant members (the case of the Andoas, Resigaros, Taushiro, and Andoque) upwards to an estimated 50,000 persons (the case of the Aguaruna and the Ashaninka including all sub-groups). We estimate Peru's total indigenous Amazonian population at about 300,000 persons.

Beginning in the late 1960's, these indigenous Amazonians adopted a strategy of organizing associations of local communities to gain government recognition and protection for their dwindling territories and natural resources. Given the gains made during the past three decades in titling more than ten million hectares in their favor, a key issue now for the long-term survival and viability of these secured territories is the careful and sustainable management of these landscapes and the resources they contain in the face of rapidly increasing market pressure (Benavides and Smith 2000; Chirif, Garcia and Smith 1991; Garcia 1995). While there is a growing awareness of the need to manage indigenous territories in a sustainable manner, indigenous peoples' organizations and the NGOs that work with them have been slow and unsystematic in accumulating reliable data and knowledge for putting this into practice.

There is tremendous pressure on them now to sacrifice their resource base for immediate consumption. If this path is chosen, both the economic security and the cultural identity of future generations is at risk. The long-term challenge is to find a path that allows local communities to satisfy their needs for both subsistence produce and market goods without sacrificing either the resource base or the bonds of social solidarity that will permit the indigenous society to project itself into the future (Smith and Wray 1996).

Tenure Security for Community Lands in the Peruvian Amazon The Amazonian States have been reluctant to recognize the collective property rights of their indigenous populations. As a result, conflict between these States and indigenous Amazonians over this issue has continued since the modern states were formed during the nineteenth century. Peru conferred legal recognition for land rights to its indigenous Amazonians in 1974 through a Native Communities Law; these collective rights included the land and forest areas "traditionally occupied" by indigenous Amazonians as well as those areas used for hunting, fishing, and gathering (Beteta 1989; Garcia 1995; ILO 1997).

In 1978, the Native Communities law was modified to reflect changes in national forest policy that eliminated indigenous property rights over forest lands, even those within a recognized native community. In its stead, the revised law opened the possibility of creating Communal Reserves under local community management. Though a great number of such reserves have been proposed, to date only two have been established: 1. the Yanesha Communal Reserve (1987) with a total area of 34,745 hectares and 2. the El Sira Communal Reserve (2001) with a total of 616,413 hectares (see page 23).

The official recognition of over 1400 and the titling of approximately 1200 native communities in the Peruvian Amazon over the past thirty years is a result in large part of a social movement that has pressured the state for collectively-titled indigenous territories. (Table 1 and Table 2 about here) During the decade 1974-1984, the government titled hundreds of native communities in heavily colonized areas of the Peruvian lowlands near the foothills of the Andes mountains. The total land/forest area of many of these communities, surrounded by colonist farms, was too small, and densely populated to permit traditional resource use practices such as the rotation of garden sites, hunting and gathering. This is the case of the Amuesha and Ashaninka communities in the upper Paucartambo-Perene watershed: for example, Alto Churumazu with 113 hectares, Puñizas with 71 hectares, El Milagro with 105 hectares, and Mayme with 110 hectares. (PETT 2000; SICNA 2002).

Beginning in the early-1980's, the Coordinating Body of Indigenous Peoples' Organizations of the Amazon Basin (COICA) disseminated among its members a new discourse on aboriginal rights to a territory, defined as a large continuous homeland, including all forest, aquatic and subsoil resources (Chirif, Garcia and Smith 1991, Morin and Saladin d'Anglure 1997; Smith 1996; 2000). COICA also aggressively promoted its vision of indigenous territorial rights with the World Bank, the European Economic Community, the InterAmerican Development Bank, government officials and the conservation community. By the mid-1990´s, both private and multi-lateral funding agencies were financing land demarcation efforts involving native community federations, NGOs and local government agencies (Chirif et al 1991; Garcia et al 1998).

The political pressure put on government land titling agencies as a result of this campaign yielded larger tracts of land (up to 50,000 hectares) for individual indigenous settlements, and where possible, larger territorial units pieced together through a mosaic of individual communities with common borders, proposed communal reserves and conservation units. (Chirif, Garcia and Smith 1991). Even though these changes have not yet been reflected in the Peruvian legislation regarding land rights for indigenous peoples, in practice, both the language and the concepts are used within official circles.

There are many examples of this new modality for land titling; we cite here that of the Machiguenga communities of the lower Urubamba river basin (Figure 1 about here), where a mosaic of 21 contiguous native communities plus three reserves constitute a single territory of almost one and a half million hectares (Benavides and Smith 2000; Smith 1997). In this case, a Peruvian NGO, in conjunction with the Machiguenga community association, worked over a period of a decade to do the physical demarcation and to push the bureaucratic land-titling machinery.

Despite the growing international pressure, a significant number of unprotected indigenous communities and the fact that Peru signed and ratified the ILO Convention 169 on the group rights of indigenous peoples, the decade-long Fujimori government (1990-2000) made little attempt to protect the lands and resources of indigenous communities, emphasizing, instead, land titling for individual families in rural areas.

First Steps towards Territorial Management After almost thirty years of land titling efforts and territorial consolidation among indigenous Amazonians in Peru and with reasonably well functioning communities and inter-community organizational movement, it is important now to ask the difficult questions about the future of these native community territories. How will indigenous Amazonians both <u>use</u> the resources of their territories to satisfy their current needs as well as <u>conserve</u> them for future generations? What collective institutions already exist for carrying out the management of common resources? What technical tools do they have at their disposal for land and resource use planning?

In May 1996, preliminary results a study and mapping of the community boundaries and the major types of vegetative cover throughout the 1.5 million hectare territory of the Machiguenga people in the lower Urubamba. were presented to a group of NGOs and indigenous peoples' organizations at a workshop held in Santa Cruz, Bolivia (Houghton and Hackler 1996; Smith 1997).[2] The organizers stressed the urgent task of long-term caring for an indigenous territory as common patrimony of a people. Suggested elements of this caring included:

1. reaffirmation of the people's historical and cultural links with the territory;
2. planning for the sustainable use and conservation of the resources found in the territory;
3. defense of the territorial integrity from external threats; and
4. development of community-based institutions capable of reaching agreement on and implementing resource-use norms among those sharing the territory.

The participants were introduced to the concept of a zoning process based on both indigenous and scientific knowledge to identify areas where use types appropriate to the biophysical characteristics could be promoted. Different use types that should be considered in designing such a zoning plan were identified and discussed. These included areas to support the indigenous economy and culture, areas for productive activities directed towards the market, areas for biodiversity conservation, areas of "national sacrifice" (petroleum exploitation, military installations, etc.) and areas for future urban-commercial expansion.

While it is true that community members have an intimate knowledge of the layout and resource base for the area that they use and manage directly, no single person, for example in the Machiguenga case of the lower Urubamba, would have an intimate or even general picture for the entire 1.5 million hectare territory. In fact, there are large parts of this territory that are known to no one. This highlights the importance of combining the skills and knowledge of community members with that of scientists and technical specialists to build an information base that is capable of projecting a global picture of the territory to be protected and managed, as well as the detail resource use and conservation patterns of each zoned area (Benavides and Smith 2000).

II Geomatics and Indigenous Territories: Building a Native Communities Information System

Shortly after the 1996 Santa Cruz workshop, Oxfam America, a Boston-based development agency, under a working agreement with the Iquitos regional office (ORAI) of the Interethnic Association for the Development of the Peruvian Amazon (AIDESEP), Peru´s largest confederation of indigenous peoples, set its GIS laboratory to the task of creating a reliable mapping and database service for Peru's native communities. In 1998, both the laboratory and this mapping service, now called the Native Community Information System or SICNA, were transferred to the Instituto del Bien Común, a Lima-based Peruvian NGO.

Contradictory Numbers and Confused Georeferencing Since the 1974 Native Communities Law, four efforts were made to gather and publish data on native communities at the national level (Chirif and Mora 1977; GEF/UNDP/UNOPS 1997; INEI 1993; PETT 1998). Unfortunately there is little agreement among them on all the major categories of information. For example, the *Atlas* produced by Chirif and Mora (1977) speaks of 58 different ethnic groups inhabiting the Peruvian Amazon while the GEF/UNDP/UNOPS atlas (1997) speaks of 42. Chirif and Mora (1977) estimate a total population of 200,000 indigenous Amazonians in Peru while the INEI Census (1993) of the National Institute of Statistics and Information puts the figure at 239,674; current SICNA estimates of total population are well over 300,000. According to INEI, the 1992 census was carried out in 1145 "indigenous communities"[6] in the Peruvian Amazon, while the Directory (1998) published by the Special Titling Program (Programa Especial de Titulación y Catastro Rural, PETT) accounted for 1265 registered native communities, and the GEF/UNDP/UNOPS atlas (1997) estimated 1495.

Land titles are awarded to native communities on the basis of a rough map drawn up for each community by surveyors using traditional field survey techniques to establish boundary points. Over the past thirty years, responsibility for this work has been transferred through several different government agencies, often with the collaboration of NGOs, which explains, in part, the contradictory data. The georeferencing of these rough land title maps is another source of confusion. In general, government surveyors locate only a pair of accessible boundary points in each community. Later in their office, the surveyors transform that information into a boundary perimeter line on paper. For many reasons, these maps are of poor quality with no geographic reference points other than, in some cases, the name of the river along which the community is located. Global Positioning System technology (GPS) was not used in this task. The lack of geographic referencing on these official community maps makes it impossible to register the community boundaries onto other maps.

The Native Communities Information System The Native Communities Information System (SICNA) is an attempt to clarify the confusion in data and in the georeferencing regarding Peru´s indigenous peoples. The concept of SICNA envisions two levels of interaction. First, it encompasses a chain of inter-linked mapping and data-gathering activities that allow local communities, their associations and regional organizations to have a clear picture of the spaces they own and occupy along with access to socioeconomic data on the native communities for their local area, their region, or for the entire Peruvian Amazon. Second, SICNA is a network of people and institutions who help to accumulate, update and analyze information while experimenting with ways to use that information to benefit the native communities. These two levels of interaction are carried out through the combination of a relatively well-equipped central mapping team and GIS laboratory located in the Instituto del Bien Común office in Lima with regional and local organizations and institutions that collaborate in data gathering and analysis.

The Inter-linked Mapping and Data-gathering activities of SICNA Work on SICNA began as a collaboration between Oxfam America and ORAI in Loreto, the largest department in Peru, containing about half of the Peruvian Amazon. The first field work was carried out in September of 1996 along the upper Napo River, in close coordination with the local federation of Kichwa communities and with the municipal government of the district of Torres Causano. Since then, SICNA has worked with more than 30 indigenous federations and a dozen other institutions to map boundaries and gather information on 750 native communities and to locate and gather information on 716 mixed indigenous and mestizo settlements.[7] Current plans call for including the estimated 1500 native communities by the year 2004.

SICNA is being assembled from four types of data.

1. Base Map SICNA is a GIS database constructed with data layered over a digital base map of the hydrographic features of the Peruvian Amazon. These features are digitized directly from the official topographical sheets produced at a scale of 1:100,000. The data for these sheets was gathered at different times over the past thirty years from different sources and by different institutions. The older maps were drawn up by the Military Geographic Institute (now the National Geographic Institute or IGN) in Lima, based on aerial photographs, radar images in some cases, and field work; the Provisional South American Datum of 1956 was used for these sheets. The sheets produced between 1980 and the early 1990's are the product of a collaboration between the IGN and the Defense Mapping Agency (DMA) of the US Defense Department; these are also based on aerial photographs, but use the datum of the World Geodetic System of 1984 (WGS84). The newest generation of base maps for the Peruvian Amazon is being produced by the DMA based on Landsat TM images using the WGS84 datum. All use a Universal Transverse Mercator projection system, but include geographic coordinates as well. Three hundred and twenty of these sheets are required to cover the entire area of the Peruvian Amazon.

At this point, Peru does not have an official digital map of the country. For that reason, any government ministry or private institution doing GIS work in the country must either digitize a base map of their own, or, through complex arrangements involving personal contacts and reciprocity, use a digital base map produced by another institution. Unfortunately there are no common standards, nor a common source for the information on the different digital base map initiatives that have already taken place.

The SICNA program decided in 1996 to use the official topographical sheets at a scale of 1:100000 as the source of information for a base map.[9] Criteria for that decision included the high quality of the these sheets, the greater precision they offered for locating GPS data and the political importance of using official maps as a starting point. Using both in-house capacity and outside contracts to digitize the hydrographic features from the topographical sheets, SICNA has constructed a digital base map covering about 35% of the Peruvian amazon (135 topographical sheets).[10]

2. Community Boundary Lines As explained earlier, land titles are awarded to native communities on the basis of a rough map drawn up for each community by government or NGO surveyors. As a result, the digital registration and georeferencing of the boundary lines for each community are complicated tasks. As a first step, the mapping team must locate and copy the boundary map for each community. Government archives, especially those regarding community land titling, are in general disarray today. In the majority of cases, the community copy of the land title map has suffered a similar fate, disappearing or deteriorating while passing from one community president to another. In Loreto Department, ORAI systematically made copies over the years of the land titles and boundary maps for most of its member communities. Unfortunately, this was not the case for other regions.

As a second step, under agreements with and accompanied by leaders from the local and regional community organizations, the mapping team visits each community in the designated work area. After explaining the purpose of the work to community members, the whole group accompanies the mapping team to at least two accessible boundary markers found along a river, stream or road. Using a hand-held

GPS unit (global positioning system data recorder), the mapping team ascertains the geographical coordinates for each point. GPS readings are also taken for other points within the community such as the school, health post, landing strip, and whatever else the community members want to have recorded on the map.

The third step in the process takes place in the GIS laboratory of the Instituto del Bien Común. Here the GPS readings are downloaded onto the base map, and used to register the land title map to the base map. To do so, a logarithmic formula using three sets of data (GPS coordinates of one boundary marker, and the length and the azimuth of each sector of the boundary line taken from the land title map) is used to establish the geographic coordinates of all the boundary points of a community. As the geographical location of these boundary points is calculated, they are registered on the base map. The results are a polygon over the base map that give the final shape and area of the community territory.

3. <u>Tabular Data Base</u> The third component of SICNA is a data base that contains 229 fields of information for each community organized into the ten thematic areas. (Table 3 about here) This information is gathered from two sources. Most of the data for the legal-administrative status of the community is taken from the documentation available from the indigenous peoples organization, the NGOs working in the region, or from the Ministry of Agriculture. This information is corroborated when possible in the community itself. Data for the other fields are gathered by the SICNA team using a standard questionnaire during their visit to each community. Often the information is gathered during a community meeting, giving community members a chance to discuss and agree upon an answer. School and health post records are consulted for data on those thematic areas. The information is

incorporated into a data base format, and through the GIS program, it is attached to the polygon representing the boundary lines of each community.

4. Complementary Information The fourth component of SICNA includes a variety of ancillary data layers that can be superimposed over the base maps with the native community boundaries. These can be grouped into three types: 1. geographic features that include settlements of different sizes, overland routes, and airports; 2. biophysical characteristics including topography, soil types, and vegetative cover types; and 3. other property or usufruct claims such as oil or mining concessions, timber concessions, conservation areas, or private titled property.

Unfortunately for projects such as SICNA, these types of data are generally difficult to find for the Amazonian region of the country, of unreliable quality, not available to the public, or not available in digital format. For example, the IGN topographical sheets have the best data publicly available on human settlements, topography and infrastructure such as roads and airports. However, the SICNA team is discovering from its field work that the data on the location and name of settlements in the Amazon is not always reliable. To correct this information, the SICNA team is collecting GPS location points and basic information for each non-native settlement in all areas surrounding the native communities being mapped.

The government natural resource institute is the best source of information on the biophysical characteristics of the Amazonian region. Unfortunately, because most of its studies were conducted before the advent of GIS systems, this information is not in digital format. University-linked research projects, such as the Andean Amazonian Rivers Analysis and Management (AARAM) project, and agencies with a conservation or development focus are important sources for data of this type, although they may not make their information available to those outside their institution. It is known that data coverages for other property or usufruct claims exist in government agencies. For example, the Ministry of Energy and Mines has all oil and mining concessions in digital format, the Ministry of Agriculture is constructing a database on timber concessions, and the official natural resource institute is said to have all conservation areas in digital format. Some of this information has been made available to the SICNA program through information exchange agreements recently signed with government agencies.

Each data set will become a coverage that can be manipulated independently either alone or together with other data sets for a richer analysis of the situation of the indigenous communities.

Maintenance of SICNA Data Boundary data and many of the categories of tabular data are unlikely to change over time. However, data on demography, housing, education, health, and economic production/consumption will need periodic updating. Carrying out this task for the entire Peruvian Amazon is clearly beyond the capacity of any single organization or NGO. SICNA is contemplating several possible solutions to this challenge. The Instituto del Bien Comun has had preliminary conversations with INEI to explore ways that SICNA can help improve this second effort to carry out an indigenous people's census while at the same time, benefit from the updated information. SICNA is also exploring the possibility of working with AIDESEP for training both the bilingual school teachers and the community registrars in data collecting techniques. In this way, data could be gathered periodically for inclusion into the Native Communities Information System.

Community boundaries, on the other hand, are least likely to change given the complex administrative-legal process required for doing so. None-the-less, as boundary errors are corrected or as new lands are added to a community, these changes will have to be verified in the field and added to the data base. The SICNA team will have to coordinate closely with the indigenous organizations and with the Ministry of Agriculture for updating these changes.

III SICNA and its Applications

A GIS data base is of little value to indigenous peoples unless it can be put to use effectively and easily for their benefit. This remains a complex challenge for SICNA and all other GIS-based information systems working with indigenous peoples in Latin America. For example, , the SICNA teamis in general agreement that broad dissemination of information regarding the situation of indigenous Amazonians is potentially very beneficial for them. Yet the local community organizations that participated in the data gathering for SICNA often veto making that information available to a broad public.

Indigenous Amazonians in general continue to be very sensitive regarding the distribution of any information on their community organization, property, and way of life. This sensitivity arises from several factors. For example, most indigenous peoples continue to view outsiders through an historical lens of resource insecurity. There is a widespread suspicion among the community associations that any information about them, their communities and their resources can be used by outsiders against their interests. While there is some truth to that, unfortunately no discrimination is made in this view regarding what kinds of information can be dangerous and what kinds can be beneficial.

We are working closely with the organizations of indigenous Amazonians to ensure that they are comfortable with the type of information stored in the data base and with the policies governing access and dissemination of that data. We are also working to show them that many kinds of information, when made public or used in certain ways, can be of great benefit to their communities. In this respect, a challenge for SICNA is finding the right medium for making that information available to the communities, to their organization and eventually to the public.

SICNA Products SICNA has already distributed a number of different products to its associates. Some of these are in digital format while others are in printed-paper format. The digital medium for information is still in its infancy in Peru as only a small sector of the society currently has the means and the training to take advantage of it. Some of the regional federations and confederations of native communities have the technical capacity to make use of this medium, but often do not have the educational background to take advantage of the quantities of digital information now available. Thus, despite the enormous possibilities offered by GIS for analyzing many different kinds of community problems and for reaching decisions about different development alternatives, such capacity has to be built patiently over a period of time.

SICNA is experimenting with different digital mediums that allow members of the users network to view and query the data in SICNA at a relatively low cost. SICNA is in a PC ArcInfo format and is most readily accessible through ESRI's ArcView platform. However, the high cost of the ArcView software reduces it availability as a medium for the majority of our potential users in Peru. We are experimenting with another ESRI product, ArcExplorer, a simplified tool for viewing and querying GIS data, with a limited capacity to design and produce maps to illustrate that data. The fact that this software can be downloaded from the Internet without cost makes it an attractive interface for users of the Native Communities Information System. Eventually SICNA digital products will be available on CD-Rom and through the Internet, both of which are convenient means to make the data available.

At this point, the printed-paper format is more familiar and more easily usable for the majority of SICNA's associates. Printed maps have been by far the most successful of these products. SICNA has produced large color maps showing the hydrographic features, community boundaries, settlements and other geographical features for each of the federations with whom mapping work has been carried out. Both the local and the regional indigenous organizations have made extensive use of these maps for affirming their community territories and for identifying priority areas for recovering lands and forest resources and for identifying boundaries between native communities and natural protected areas. As a result of a consistent effortby SICNA, these maps, technically superior and based on better data than official maps, have begun to make their way into government offices including the planning arms of Ministries that play a key role in determining land use and land titling. In February, 2002, the Instituto del Bien Común signed a cooperative agreement with the government land titling agency, PETT, to verify the SICNA data and then confer to it the status of official cadaster of native communities in Peru.

While printed maps will continue to be the most popular of the products, SICNA is committed to sharing the tabular data and its analysis with the communities and NGOs and encouraging its use in planning activities. The GIS laboratory at the Instituto del Bien Común has developed a program for converting the tabular data into an easily readable format printed in small booklets made available to the communities and their organizations. SICNA team members are also developing thematic maps for community use; these are maps show the results of an analysis of any combination of SICNA data.

Experimental Applications of SICNA

1. Defining Indigenous Territory through Resource-Use Mapping Along the Ampiyacu-Yahuasyacu River, a tributary of the Amazon near the Peruvian-Brazilian border, there are thirteen communities of Huitoto, Bora, Yagua, and Ocaina Indians. Some members of the SICNA team had conducted research here on the indigenous economy in a market context in 1992 (Smith and Wray 1996). Although they had been among the first communities in Loreto to receive land titles after the 1974 Native Communities law, the average size of the parcels titled was quite small and clearly did not include all the forest and river areas used by the local population for subsistence and market activities. Community members expressed on many occasions their urgent interest to protect the natural resources in a larger area around their communities from outside poachers. Although their community association, Federation of Native Communities of the Ampiyacu (FECONA), had, with some success, established control over the river access to their territory, there existed many other points of clandestine entry through the forest that were being used to extract resources.

The situation became desperate in 1999 for two reasons. As a result of the peace accord signed between Peru and Ecuador, the Peruvian government ceded property rights to the Ecuadorian government for a parcel of land near the mouth of the Ampiyacu River, as a center for Ecuadorian commercial activities on the Amazon River. At the same time, information leaked out to community leaders that a Korean company had presented a formal request to the Peruvian government for a 250,000 hectare concession for developing an industrial complex based on forest and possibly mineral products. The requested concession was located in a heavily forested region between the Ampiyacu and Putumayo Rivers, precisely in the area used by the indigenous populations of both rivers.

The mapping team at the Instituto del Bien Común proposed working with the three community associations of this area and with ORAI to protect the natural resources in the headwaters of the Ampiyacu, Apayacu and Algodón Rivers from encroachment. The strategy was to design with community participation and then to propose to the government the creation of a communal reserve in that area. Given the political resistance to titling large indigenous territories in Peru, the communal reserve offers the only other alternative to the native communities to protect areas beyond their communities on which they rely. Subsequent to its creation by the 1978 Forestry Law, the communal reserve was incorporated into the national park system under the administration of the Ministry of Agriculture. This change offered stronger protection for the communal reserves and the resources they contain, but at the same time it also weakened indigenous control over the same.

The mapping team proposed basing the proposal for a communal reserve on a rigorously constructed map of community resource use. The methodology for mapping community resource use was developed by the Instituto del Bien Común based on field work in two areas of the Peruvian Amazon, plus exchange with other community mapping efforts (Brown et al 1995; Chapin1997, 2001; Saragoussi et al 1999; also see Herlihy in this volumn).

Prior to field work, the mapping team used the SICNA data base to generate a georeferenced base map of the entire region that included the community boundaries and other geographical features. A satellite image of the same area and at the same scale was printed as an aid in identifying features not on the base map and in orienting community members. The mapping team then worked with leaders from the three associations and the 25 communities during two periods of field work.[13] During the first period of eight weeks, the team worked with members of each community mark the areas where they make gardens, fish, hunt and gather a variety of forest resources on a transparent georeferenced overlay of the base map. Natural resources important for both subsistence and market use were taken into consideration. Points of cultural significance were also marked. In many cases small streams and other features not found on the base map were added. All of this information was discussed and agreed upon by the participating community members. A different overlay was used in each community, resulting at the end of this period of field work, in 25 community resource use maps.

Back in the laboratory, GIS specialists used a digitizing table to register the information from the community maps into the GIS system and to build a composite map combining all the resource use sites from the 25 community maps. Not surprisingly, there was an enormous amount of overlap, clearly demonstrating that large common areas were being used by members of different communities without apparent discrimination or conflict.

This draft composite map was then taken back to the communities for verification. This was carried out in two ways. The team revisited some of the communities asking the leaders and members to verify the points of resource use, cultural significance and new geographical features now on the printed composite map. The mapping team then trained three leaders from the Ampiyacu communities to use a hand-held GPS units. This group spent three weeks traveling into the headwaters of the Yahuasyacu river to record coordinates for actual hunting and gathering sites found there; a second group carried out the same ground-truthing process in the headwaters of the Apayacu river.[14]

A corrected composite map was then generated and used, along with the satellite image, to define the boundaries for the proposed Communal Reserve (Figure 2 about here). In most cases, either the watershed divide or a river was proposed as a boundary for the Communal Reserve; the total area included within the proposed Reserve is 1,018,000 hectares. The mapping team then met with members of the three community associations to discuss the proposed boundaries for the Communal Reserve. In May of 2001, the proposal was presented to the government agency responsible for the national system of protected areas. The outcome now depends on the capacity of the community associations and ORAI to lobby for the proposal.

2. <u>Defining an Indigenous Territory as Cultural-Historical Landscape</u> We know that a corridor of upper Amazon rainforest stretching from San Ramon (Dept. of Junín) in the south to Pozuzo (Dept. of Pasco) in the north was home to the Amuesha people at least since the late 16th century when the written record began. The Amuesha (who

call themselves yaanehsha' or yaamootsesha') are part of a language family (Arawakan) and economic culture of the Amazonian world, and yet share a cosmovision, ritual life, and many linguistic markers of the Andean world. Their role as a cultural buffer on the cultural-ethnic frontier between the Andean and the Amazonian worlds has been suggested elsewhere (Smith 1983; Wise 1976).

The Amuesha people did not suffer the tremendous dislocation imposed on other indigenous peoples in the Peruvian Amazon during the rubber boom era at the end of the 19th century, when so many were moved from one region to another as cheap or slave labor. However, the influx of Andean and European settlers into their traditional homeland corridor beginning about 1860, slowly pushed them out of large parts of it and down into the Palcazu and Pachitea river systems. Nonetheless, their cultural and historical memory, ratified by the presence of a few surviving communities in that corridor, keep alive their association with their ancestors in this territory. The Amuesha system of toponyms together with their oral tradition which includes a wealth of geographical references to places, mountains, rivers, pools, caves, and other features, suggest that they have been residents of this corridor for a long time.

In the previous example of a SICNA application in the Ampiyacu-Algodon, we described an effort to map current natural resource use as a defining criteria for indigenous territoriality. In this case, the cultural memory of place in the history of the Amuesha is being mapped as a defining criteria for indigenous territoriality. The Amuesha have an extraordinarily rich oral tradition with a cast of over 200 “mythical-historical” figures, including major and minor deities, warriors, priests and ancestors.

Each of these was once associated with a place or places that could be located within the traditional territory.

An initial step in this mapping effort is to gather as much of the information about place as remains in the Amuesha memory.[16] One source of this information are the many different versions of the hundred or so oral histories that are still being told. These must be recorded, transcribed, compared and analyzed carefully to identify all the references made to geographical features as scenarios of ancestors' actions. As in the neighboring Andean societies, mountains are extremely important scenarios of dramas past that continue to house invisible ancestor or to act as powerful beings in their own right . For example, the mountain Chemot̃epen located in Oxapampa is said to have been the location of the temple and the final hiding place of Our Grandfather Coromesh, while the mountain Yatapen in the Cacazu watershed is the hiding place of Our Grandfather Rorenso, whose urine continues to color the stream the flows down its southern flank. We have identified and georeferenced 115 mountains with their names and in some cases their stories and songs; we estimate this to be about one-third of the known mountains found in Amuesha territory.

A second source of information is the present day geographical knowledge of community members. They all can identify and name geographical features, historical sites and sites of cultural or ecological importance in the vicinity of their community. The mapping team is systematically gathering place names with histories and commentary in each community and where possible, a GPS reference point. In addition to mountains, we are asking about rivers, streams, springs, waterfalls, pools, cliffs, caves, dwelling sites, nesting sites, salt licks and sacred sites including former temple sites. We are attempting to map old trails that connected communities before modern roads were built along with their river crossings and resting spots, as they are important indicators of past connections.

A third source of information are historical documents about the region that begin as early as the late 16th century and occasionally include important data about place. Documents from the late 19th and early 20th century, especially those written by road engineers suggesting the best routes for trails or railroads, give detailed hydrographic information with associated Amuesha toponyms.

All this data is being georeferenced and incorporated into a GIS database constructed as an overlay to the SICNA base map with the modern native Community boundaries (Figure3 about here). Different types of features (mountains, for example) are organized into separate layers allowing data sets to be manipulated independently. While printed maps will certainly be a product of this effort, we are also considering a multimedia product based on GIS that will include maps, satellite images, tabular data, photographs, video and recordings of music and oral history.

IV. Mapping Our Past and Our Future

All human beings create and use maps. Maps are an intimate and necessary part of our everyday existence. Most of our maps, however, are mental images that are never expressed in graphic form. Urban dwellers, for example, create and use mental maps to guide them through the maze of city streets from home to office to supermarket, or to navigate the public transport system from their point of departure to their destination. Rural Amazonians create mental maps of their surroundings for much the same purposes. The men use them as a guide through the forest trails, past a fruiting tree, to the salt lick where they await the arrival of a deer. The women use them to locate the patch of beans or the ripe papaya fruit within the complex arrangement of cultivated plants in her slash-and-burn garden.

As mental representations of geographic features and their spatial relationship, maps have always been part of the cultural world of the indigenous peoples in Amazonia. Because their livelihoods depend on their natural surroundings, they are acutely aware of the geographic features around them and the spatial relations among those features. They know, in terms of direction and distance, where their household stands in relation to the river, the gardens, the salt licks, their neighbors and all the other useful features in their natural and social world. Perhaps that acute awareness of their natural surroundings explains why they are able to orient themselves with such great facility on modern graphic maps introduced by the researcher, the government agent or the community mapper.

As we have shown, during the decade of the 1990's, indigenous peoples in Amazonia have been discovering the usefulness of modern maps and mapping technology for organizing information about their territories, for reaffirming and defending their property rights, their cultural rights and their history and for planning the future management and development of their territories. There is a growing interest among indigenous peoples' organizations and those working with them to incorporate the practical lessons from and applications of the growing field of geomatics into their tool kit for long-term defense and development.

Endnotes

[1] The most recent official data for Peru's indigenous Amazonians are from the 1992 Census of Indigenous Communities which has been widely criticized (INEI 1993). See page 8, Note 7.

[2] This study was carried out by Oxfam America and the Woods Hole Research Center combining participatory field methodology with remote-sensing and GIS laboratory technology.

[3]

[4].

[5] AIDESEP is the largest of two national-level confederations of community-based organizations of indigenous Amazonians in Peru.

[6] In Peru, only the native community is officially recognized in the Amazonian region. The PETT publication (1998) is based on this unit of analysis. One of the sources of confusion in the INEI census is the absence of a definition for this unit called "indigenous community" in the census. There are many examples in the INEI census in which specific "indigenous communities" listed in the census do not correspond with the native community unit recognized by the State.

[7] To visualize the results, see www.biencomun-peru.org\sicna.htm .

[8] The UNDP-PNIC digital map based on sources at 1:250000 was never made public, and appears to have lost legitimacy among government ministries. The Instituto Geológico Minero y Metalúrgico (INGEMMET) of the Peruvian government has recently made available to the public at market prices its digitalization of 375 topographical sheets (www.ingemmet.gob.pe) .

[9] The SICNA mapping team has eight members, six of whom are trained in the use of GIS and GPS technology; five of these six conduct both field work for periods that range from 3 to 6 weeks followed by 6 to 8 weeks working on their data in the GIS laboratory.

[10] Given the variety of sources and datum used over time to produce the individual sheets, there are occasional problems and distortions resulting from joining the quadrangles with each other. The mapping team uses ArcInfo PC and Arcview software from the Environmental Systems Research Institute (ESRI, Redlands, CA) to construct and manipulate its GIS database.

[11] The elimination by Presidential decree in May of this year of the intentional error introduced by the US military who own the GPS satellite system has improved the accuracy of our work and reduced the need to make post-reading corrections.

[12] These are the Federation of Native Communities of the Ampiyacu (FECONA) with 13 communities in the Ampiyacu watershed, the Federation of Native Communities of the Middle Putumayo (FECOMPU) with 9 communities in the Putumayo and Algodón watersheds, and the Federation of Yagua Peoples of Orosa and Apayacu (FEPYROA), with three communities in the Apayacu watershed.

[13] This work was carried out under the leadership of Mario Pariona. The regional organization of AIDESEP provided important support for this effort.

[14] A recent Master's Degree thesis at Instituto Nacional de Pesquisa da Amazonia (INPA, Manaus, Brazil) demonstrated an average 11.70% error in a sample of 144 GPS points verifying the participatory resource use mapping methodology for 15

domestic units (8% of total number of points mapped) carried out by the Fundacao Vitoria in the Jau National Park, Brazil. (Pedreira 2000)

[15] In many cases, hispanicized versions of Amuesha toponyms continue in use in the region; in other cases, although Spanish toponyms have taken over, the Amuesha themselves keep alive a memory of their own original place naming system.

[16] The project is being carried out by Richard Chase Smith and Espiritu Bautista, an Amuesha from the Community of Loma Linda.

Figure 1.

Machiguenga Native Communities and protected areas together form a 1.5 million hectare territory in the lower Urubamba River basin.

(Credit: Ermeto Tuesta, Mario Pariona, Richard C. Smith, GIS Laboratory of IBC, CEDIA, SICNA)

Figure 2.

Mapping of community resource- usage is employed to define boundaries for a proposed Ampiyacu-Algodon Communal Reserve: Partial view of final map. Ampiyacu River Sector.

(Credit: Mario Pariona, Community members of FECONA, FEPYROA and FECONAMPU, GIS Laboratory of IBC, SICNA)

Figure 3. (choose one of two alternatives)

Portion of map of the Cacazu Valley documenting the cultural-historical landscape of Amuesha-Yanesha' people in Peru´s Central Selva. Mapped elements include streams, river crossings, mountains, lakes, waterfalls, historical sites, cliffs, and in largest print, location of Amuesha divinities.

(Credit: Richard C. Smith, Espiritu Bautista, Carla Soria, GIS Laboratory of IBC, SICNA)

Table 1

Areas Titled or Reserved for Peru's Indigenous Amazonian Peoples – 2001

# Hectares Titled*	# Hectares Reserved**	Total # Hectares	% of Peruvian Amazon***
10,503,888	996,035	11,499,923	15.07%

* Total area demarcated, titled and under concession rights to native communities (PETT 2000; SICNA 2002).

** Includes the Yanesha Communal Reserve (34,745 hecs.), the El Sira Communal Reserve (616,413 hecs) and the Nahua-Kogapakori Reserve (344,877 hecs).

*** The Peruvian Amazon has a total area of 76,344,300 hectares (Mora and Zarzar 1997).

Table 2

Estimated Area in need of Titling or Protection for Peru's Indigenous Amazonian Peoples – 2001

# Hectares to be Titled*	# Hectares to be Reserved**	Total # Hectares	% of Peruvian Amazon
2,860,640	4,500,000	7,360,640	9.64%

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* Calculated as 320 (the number of communities in need of titling according to Mora and Zarzar 1997, PETT 2000, and SICNA 2002) times 8,939.50 hecs. (average number of hectares demarcated for currently titled communities)

** Calculated as the estimated area of the following Communal Reserves that have been petitioned and are in process: Vilcabamba 1, Vilcabamba 2, Amarakaeri, Alto Purus, Guepi, Santiago-Comaina and Ampiyacu-Algodon (SICNA 2002)

Table 3

SICNA Database Design

Thematic Areas	# Data Fields
1. Code, Name, ethnic affiliation, organization	4
2. Demography	13
3. Location	8
4. Legal-administrative status	64
5. Housing	3
6. Education	22
7. Health	6
8. Religion	12
9. Economic production/consumption	93
10. External projects impacting the community	4
TOTAL	229

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