Mapping of Selected Important Bird Areas near Quito, Ecuador

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Introduction and Justification

The Important Bird Area (IBA) program is a global effort, administered by BirdLife International, to identify areas that are most important for maintaining bird populations, and to focus conservation efforts at protecting these sites. IBAs are sites that provide habitat essential for the breeding, feeding, wintering or migration of one or more species of birds. IBAs may be large or small and either publicly or privately owned, but share characteristics such as a high diversity species, threatened or endangered species or the presence of unusually large numbers of birds.

Since 2002 the Americas Division of Birdlife International in alliance with Conservation International and partner organizations has been working the IBA Program in the Tropical Andes including these 5 countries, Venezuela, Colombia, Ecuador, Peru and Bolivia. CECIA is a local partner designated BirdLife International in Ecuador. The IBA program in Ecuador was reestablished in 2003. In this initiative, CECIA have been a participant with the Environmental Minister of Ecuador and other national organizations, this organizations (preparation and identification) had developed the two first stages of the IBAs program and had identified a network of sites that provide critical habitat for birds.

About the 75% of the total IBAs in Ecuador don't have map boundaries defined. In consideration for the future in order to continue to follow the stage of the program, planning for action among IBAs, and the broad classes of action to be undertaken (BirdLife., 2003), it is indispensable to have digital polygon maps and profit many conservation opportunities in IBAs.

Using currently available satellite imagery and GIS data concerning Ecuador, it is possible to produce an array of useful maps and GIS data at various spatial scales to help those concerned with avian biodiversity conservation make informed decisions about conservation strategies.

This report is a preliminary landscape analysis of the Important Bird Areas near Quito, using GIS and remote sensing techniques to describe the spatial distributions of human population and development in the selected area, as well as describe the general types of vegetation cover and land use patterns in and around selected IBAs. This technique could be applied to the IBAs which don't have a boundaries map.

These selected IBAs, several alternatives IBA boundaries are proposed based on the conservation criteria for endangered avian species in that region, considering current habitat conditions and socio/political constraints to conservation strategies in that region.

Methods

Acquiring and Processing GIS Data

GIS Data Used and Processing Steps

IBA map alternative we produced by merging relevant GIS data from the Digital Chart of the World (DCW - ESRI, 1993) with relevant GIS data provided from Ecuador or downloaded from the Internet. Input layers representing developed sites such as roads, power lines, mining activity locations, urban area boundaries, airports, pipelines, etc. were put into a common projection (UTM zone 17N).

Satellite Images Used

We used raster data management analyst program to process the satellite imagery.

Table: Satellite images of Ecuador from Internet

Names	Descriptions	Projections	Data Type	Source
Satellite image p10r60	tm7/p10r60/14 Nov1999	WGS_1984_UTM_ZONE_17N	Image	
Satellite image Ndvi_of_1999tm7.img	tm7/p10r60/14 Nov1999	WGS_1984_UTM_ZONE_17N/ndvi	Image	

Table 2: Data from Ecuador like rivers, roads, population, elevations and IBA locations.

Name	Descriptions	Projections	Data Type	Source
new-iba	Important Birds Areas for Ecuador map-information received from Ecuador	WGS_1984_UTM_ZONE_17N	Point	Birdlife
Protected –u17	Government Protected areas in Ecuador	WGS_1984_UTM_ZONE_17N	Polygon	Birdlife
Pueblos-u17	Populated places	WGS_1984_UTM_ZONE_17N	Polygon	Birdlife
PPPOINT-u17	Populates places, urbanized areas and small villages	WGS_1984_UTM_ZONE_17N	Point	DCW
curvas_nivel_ecuador-u17	Topographic curves	WGS_1984_UTM_ZONE_17N	Line	Birdlife
riosg-u17	Principal rivers and streams	WGS_1984_UTM_ZONE_17N	Line	Birdlife
viasg-u17	Primary, secondary and terciary roads and trails	WGS_1984_UTM_ZONE_17N	Line	Birdlife
Map of Ecuador	Map of Ecuador and boundaries		Line	Birdlife

Creation of Land Cover Layer from Satellite Image
***Create alternatives boundaries for each IBA*.**
Step I: Map vegetation and land use in Quito IBA area
1. Digitized cultivates areas and places population in the study area
2. Attributed shape files with their vegetation/land use shape files
3. Merged the vegetation and land use shape files together for Quito study area.
4. After merging shape files together looked for gaps or other places where information is missing.
5. Fixed any errors or omissions identified in the step 4.
6. Created final vegetation/land use shape file.

Step II: Digitized and created two alternative boundaries for each IBA in Quito area.
Digitized **maximum** protected area that encompasses most undisturbed habitat and provides connectivity between IBAs if possible.

Digitized **medium** level of protected area in IBAs that balances the conservation needs of the birds, hopeful will maintain minimum viable populations for the 100 years and balances political, social and economic constraints.

Step III: Created map compositions that illustrates the IBAs in Quito area

1. Created map composition that illustrates the **medium and maximum** IBA proposal with a background of the color Landsat TM 7 satellite image, rivers, and places names.

2. Created a composition that illustrates the **medium and maximum** IBA proposal with a background of the vegetation /land use map, roads, rivers and place names.

3. Created composition that illustrates the **medium and maximum** IBA proposal with the background of elevation, rivers, and place names.

Maps

With GIS data provided by DCW for Ecuador and other GIS data sources we created alternative IBA boundaries, which had been hand digitized on-screen, with each alternative dependent upon a different array of criteria that helped guide the boundary selecting process.

We created at a much finer spatial scale than the previous proposed products, typically focusing on an individual IBA. The mapping scale was determined mostly by our ability to adequately describe any relevant habitat patches or network of patches within a region concerning the endangered birds a given IBA was created to protect. Once the scale and analysis extent was determined, a general vegetation/land use classification was conducted via image classification and analysis approaches using multi-temporal satellite imagery (TM and TM7 scenes).

Results

Analyze the IBAs in relation whit the Government Protected Areas

The IBAs of Ecuador are distributed in all Ecuador, but in the North, South and Southwestern there is a most concentration of IBAs. We can see in the Map 1, that the almost IBAs aren't includes in the Government Protected Areas.

Analyze the IBA boundary alternatives, create maps of IBA alternative

We have proposed two alternative boundaries. The first alternative is the maximum boundaries and the second alternative is the medium boundaries, in each IBA near to Quito. In the digitalization of the maximum boundaries, we consider cultivated areas, forest, and patch forest and in the digitization of medium boundaries, we consider the altitudinal distribution of birds, cultivated areas, forest and patch forest. In each created map, we can see the location of the rivers, roads, populations, elevation contours and place names.

Interpret satellite imagery to create map of vegetation and land use.

The resulting vegetation and land use map would provide information about the baseline vegetation and land use within individual IBAs and in the surrounding landscape.
In these maps we can see very clearly how in the eastern part of the IBAs around Quito, there are human pressures from cultivation and urbanization. Nevertheless in the west of the IBAs the human pressures from cultivated areas are less and, so we can see considerably larger amounts of natural forest in the IBAs.

Table 3: Vegetation and forest superficies in the Maximum Boundaries the IBAs near to Quito.

IBA	VEGTYPE	HECTARES
Maquipucuna-Río Guayllabamba	bosque	29274.068
Maquipucuna-Río Guayllabamba	cultivos	9309.422
Playa Rica-Palmitopamba	bosque	6377.004
Playa Rica-Palmitopamba	cultivos	3039.493
Reserva Orquideológica El Pahuma	bosque	8472.187
Reserva Orquideológica El Pahuma	cultivos	1983.492
Reservas Yanacocha-Verdecocha and Volcan Atacazo	bosque	57569.170
Reservas Yanacocha-Verdecocha and Volcan Atacazo	altamontana	1632.684
Reservas Yanacocha-Verdecocha and Volcan Atacazo	area urbana	1.653
Reservas Yanacocha-Verdecocha and Volcan Atacazo	cultivos	8121.480

Table 4: Vegetation and forest superficies in the Medium Boundaries the IBAs near to Quito.

IBA	VEGTYPE	HECTARES
Maquipucuna-Río Guayllabamba	bosque	21671.932
Maquipucuna-Río Guayllabamba	cultivos	914.906
Playa Rica-Palmitopamba	bosque	3402.549
Playa Rica-Palmitopamba	cultivos	217.977
Reserva Orquideológica El Pahuma	bosque	4190.893
Reserva Orquideológica El Pahuma	cultivos	27.455
Reservas Yanacocha-Verdecocha	bosque	17488.999
Reservas Yanacocha-Verdecocha	altamontana	1631.650
Reservas Yanacocha-Verdecocha	cultivos	840.586
Volcan Atacazo	bosque	18603.979
Volcan Atacazo	cultivos	337.524

Discussion

“The last several millennia have seen the earth transformed from an expanse of contiguous habitat interrupted only by natural barriers or localized natural disturbances, to a patchwork of natural, human-modified, and thoroughly destroyed habitats. Habitat modification and degradation on many scales has fragmented natural areas into habitat patches separated by highways, cities, agricultural fields, plantation forest, mines, railroads, deforested wastelands, and countless other barriers. Because this trend will continue in the foreseeable future, conservation efforts must proceed with the understanding that only a small, critical fraction of the word’s habitat may survive as natural or seminatural areas. This makes it all the more crucial that stewardship of these remaining areas be undertaken in a responsible and biological sound manner through good reserve design” (Meffe and Carroll, 1994).

Nature reserves are typically developed for one or more primary biological motivations. One of this is to protected particular species or groups species of special interest. These are typically either several endangered species or taxa otherwise of high visibility. In this process, many others species and entire ecosystems will be preserved as a secondary benefit under the “umbrella” of these high visibility (Meffe and Carroll, 1994).

Reserve selection is inevitably followed by reserve design: deciding how large reserve should be, where its boundaries should lie. Conservation biologists have used Geographic Information System (GIS) technology to combine maps representing distributions of many different species and existing reserves into composite maps (Hunter, 1996).

In the case of the design of the Important Birds Areas is based on four biological criteria, endangered birds, biome restricted birds, restricted range birds and congregatory birds. When we mapped the IBA boundaries in the Quito area, we tried to incorporate the above four biological criteria along with general criteria that has been developed by conservation biologist in designing nature reserves. We made an initial attempt to consider the extent of habitat fragmentation and the size of habitat patches that would be needed by the target bird species to be protected in each IBA.

We created two alternative boundaries for each IBA. The maximum boundary proposal attempts to provide habitat linkages between IBAs and existing protected areas. It also attempts to maximize the amount of unfragmented forest habitat contained in each IBA.

Conclusion

1. We have created the basin and important information to build the boundaries of each IBA in Ecuador. We could use this information in planning stages three and four in the process of IBA program in Ecuador and also as a tool to promote their conservation efforts in the future.

2. The maps could be used to outline conservation and ecological action that are feasible and realistic that could be taken at the site.

3. The focus of this work was to provide adequate training for Orfa Rodriguez, Pacific Biodiversity Institute Intern, on the basis of methods and principals of conducting research and remote sensing techniques for biological conservation. We consider it very important to continue the process of "Ecuadorian IBAs Mapping".

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Maffe,G and Caroll, R.1994. Principles of Conservation Biology. Printed in U.S.A.

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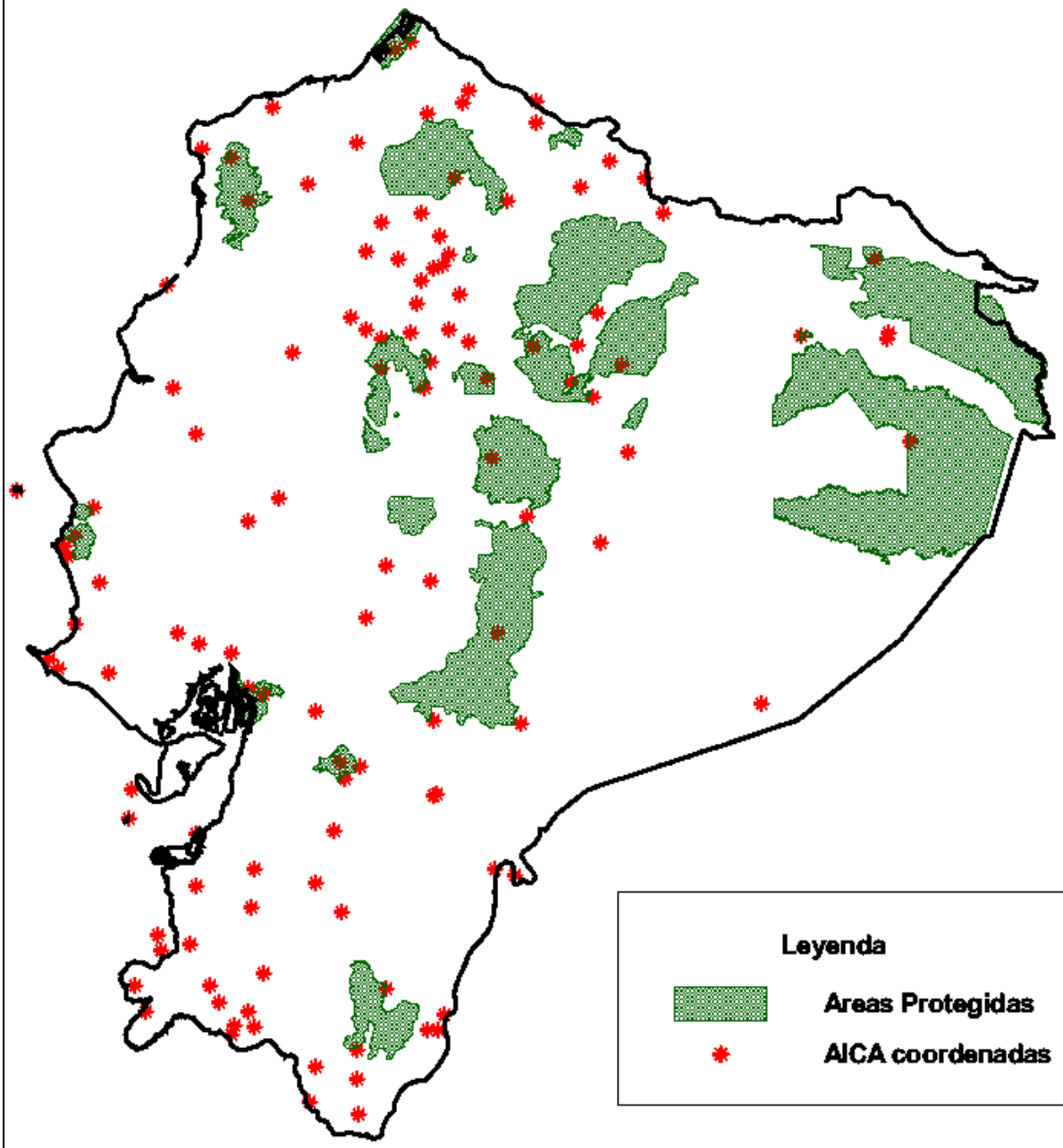

50 0 50 100 150 Kilometers

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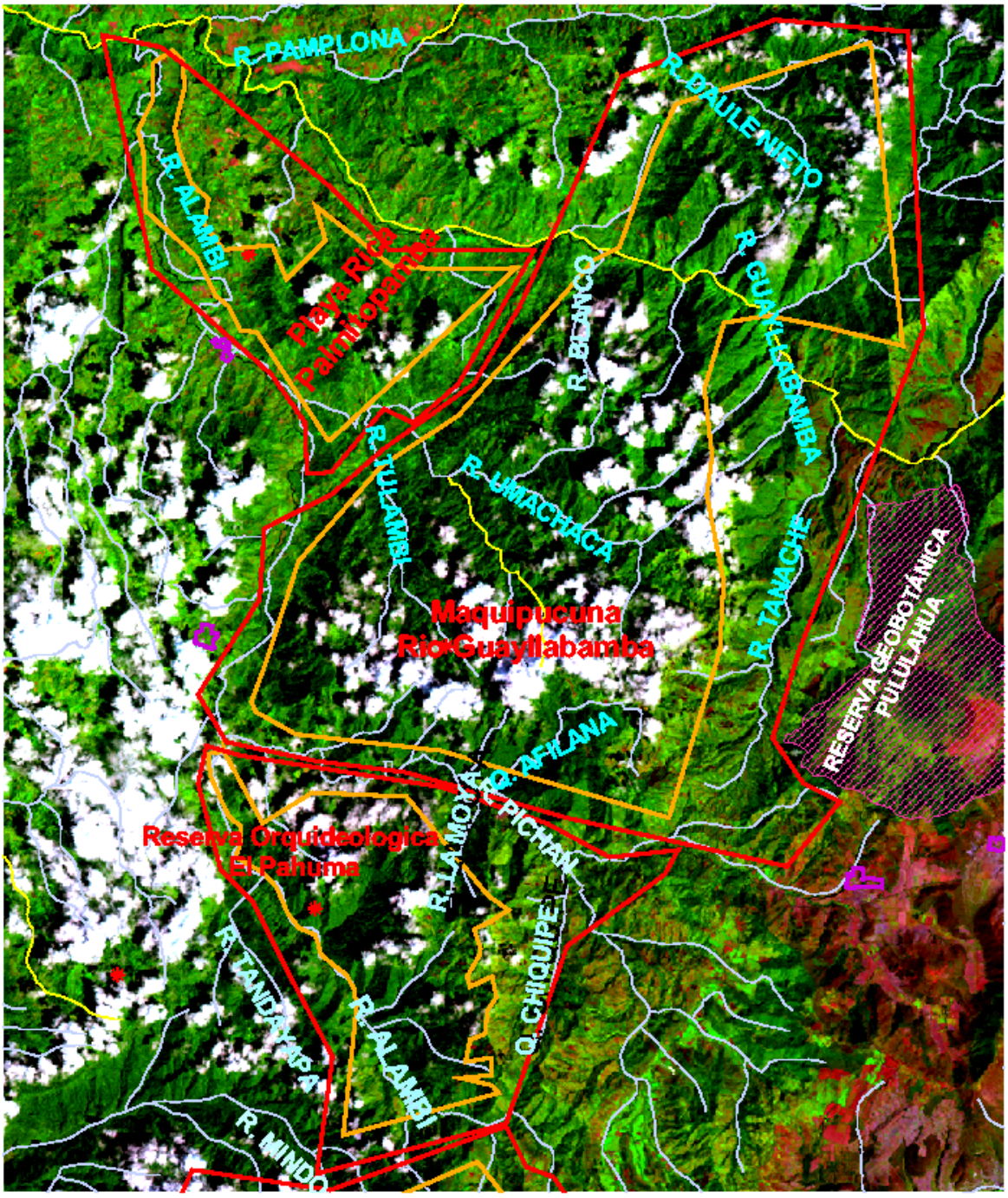
AICAs de Pahuma, Playa Rica-Palmitotambo, Maquipucuna-Guayllabamba
Landsat Enhanced TM 7 Image , Nov 1999



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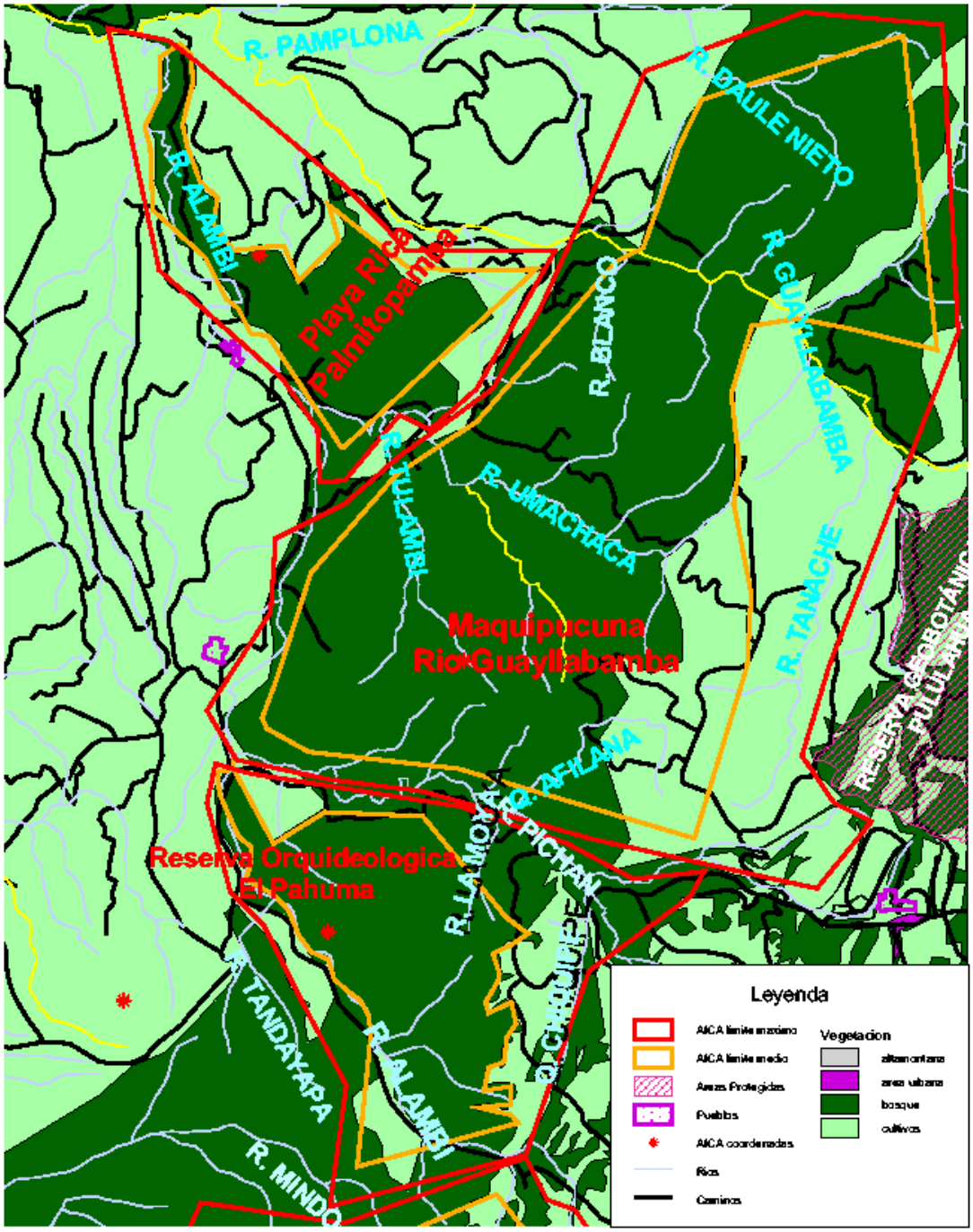
AICAs de Pahuma, Playa Rica-Palmitotambo, Maquipucuna-Guayllabamba
Cobertura Vegetal



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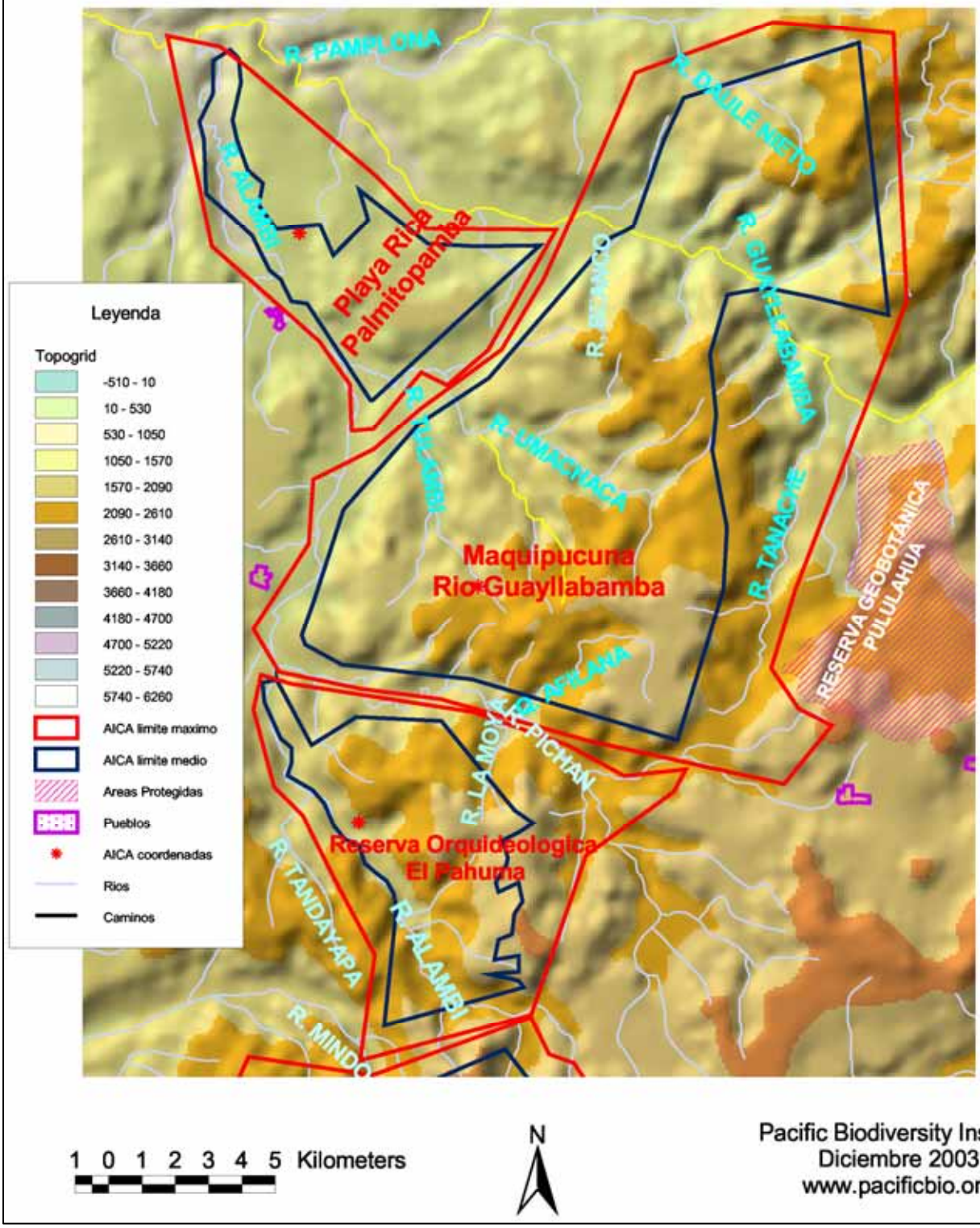
AICAs de Pahuma, Playa Rica-Palmitotambo, Maquipucuna-Guayllabamba
Topografia



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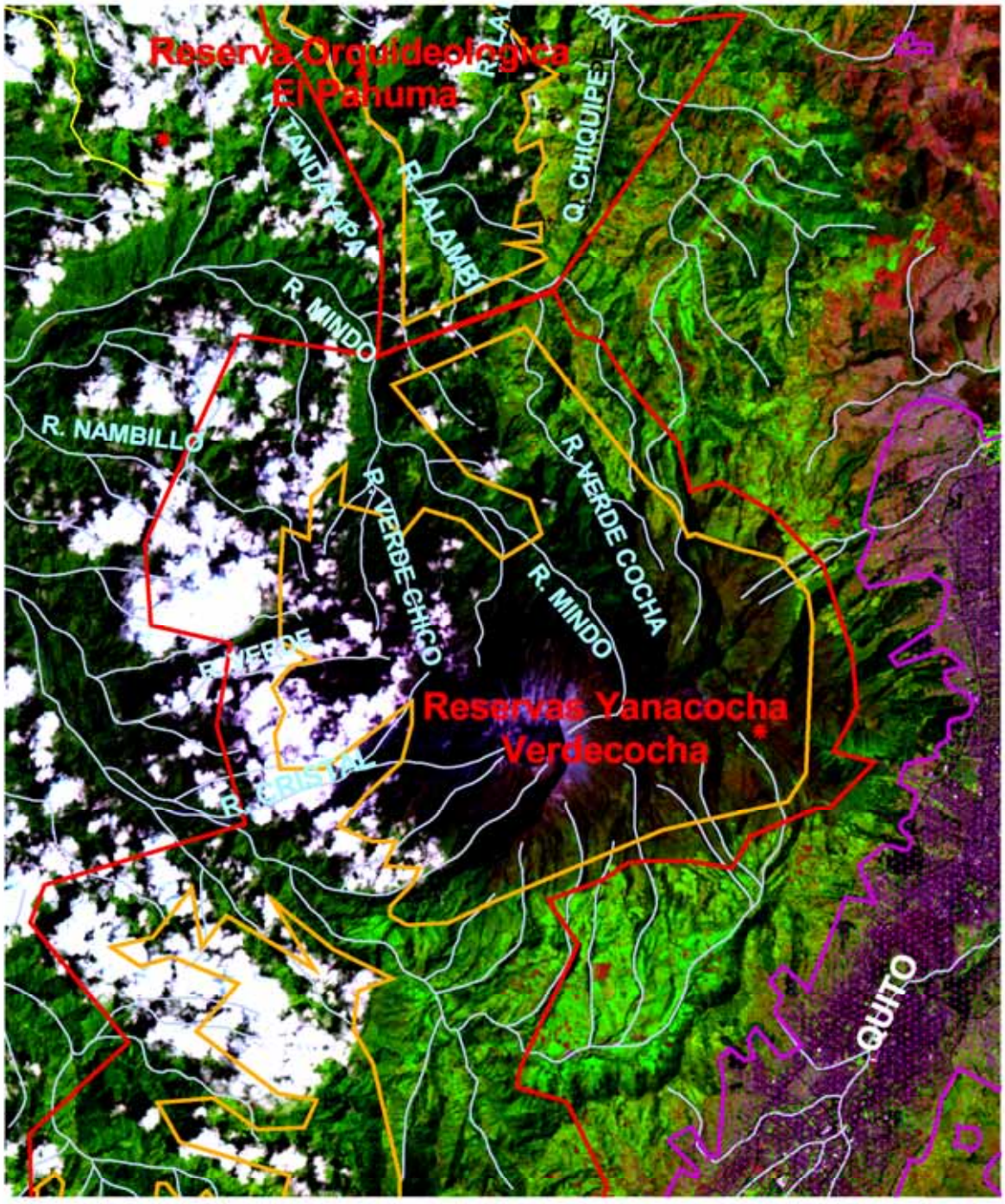
AICA de Yanacocha
Landsat Enhanced TM 7 Image , Nov 1999



AICA limite maximo
AICA limite medio
Areas Protegidas
Pueblos
AICA coordenadas
Rios

1 0 1 2 3 4 5 Kilometers

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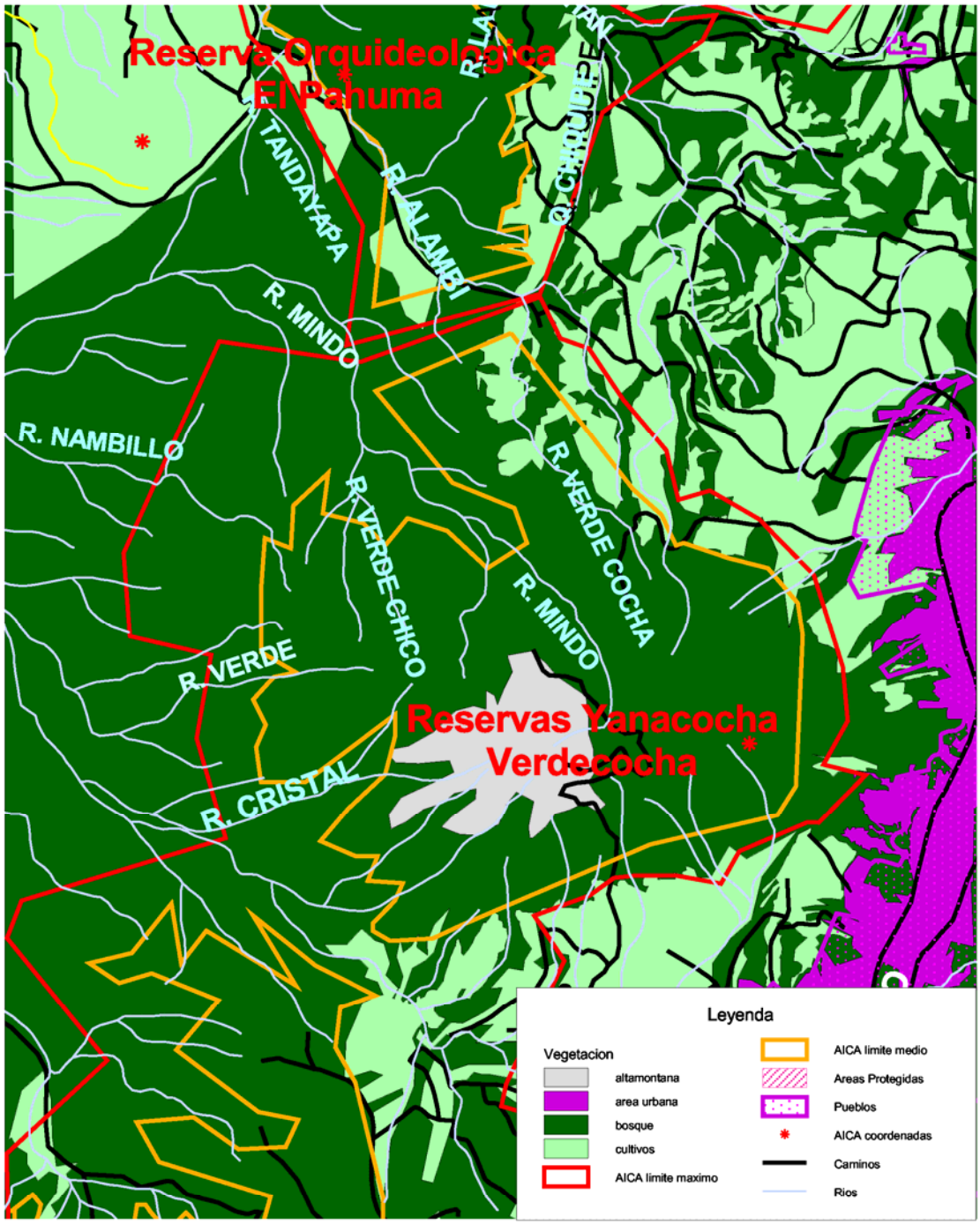
AICA de Yanacocha
Cobertura Vegetal



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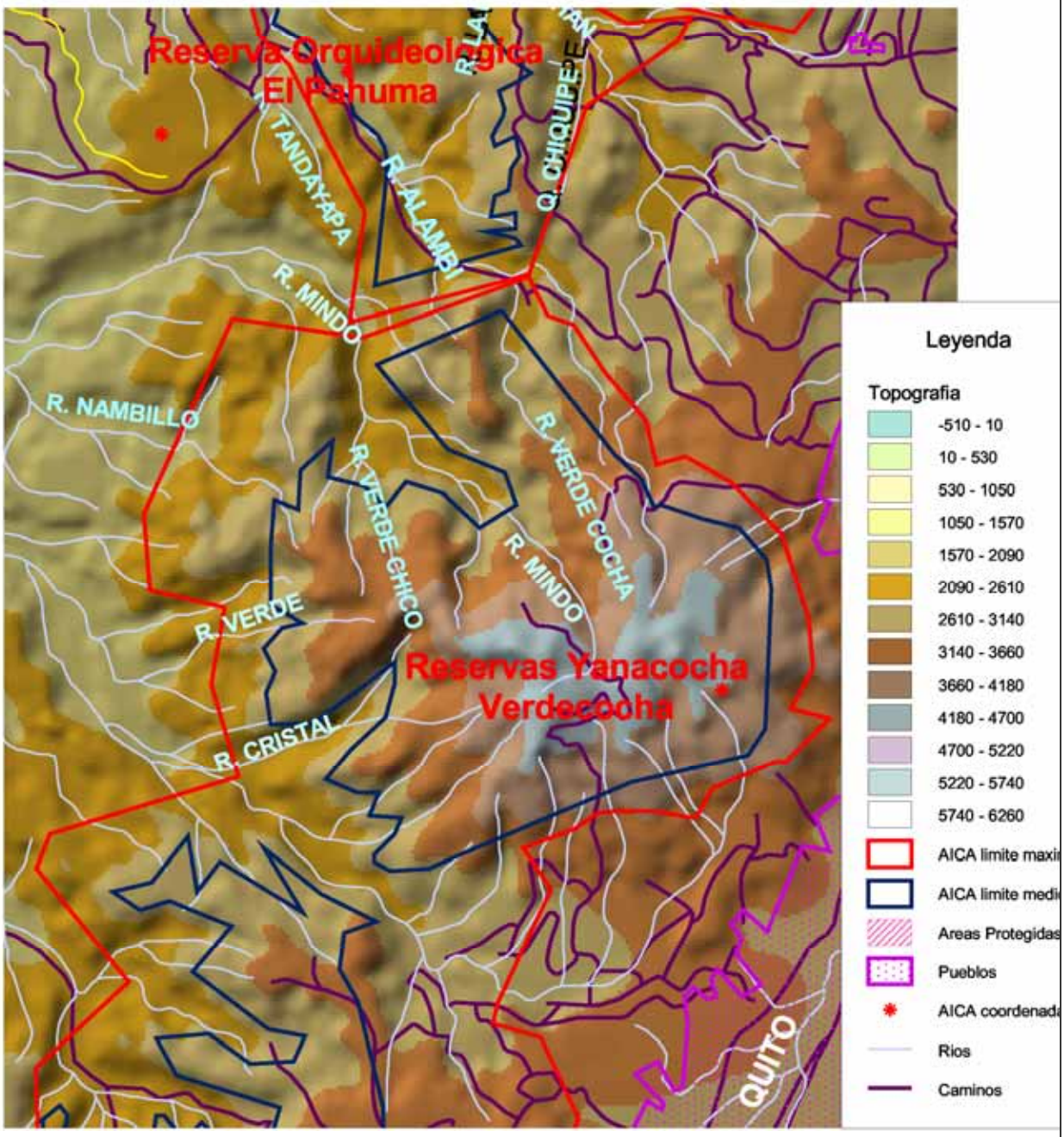
Topografia



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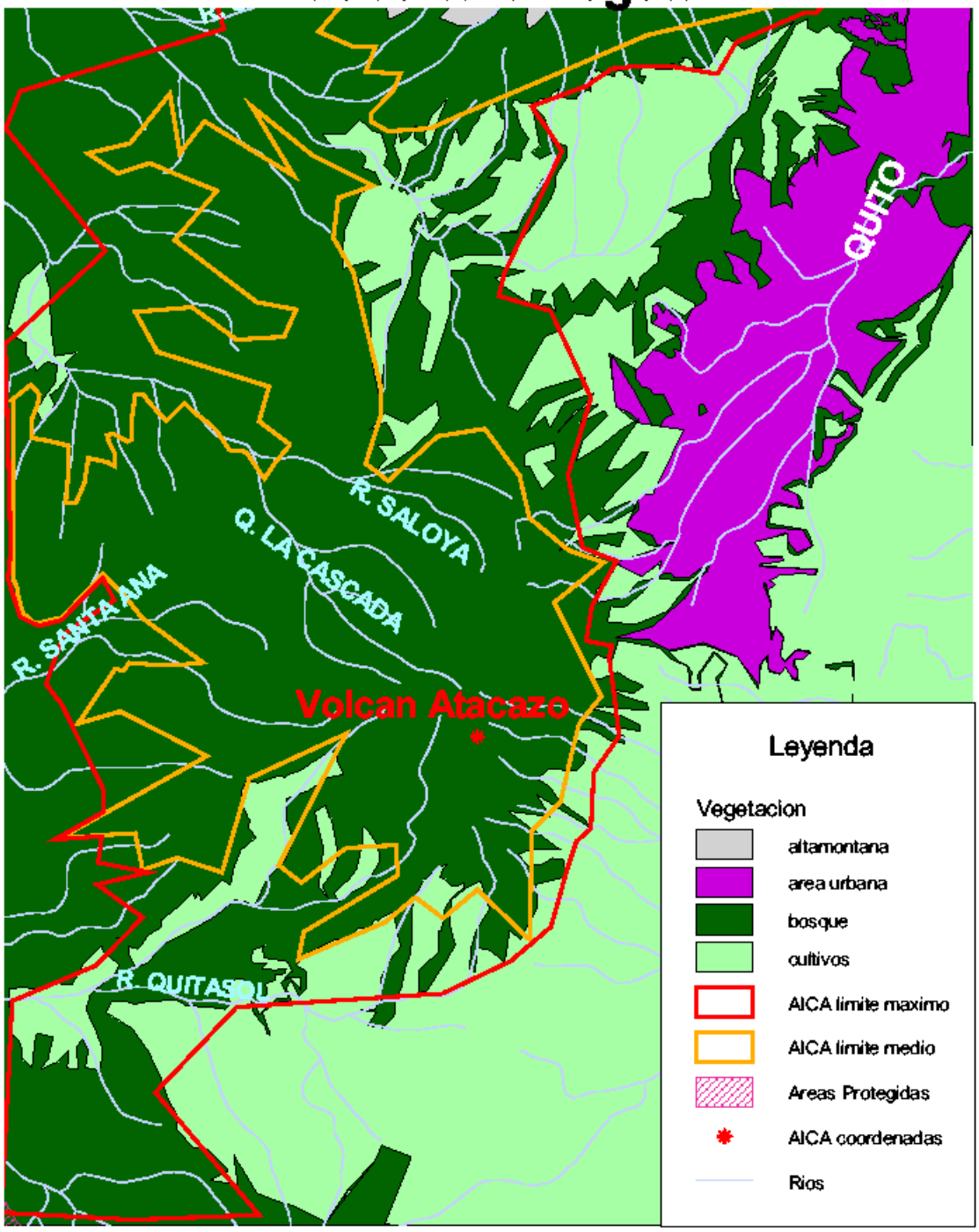

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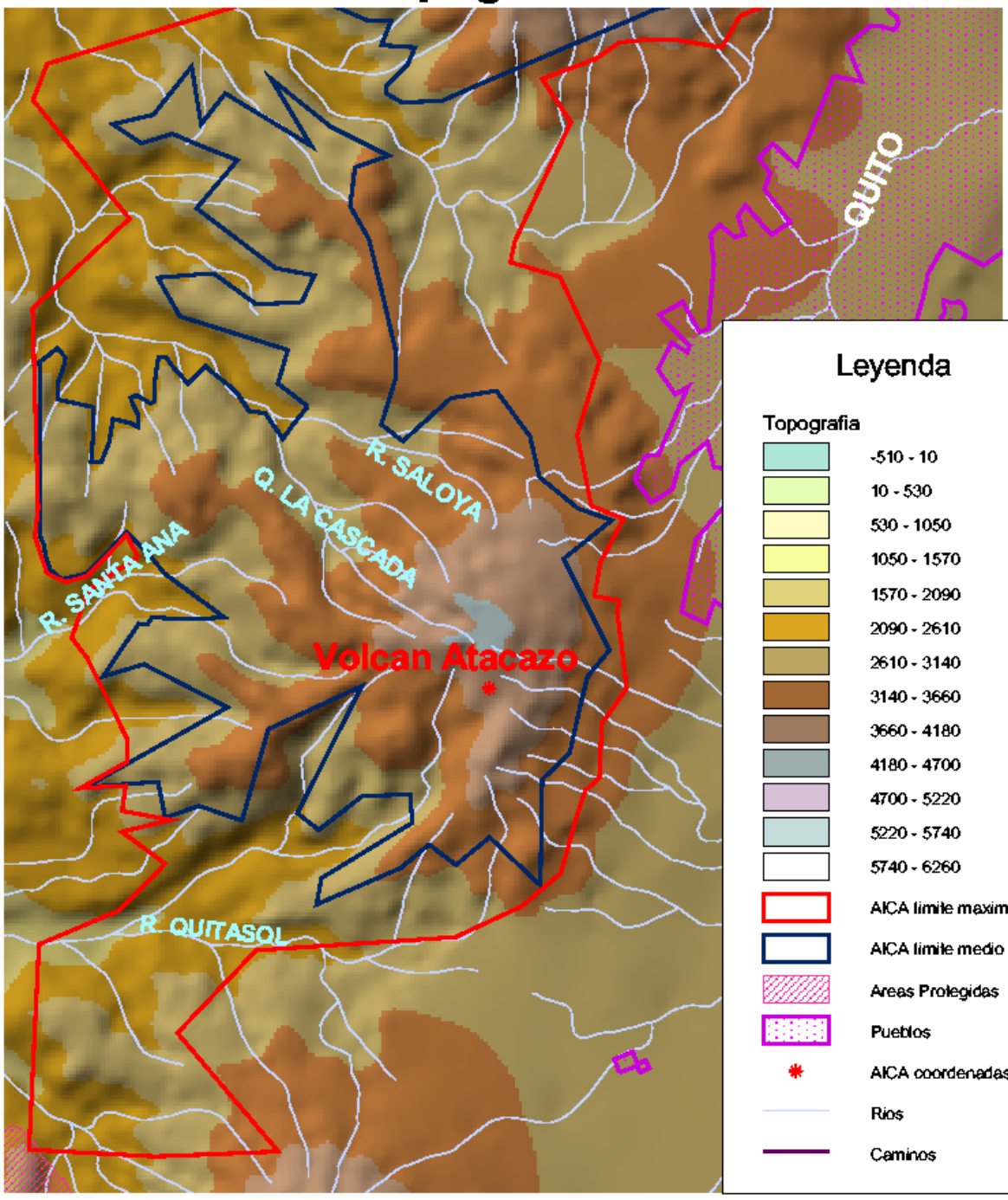

Leyenda

Topografia

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- 2090 - 2610
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- 3140 - 3660
- 3660 - 4180
- 4180 - 4700
- 4700 - 5220
- 5220 - 5740
- 5740 - 6260
- AICA limite maximo
- AICA limite medio
- Areas Protegidas
- Pueblos
- AICA coordenadas
- Rios
- Caminos

1 0 1 2 3 4 5 Kilometers

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