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EARLY WARNING SYSTEM FOR EMERGING INFECTIOUS DISEASES IN SOUTHWESTERN AMAZONIA: ADAPTATION TO THE NEGATIVE IMPACTS OF GLOBAL CLIMATE CHANGE ON HUMAN HEALTH

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SCIENCE PROBLEMS AND OBJECTIVES

The relationships between some determinants, at regional level, of Global Climate Change and their impacts on Ecosystems Services, especially on the capacity of Amazonian ecosystems to regulate the spreading of vector-borne infectious diseases is the focused problem. In Amazonia, forest burning is used to convert forested areas into pastures or plantations, emitting GHGs. On the other hand, Global Climate Change projections point to a regional decrease in humidity and increase in temperature - climatic conditions that foster forest fires, which in turn will further increase GHGs, closing the perverse circle. Unprecedented regional changes due to the ongoing implementation of hydroelectric dams, hydro-ways and paved roads are expected to have great impacts on the epidemiology of human diseases, over the next years. LUCC and the associated biodiversity-loss favour the disruption of natural cycles that impinge on vectors' abundance, jeopardizing an Ecosystem Service known as Infectious Diseases Regulation (the ability of ecosystems to act as buffer zones between zoo noses and human populations). Increased migration and urbanisation will affect the spread of transmission of vector-borne diseases, by increasing the density of both people and vectors and the transit of people. The most striking changes in the epidemiology of vector-borne diseases already observed in the Andes-Amazon region, so far, are the (re)emerging diseases transmitted by phlebotomine sand flies: Cutaneous Leishmaniasis and Bartonellosis (Carrion Disease). This project aims at developing adaptation strategies and tools to face the negative impacts of Global Climate Change on the health determinants of human communities living in the Southwestern Amazonia tri-national region. Early Warning Systems for Emerging Infectious Diseases will be developed to enable health professionals to anticipate and face the negative impacts of climate change on the spreading of (re)emerging vector-borne infectious diseases. A better understanding of the role played by unsound regional development policies in perpetuating the above-depicted perverse circle will represent a timing response to the urgent need to advance scientifically informed decision-making in respect to socio-economic impacts, vulnerability and responses - concerns of the Global Climate Change Human Dimensions' community.

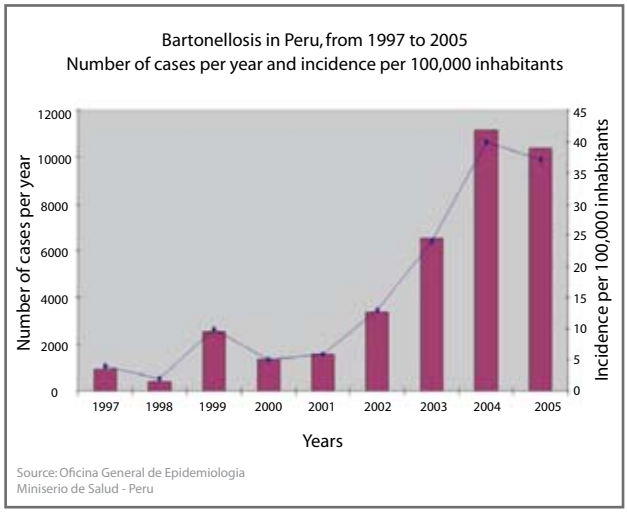

Figure 1. Evolution of Bartonellosis' Incidence in Peru (1997-2005)

CURRENT RESULTS AND PERSPECTIVES

Cutaneous Leishmaniasis is a pan-tropical neglected disease affecting 88 countries, of which 72 are developing ones and 13 are among the least developed. Most of Cutaneous Leishmaniasis (90%) occurs in 7 countries, among them are Brazil and Peru, where environmental changes (such as new settlements, intrusion into primary forest, deforestation, human migration, agricultural development, dams building) increase the exposure to its sand fly vectors and are leading to a clear and disturbing increase in the number of cases. The known reservoirs are both silvatic and domestic: marsupials, rodents, sloths, anteaters, dogs, equines e mules. The interaction parasite-reservoir is a complex system and deserves further investigation efforts to better define the role of reservoirs in the disease cycles. The Pan-American Health Organization estimates five unreported cases for each reported case in the Americas.

Cutaneous Leishmaniasis Detection Coeficient (number of cases per 100,000 inhabitants)	Scales
18	Average in Brazil, in the last 20 years
13 to 40	Average in Peru, from 1985 to 1994
71	Level of very high risk of transmission, according to the Brazilian Ministry of Health
93	Northern Region (average in the last 20 years)
126	Acre State (average 2000-2007)
1,232	Assis Brasil municipality (average 2000-2007)
198 to 1,622	Variation between the six Bolivian municipalities along the tri-national borders (2004)

Table 1. Cutaneous Leishmaniasis Detection Coeficient at different scales

Bartonellosis (Carrión Disease) is caused by *Bartonella bacilliformis*, transmitted by phlebotomine sandflies, and may have three clinical forms: a high lethality acute form know as Oroya Fever; a chronic one known since pre-Incan times as Peruvian Wart; and 9-29% asymptomatic. It was, since pre-Colombian times, a disease confined to high-altitude Andean valleys. In Peru, an alarming spread of the disease during the last decade has been seen, with the number of Departments infected mounting from 4 in 1995 to 14 in 2004 (some at just 150 metres high) and its incidence soaring from 4 to 40 cases per 100,000 inhabitants between 1997 and 2005 (*Figure 1*). In 2004, for the first time, 175 cases were reported in the Department of Madre de Dios, bordering the disease-free Peru-Bolivia-Brazil tri-national borders, where health professionals are not trained to diagnose or to treat the disease. It was suggested that ENSO (El Niño Southern Oscillation) would have influenced the epidemiology of Bartonellosis, and its spreading in Peru is also linked with increased "temporary migration" and "LUCC due to agriculture pressures".

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