

# **A digital soil data base of the region near the Solimões river between the cities of Coari and Manaus – Brazilian Amazon**

Teixeira W. G.<sup>1</sup>; Arruda W.<sup>2</sup>; Iwata S. A.<sup>3</sup>; Martins G. C.<sup>1</sup>; Lima H. N.<sup>4</sup>

1. *Embrapa Amazônia Ocidental, presently at SIPAM – Rod AM 010 – Km 29 – Manaus – AM 69011 - 970*

2. *Instituto Nacional de Pesquisas da Amazônia – INPA - Manaus*

3. *Petrobras – UNBSOL – Manaus*

4. *Universidade Federal do Amazonas – UFAM – Manaus*

## **Abstract**

River between the cities of Coari and Manaus is nowadays focus of attention due to the exploration of oil and gas in the Urucu river Province. The objectives of this article was to present the methodology used to built a digital data base of this region river combining soil surveys that are only available as printed maps in different scales. Firstly, the soil maps were scanned and vectorized and the soil unities were identified. Finally, all the information was gathered in a unique digital soil database, with scales ranging from 1:250.000 to 1:10.000. The predominant soils near the borders of Solimões River are the very fertile Fluvisols and Gleisols, whereas in the terra firme predominate yellow Ferralsols and Acrisols. Near the town of Iranduba, Plintosols are more typical. Some Podzols are found scattered in those area, normally in the base of short valleys. Anthrosols with very rich anthropogenic horizons also occur, which are locally called Terra Preta de Índio.

## **1. Introduction**

The region near the Solimões river between the cities of Coari and Manaus is nowadays focus of attention due to the exploration of oil and gas in the Urucu river Province. Petroleum is transported from Urucu until the town of Coari through a pipeline and then by ship until a refinery in Manaus. A net of researchers are studying different aspects of this region in a cooperative project called – Potenciais impactos e riscos ambientais do transporte de gás natural e petroleo na Amazônia (PIATAM). One of the objectives of this project is to build a soil georeferenced digital data base that may be used to plan, monitor and reduce the impacts caused by the petroleum exploitation on the environment and the people living in the region. In this article we show the methodology used to combine the available soil surveys for this regions in a unique digital data base

## **2. Material and Methods**

In the context of the Piatam project, information about soil characteristics and its spatial location is a key factor to ensure the sustainability of the region, as well as to allow a secure intervention in <sup>1</sup> the case of an accident (i.e. oil spill). As information and soil maps are scattered in reports not easily available, the objective of this project was to organize, in a unique digital database, information concerning soil characteristics from the area near the Solimões River between the cities of Coari and Manaus. The existence of an easily accessible data base gathering surveys carried out at different levels of detail may help researchers and decision makers in identifying areas where

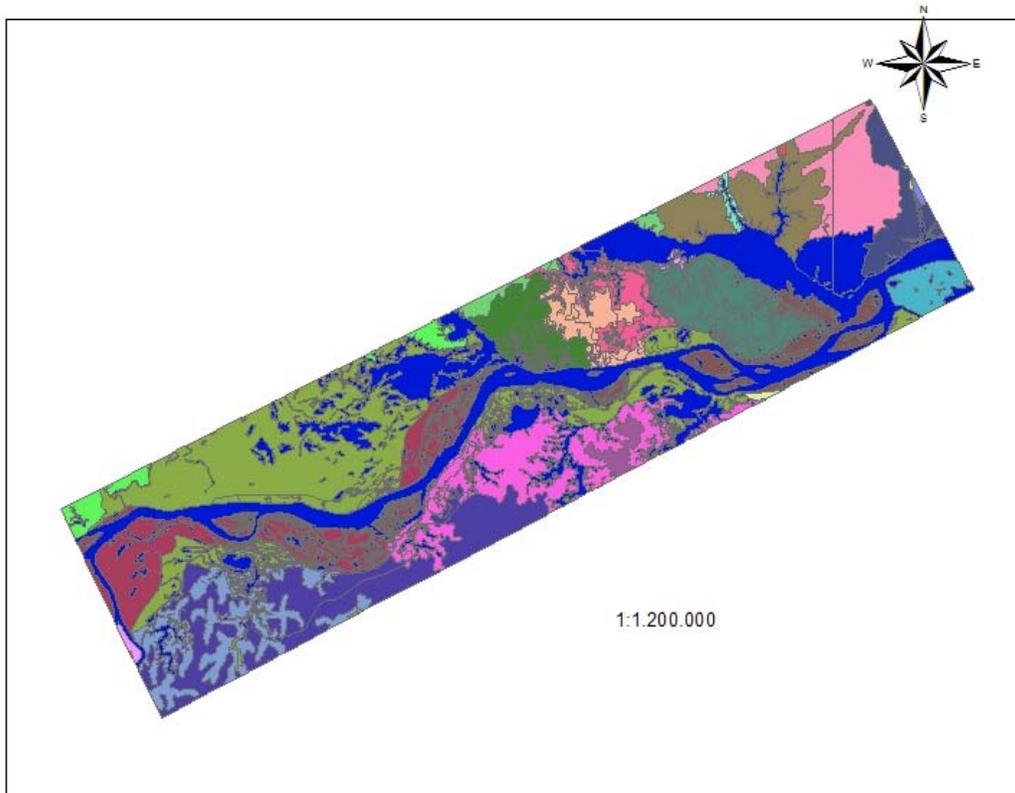
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<sup>1</sup> \* Corresponding author. Tel: +49- 92 36210300 -E-mail address: [lau@cpaa.embrapa.br](mailto:lau@cpaa.embrapa.br)

more data are necessary. The existence of four soil surveys reports comprising this region could be identified: an exploratory soil survey – Folha Manaus SA-20 – Project Radambrasil – Map 1:1000.000 – 1974; a reconnaissance soil survey of the city of Manacapuru – PDRI Project - Map 1:100.000 – 1978; a reconnaissance soil survey of the region of Cacaú Pirêra and Manacapuru (Road AM 070) – Project IPEAN - 1970 - Map 1:120.000 and semi-detailed soil survey for the Experimental Research station of Caldeirão - Embrapa Amazônia Ocidental – Map 1:10.000. A digital soil database is also available for this region - Digital Data-Base of Legal Amazon - (SIPAM – IBGE - 2004) in detail of 1:250.000. This Digital Data-Base was used as base and compiled with other soil surveys in the regions where more detailed information were available, the final product is a unique digital base comprising all the soil survey information available. Firstly, the soil maps were scanned and vectorized, the soil unities were identified. Until now the soil classes nomenclature was kept in the original classification. Finally, all the information was gathered in a unique digital soil database, with scales ranging from 1:250.000 to 1:10.000.

### **3. Results and Discussion**

The predominant soils near the borders of Solimões River are the very fertile Fluvisols and Gleisols, whereas in the terra firme predominate yellow Ferralsols and Acrisols. Near the town of Iranduba, Plintols are more typical. Some Podzols are found scattered in those area, normally in the base of short valleys. Anthrosols with a very rich anthropogenic A horizon also occurs, which are locally called Terra Preta de Índio (TPI) and normally constitute archeological sites. The anthropogenic A horizons appear to have been developed by pre-Columbian Indians over original Ultisols and Oxisols. Only a TPI profile has been described in a hydromorphic soil near the town of Manacapuru (Teixeira et al., 2005). The Figures 1, 2 and 3 show details of the maps that are gathered in a unique database. This digital data base facilitates the access to information about the soil in this region. The use of zoom functions permits to visualize scale in details, obviously where this information exists. The Experimental Research Station of Caldeirão near the city of Manacapuru has a semi-detailed soil survey. In this survey soil units was identified in the scale of 1:10.000 (Figura 3). Figure 2 show the soil surveys near the Rodway AM-070 and near the city of Manacapuru that has was vectorized and combined in a unique data base. The other parts of the region the soil units keep the detail provide in the original data base of SIPAM – 1:250.000. Figure 4 shows a detail in the final data base zooming the area where is located he Research Station of Caldeirão with detail available in 1:10.000. A limitation of this database is to print it, as the scale of details changed this kind of data base is typically to be used in a computer with software that make possible zooming the map. It is available in a format shape (shp) that is possible to visualize in program like ArcView or ArcGis (ESRI, USA). An ongoing project is revising the legend following the last edition of the Brazilian System of Soil Classification (1999). This project also included a databank called SOLOAMA, containing the information about the soil physical, chemical, morphological and mineralogical aspects, partly spread in soil survey reports, scientific articles and doctor and master thesis and partly original data are collected during the PIATAM excursions.



- 14
- 12-02-NDIA
- Água
  - URU QUARTZOL HIDROMÓRFICO, Ica, Tc, ú moderado, textura arenosa, relevo plano + LITOSSOLO ÚMIDO, Ica, Tc, ú moderado, textura média, relevo plano
  - GLISSOLO, eutrófico, Ta, ú moderado, textura argilosa, relevo plano + SOLO ULUVIOL, eutrófico, Tb, ú moderado, textura indistinta, relevo plano
  - GLISSOLO, eutrófico, Ta, ú moderado, textura indistinta, relevo plano + SOLO ULUVIOL, eutrófico, Tb, ú moderado, textura indistinta, relevo plano + GLISSOLO MÚLTICO, eutrófico, Tc, relevo plano
  - GLISSOLO, Ica, Tc, ú moderado, textura indistinta, relevo plano + SOLO ULUVIOL, eutrófico, Tb, relevo plano + SOLO ULUVIOL, eutrófico, Tc, relevo plano + SOLO ULUVIOL, eutrófico, Tc, relevo plano
  - GLISSOLO, Ica, Tc, ú moderado, textura indistinta, relevo plano + URU QUARTZOL HIDROMÓRFICO, Ica, Tc, ú moderado, textura arenosa, relevo plano
  - GLISSOLO, Ica, Tc, ú moderado, textura indistinta, relevo plano + SOLO ULUVIOL, Ica, Tc, ú moderado, textura indistinta, relevo plano + URU QUARTZOL HIDROMÓRFICO, Ica, Tc, ú moderado, textura arenosa, relevo plano
  - LITOSSOLO ÚMIDO, Ica, Tc, ú moderado, textura argilosa, relevo plano e suave ondulado + URU QUARTZOL, Ica, Tc, ú moderado, textura arenosa, relevo plano e suave ondulado
  - LITOSSOLO ÚMIDO, Ica, Tc, ú moderado, textura argilosa, relevo plano e suave ondulado + POZZOLCO VERMELHO-ÚMIDO, Ica, Tc, ú moderado, textura média argilosa, relevo plano e suave ondulado + PUNTOSSOLO, Ica, Tc, ú moderado, textura média argilosa, relevo plano e suave ondulado
  - LITOSSOLO ÚMIDO, Ica, Tc, ú moderado, textura argilosa, relevo plano e suave ondulado + SOLO PETROPLÚTICO, Ica, Tc, ú moderado, textura média argilosa, relevo suave ondulado e ondulado
  - LITOSSOLO ÚMIDO, Ica, Tc, ú moderado, textura muito argilosa, relevo ondulado a forte ondulado + POZZOLCO ÚMIDO, Ica, Tc, ú moderado, textura média argilosa, relevo forte ondulado + LITOSSOLO ÚMIDO, Ica, Tc, ú moderado, textura argilosa, relevo forte ondulado
  - LITOSSOLO ÚMIDO, Ica, Tc, ú moderado, textura muito argilosa, relevo plano e suave ondulado + POZZOLCO VERMELHO-ÚMIDO, Ica, Tc, ú moderado, textura média argilosa, relevo plano e suave ondulado
  - LITOSSOLO ÚMIDO, Ica, Tc, ú moderado, textura muito argilosa, relevo plano e suave ondulado + SOLO PETROPLÚTICO, Ica, Tc, ú moderado, textura média argilosa, relevo suave ondulado e ondulado
  - LITOSSOLO ÚMIDO, Ica, Tc, ú moderado, textura muito argilosa, relevo suave ondulado + POZZOLCO VERMELHO-ÚMIDO, Ica, Tc, ú moderado, textura média argilosa, relevo suave ondulado e ondulado
  - LITOSSOLO ÚMIDO, Ica, Tc, ú moderado, textura média argilosa, relevo suave ondulado + SOLO PETROPLÚTICO, Ica, Tc, ú moderado, textura argilosa, relevo ondulado + POZZOLCO VERMELHO-ÚMIDO, Ica, Tc, ú moderado, textura média argilosa, relevo suave ondulado
  - LITOSSOLO ÚMIDO, Ica, Tc, ú moderado, textura média argilosa, relevo plano e suave ondulado
  - PUNTOSSOLO, Ica, Tc, ú moderado, textura argilosa, relevo plano e suave ondulado + POZZOLCO VERMELHO-ÚMIDO, Ica, Tc, ú moderado, textura média argilosa, relevo plano e suave ondulado
  - PUNTOSSOLO, Ica, Tc, ú moderado, textura argilosa, relevo plano e suave ondulado + POZZOLCO VERMELHO-ÚMIDO, Ica, Tc, ú moderado, textura média argilosa, relevo plano e suave ondulado
  - PUNTOSSOLO, Ica, Tc, ú moderado, textura indistinta, relevo plano + POZZOLCO VERMELHO-ÚMIDO, Ica, Tc, ú moderado, textura argilosa, relevo plano
  - POZZOLCO VERMELHO-ÚMIDO, Ica, Tc, ú moderado, textura arenosa, relevo plano + URU QUARTZOL HIDROMÓRFICO, Ica, Tc, ú moderado, textura arenosa, relevo plano
  - POZZOLCO VERMELHO-ÚMIDO, Ica, Tc, ú moderado, textura argilosa, relevo plano e suave ondulado + PUNTOSSOLO, Ica, Tc, ú moderado, textura argilosa, relevo plano e suave ondulado
  - POZZOLCO VERMELHO-ÚMIDO, Ica, Tc, ú moderado, textura argilosa, relevo plano e suave ondulado + PUNTOSSOLO, Ica, Tc, ú moderado, textura média argilosa, relevo plano
  - POZZOLCO VERMELHO-ÚMIDO, Ica, Tc, ú moderado, textura média argilosa, relevo plano e suave ondulado + PUNTOSSOLO, Ica, Tc, ú moderado, textura média argilosa, relevo plano
  - POZZOLCO VERMELHO-ÚMIDO, Ica, Tc, ú moderado, textura média argilosa, relevo suave ondulado e plano + PUNTOSSOLO, Ica, Tc, ú moderado, textura argilosa, relevo suave ondulado e plano + LITOSSOLO VERMELHO-ÚMIDO POZZOLCO, Ica, Tc, ú moderado, textura argilosa, relevo plano
  - SOLO ULUVIOL, eutrófico, Tb, ú moderado, textura indistinta, relevo plano + GLISSOLO, eutrófico, Tc, ú moderado, textura indistinta, relevo plano + GLISSOLO MÚLTICO, eutrófico, Tc, relevo plano
  - SOLO ULUVIOL, eutrófico, Tb, ú moderado, textura indistinta, relevo plano + GLISSOLO, eutrófico, Tc, ú moderado, textura indistinta, relevo plano + GLISSOLO MÚLTICO, eutrófico, Tc, relevo plano

Figure 1 – Soil map of the valley of Solimões river between the cities of Coari and Iranduba. Adapted from the SIPAM / IBGE AMAZON DATABASE 1:250.000

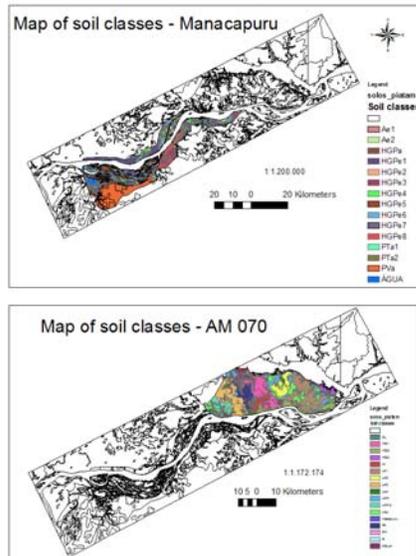


Figure 2 – Soil maps of a part of the city of Manacapuru and the Rodway AM – 070 between Cacau-Pirêra and Manacapuru. Vectorized from printed map in the scale of 1:120.000 (AM – 070) and 1:100.000 (Manacapuru).

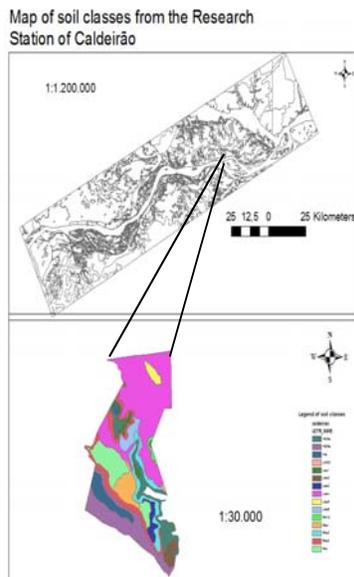


Figure 3 – Location of the Experimental Research Station of Caldeirão (Iranduba – AM) and its semi-detailed soil survey data base (originally printed in a scale of 1:10.000).

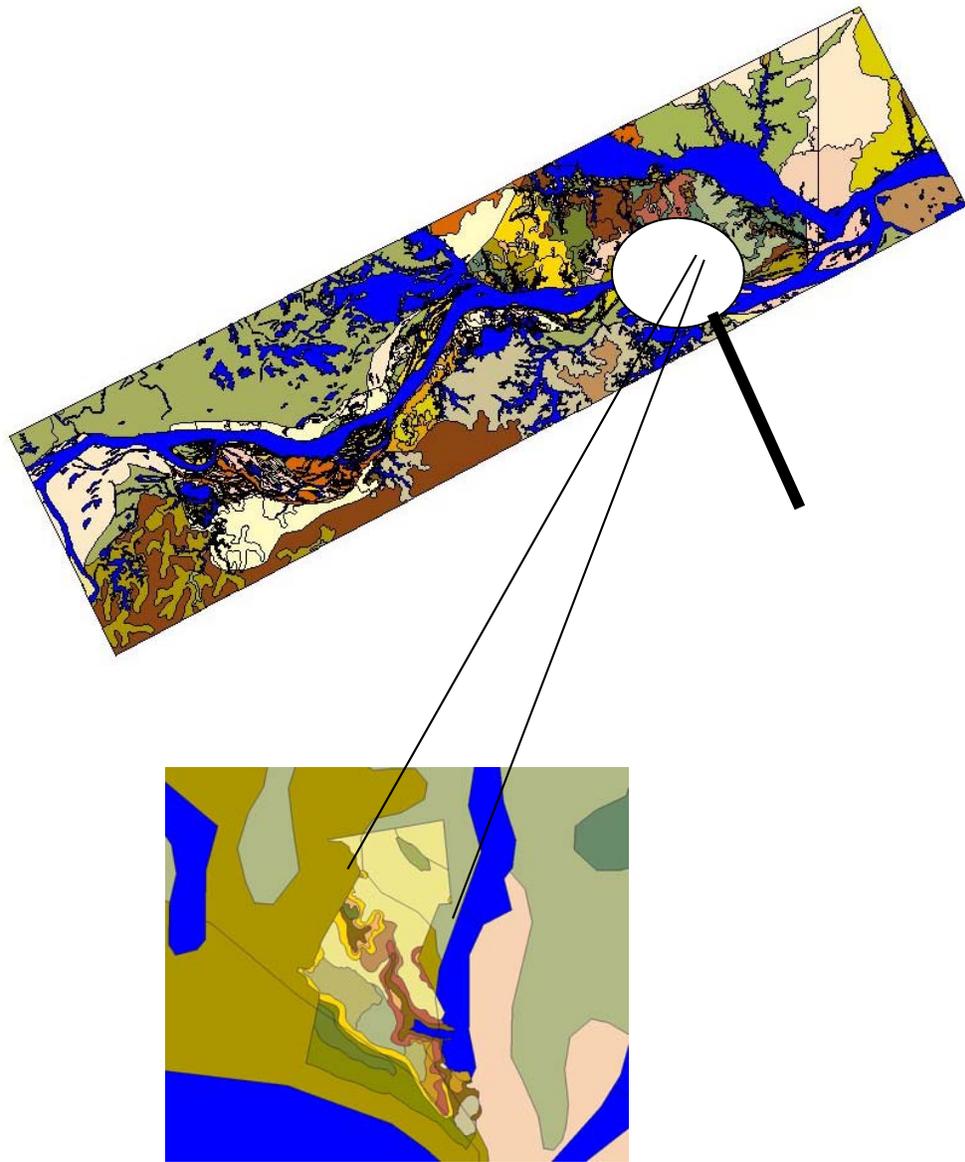


Figure 4 – Map of the soil classes near the Solimões River compiling information from three data base. The zoom shows a detail of the Research Station of Caldeirão where soil maps are available in a scale of 1:10.000.

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