Potosí mining contamination – household and farming responses in the upper Pilcomayo basin, Bolivia

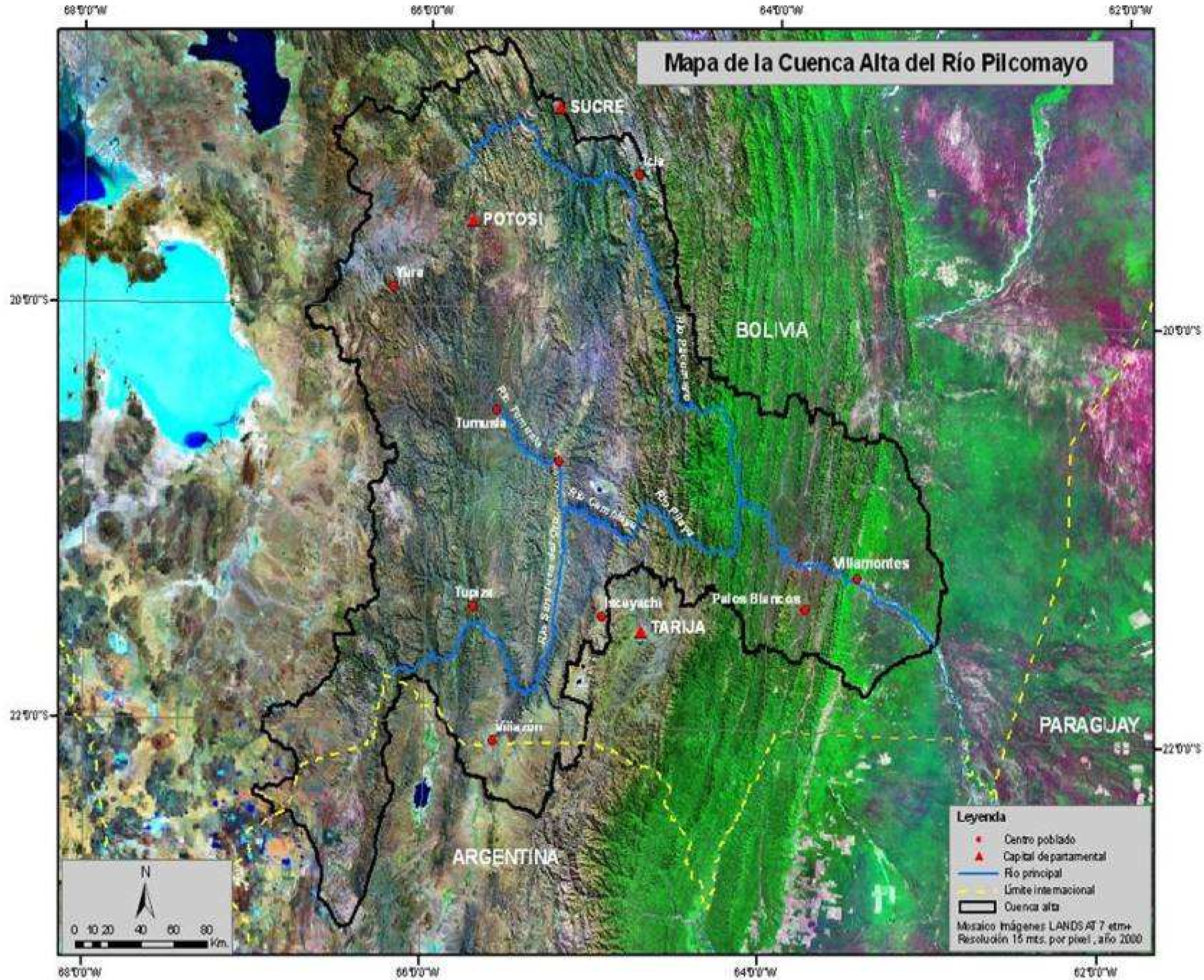
David Preston

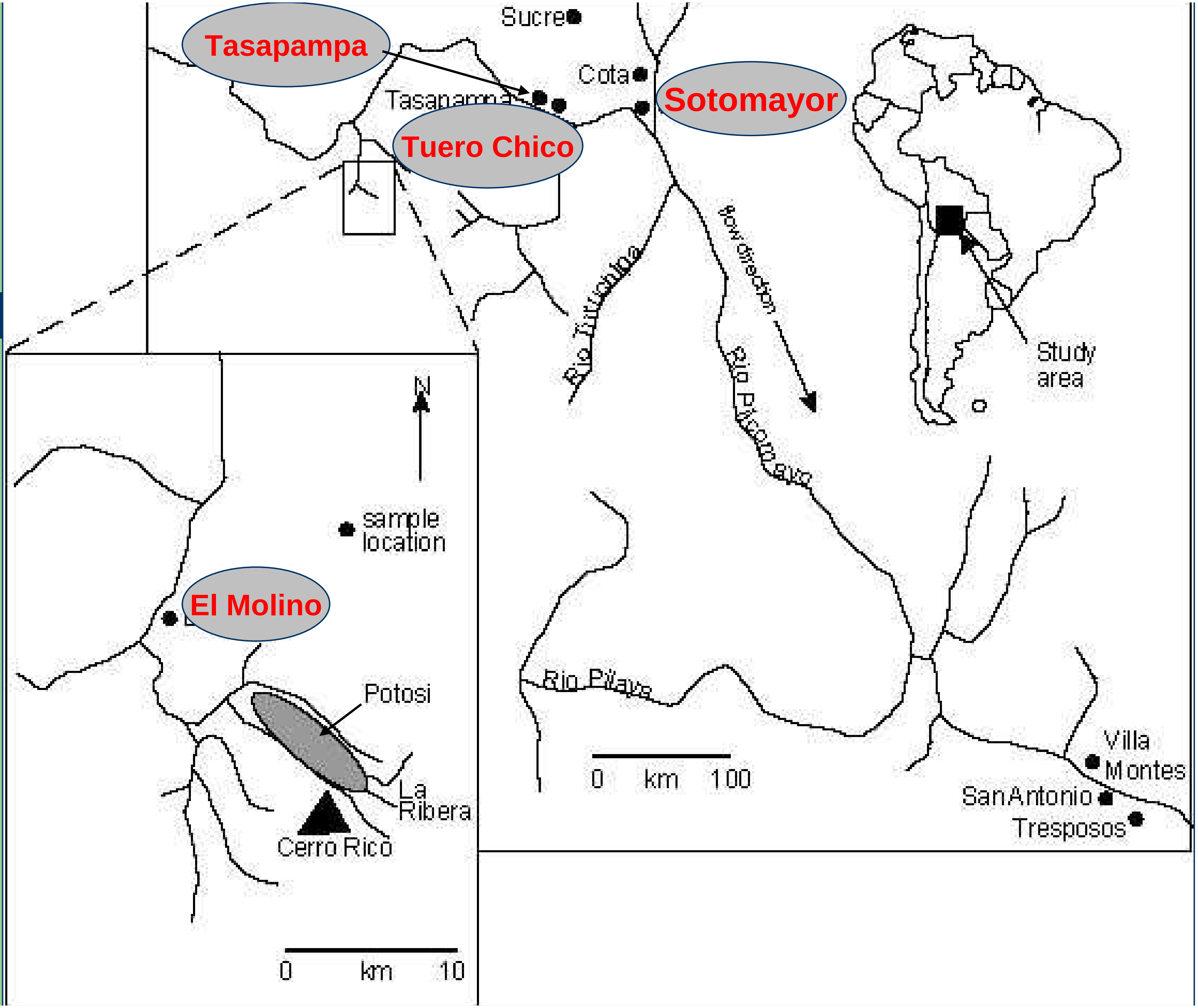
- Potosí has been a major mining area since about 1540
  - For both large mining enterprises and small miners, the latter often working ‘waste’
- The Pilcomayo has therefore carried mining waste for over 460 years
- Mining waste is therefore stored in present and historic sediments

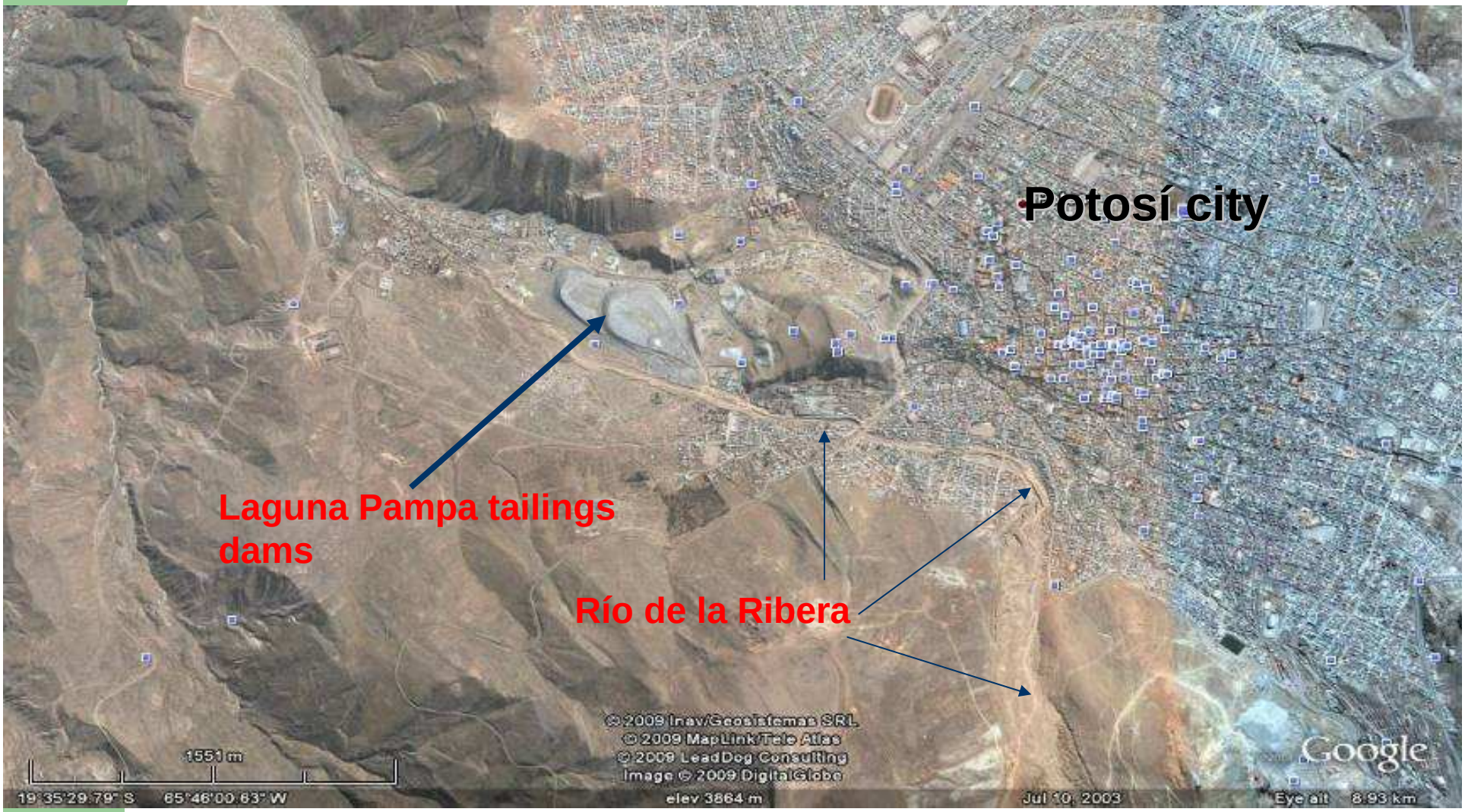
- This presentation reports on work carried out over the past 12 years with earth science colleagues:

Karen Hudson-Edwards, Birkbeck College
& our former doctoral student Jane Archer
Mark Macklin (Leeds and now UW Aberystwyth)
Jerry Miller (W Carolina University)

Email me [**d.a.preston@leeds.ac.uk**] to receive the published papers


Mapa de la Cuenca Alta del Río Pilcomayo
SUCRE
POTOSI
Yura
BOLIVIA
Tumusla
Río Pilaya
Villamontes
Tupiza
Palos Blancos
TARIJA
PARAGUAY
ARGENTINA
N
0 10 20 40 60 80
Km.
Leyenda
Centro poblado
Capital departamental
Río principal
Límite internacional
Cuenca alta
Mosaico Imágenes LANDSAT 7 etm+
Resolución 15 mts. por pixel , año 2000


Tasapampa
Sucre
Cota
Sotomayor
Tasapampa
Tuero Chico
flow direction
Rio Tumusla
Rio Pilcomayo
Study
area
N
sample
location
El Molino
Potosi
La
Ribera
Cerro Rico
0 km 10
Rio Pilaya
0 km 100
Villa
Montes
San Antonio
Tresposos


Potosí city
Laguna Pampa tailings dams
Río de la Ribera
© 2009 Inav/Geosistemas SRL
© 2009 MapLink/Tele Atlas
© 2009 LeadDog Consulting
Image © 2009 DigitalGlobe
Google
1551 m
19°35'29.79" S 65°46'00.63" W
elev 3864 m
Jul 10, 2003
Eye alt 8.93 km

- Cerro Rico

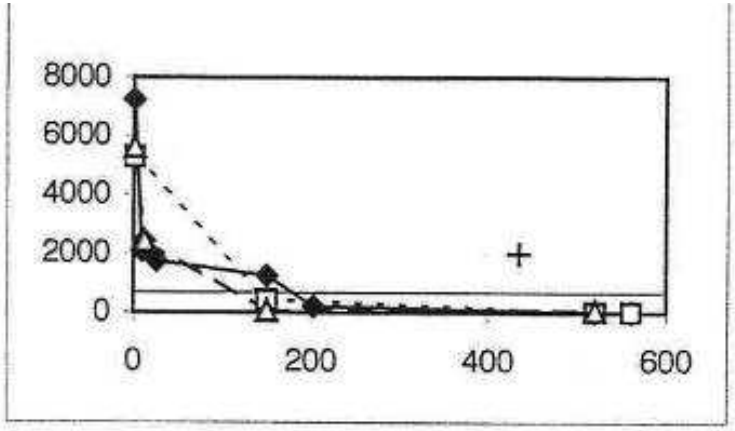
- Waste water 2003

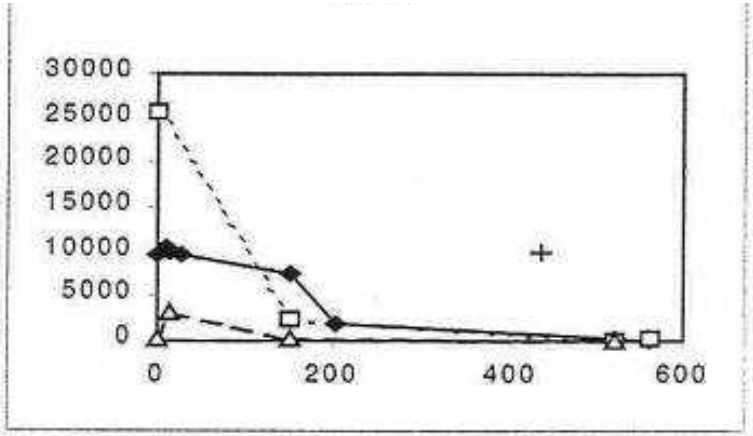
Human responses

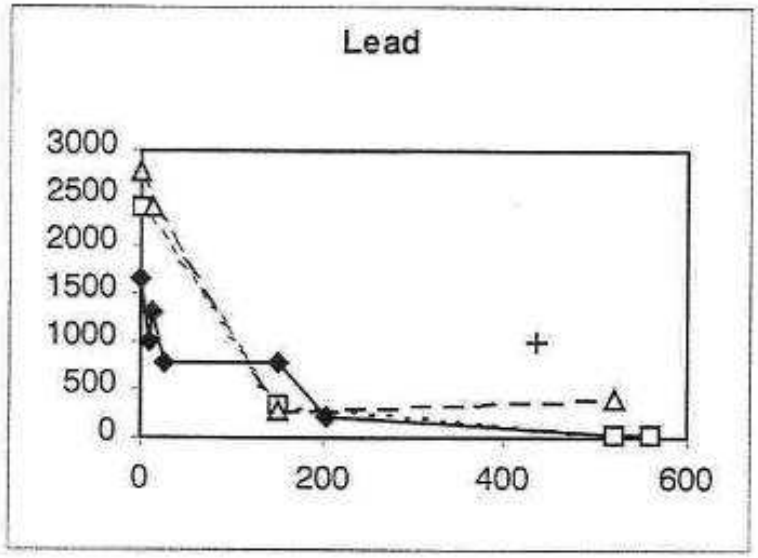
- People in riverside communities know when the river is contaminated
  - By smell
  - By water appearance
- Our research sought to identify heavy metal and metalloid contamination of vegetables, water, human blood and urine in a sample of communities including one not using Pilcomayo water
- Aluminium, Antimony, Arsenic, Cadmium, Copper, Lead and Zinc

Contaminant loads

- vary according to levels of mining activity – presumably decreasing now as metals prices fall
- and seasonally, so most contamination when sediment loads high with first heavy rain after dry season
- And distance from site of contamination
  - More than 200 Km. downstream contamination much reduced







+ confluence of Rio Pilaya

Dutch 'C' value (immediate remediation required)

◆ 1998 data

□ 1997 data (Smolders & Smolders, 1998)

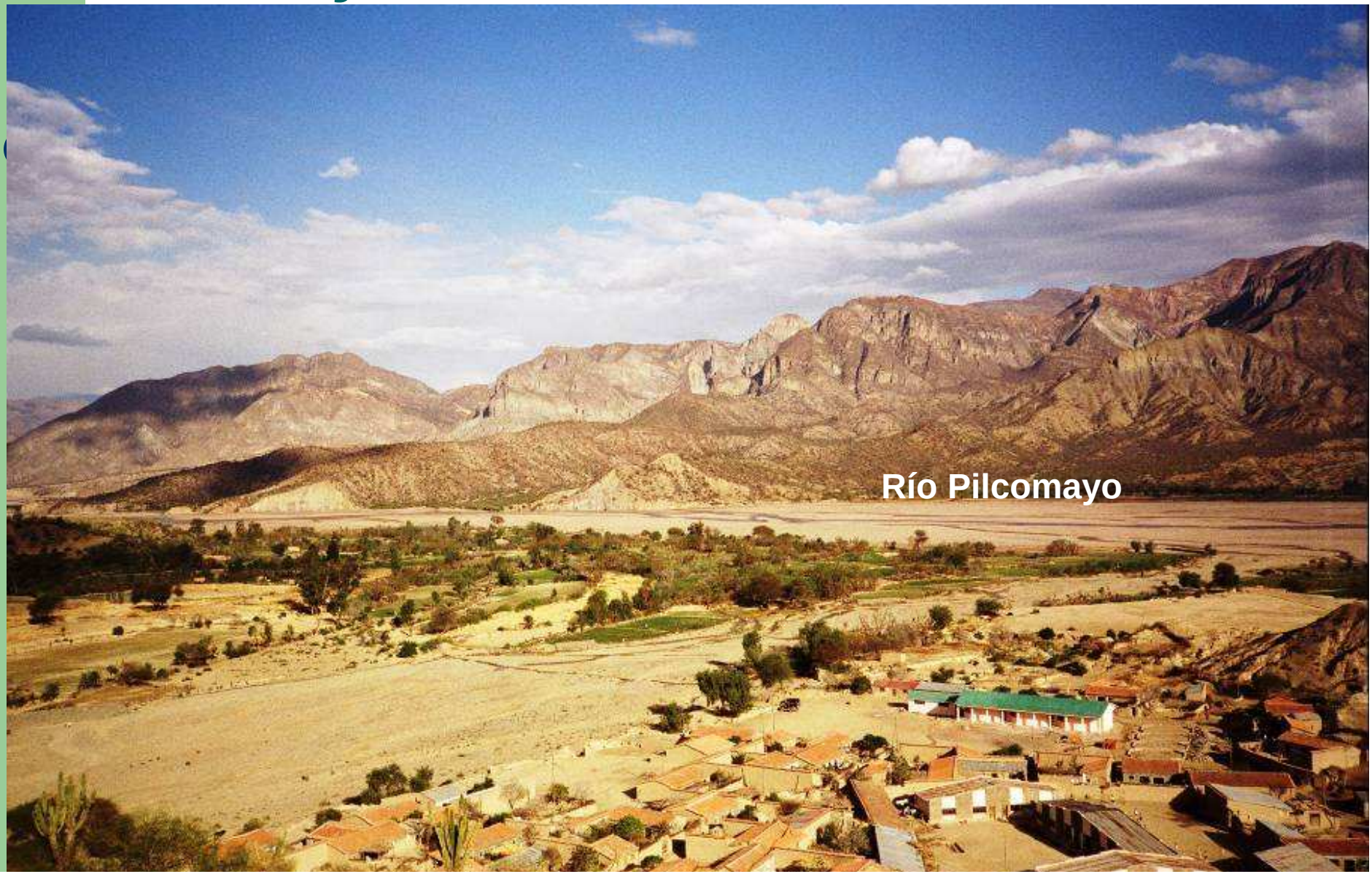
Δ 1996 data (Macklin et al., 1996)

Figure 1. Rio Pilcomayo channel sediment-borne concentration of heavy metals and arsenic (in mg/kg) with distance downstream from Potosi (in km), for 1996 to 1998.

Avoiding contamination

- Drinking water from wells or distant springs
- Irrigation water from uncontaminated tributaries – for livestock drinking too
- Washing produce before sale in city markets
- BUT alarmism from so-called ‘green’ NGOs
- IS the water from alternative sources much better?

Sotomayor - 168 Km. downstream from Potosi




Sotomayor
Cota village


64°30'15"W
64°30'0"W
64°29'45"W
N
Quebrada JATUN KHAKHA
SOTOMOYOR
33°40'0"N
Canal Actual de riego
Sedimentador
Río Pilcomayo
33°29'45"N
Ubicación Canal de Riego/Sedimetador
SOTOMAYOR
Imágen Satelital "IKONOS"
Resolución 1 Mt. por pixel.
Escala

Research conclusions

- Lead concentrations in some vegetables from two communities (inc. Sotomayor) exceeded guidelines

- Metal concentrations in unfiltered drinking water exceed guidelines **but** no significant differences between riverside communities and controls – & from distant springs

- Metal/metalloid concentrations in urine and blood increased with age but no correlation with season or between years
- Contamination of field crops may be through soil particles or wind-borne dust on leaves and roots

- **All rural communities need good drinking water but communities adjacent to contaminated rivers deserve priority**