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SOCIO ENVIRONMENTAL CONFLICTS IN ECUADOR. THE USE OF PREPROCESSING AND DATA MINING TO DETECT INFLUENCING FACTORS ON VIOLENCE AND CRISIS (1985 - 2016)

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Two spaces below the title, 10 pt Arial, Upper and Lower Case, underline author presenting paper

Abstract: The main concern regarding the spread of Socio Environmental Conflicts (SEC) is the constant increase of extractive activities to support the economic system. Conflicts originated in the clash of interests between the extractive industries and local populations is the more visible outcome, but the complexity of this phenomenon may not be that obvious. Among South American countries, the highest murder rates of environmental activists corresponded to Brazil, Peru and Colombia, three of the four Amazonian countries along with Ecuador (Global Witness, 2015). In addition, all of them have similar characteristics such as high levels of inequality and the presence of ancestral indigenous communities in areas affected by extractivism. Although less violent, SEC in Ecuador are rapidly increasing, typically related to land use, mining, water management and fossil fuels. For its variety of ecosystems, resources and cultural diversity, the Ecuadorian territory is very vulnerable and the rush to exploit its resources threatens ecosystems balance, their ancestral inhabitants, and overall economic and political stability. At the same time, lack of knowledge on how socio-ecological systems generate and interact with SEC, adversely affect related policy-making. This research aims at building a sound theoretical and empirical framework which serves as conceptual support for understanding environmental conflicts and assessing policy decision-making. The first step of this project has been the construction of the Data Base containing more than 50 cases of SEC in Ecuador (from 1985 to 2016), by merging information spread over independent data information sources, most of them available in the web of Environmental Justice Atlas (EjAtlas) developed by the Eject project (Temper et al., 2015). The SEC are described over a set of more than 330 variables, from where 38 are numerical, 2 are dates, 23 are qualitative, 9 are dichotomous and 13 multiresponse represented in a total of 297 dichotomous variables, regarding the main drivers of conflicts, basic information, location, actors, and data about impacts and outcome. A standard model to describe a SEC is proposed and the current data base is now suitable to be grown along time by automatic means. It provides a rich support to explore and better understand SEC complexity in Ecuador using data mining techniques (Gibert 2008). First, a complex pre-processing is required (Gibert 2008b) to deal with multiresponse qualitative variables, and terminology standardization or deciding the granularity of certain variables (like territorial indicators or degree of details about the involvement level of the different actors). A basic descriptive statistics considering multivalued data shows that most of the conflicts are currently active but some are also stopped. Most of them begin by preventive resistance followed by reaction to implementation during construction or asking for reparation after impacts appears. More than half started after 2002 and potentially affect less than 33500 persons at local level, basically from rural areas. Main controversial issues are Fossil Fuels and Climate Justice/Energy (oil, gas), Mineral Ores and Building Extractions (gold, silver, copper), Biomass and Land (including deforestation) and Water. Some provinces seem to concentrate higher level of conflicts (Esmeraldas, Orellana, Pichincha,

Manabi and Azuay). Main groups mobilizing are indigenous groups or traditional communities, farmers, neighbours, social movements and less frequently local parties, or scientists. Main forms of mobilizing are judicial activism in court cases, through NGOs, sending official complaint letters and petitions, street protests or public campaigns. Visible environmental impacts are mainly groundwater or surface water pollution, biodiversity loss or wildlife impact, soil contamination, food insecurity crop damage, loss of landscape, aesthetic degradation, soil erosion, deforestation and loss of vegetation cover, global warming, large scale disturbance of hydro and geological systems and desertification. Health impacts are associated to malnutrition, accidents, exposure to unknown risks or radiations, mental problems including stress depression and suicide. From the socioeconomic point of view, conflicts impact to loss of livelihood, loss of landscape and sense of place, land dispossession, displacement, loss of traditional knowledge practices and cultures, increase in violence and crime, lack of work security, labour absenteeism, firings, unemployment, militarization and increased police presence, violation of human rights, social problems like alcoholism or prostitution, increase in corruption, co optation of different actors and specific impacts on women. Main outcomes appear to be court decision undecided or victory for environmental justice, applications of existing regulations, criminalization of activists, repression and migration displacement. Then, clustering based on rules with generalized Gibert's mixed metrics (Gibert 2014) is used to discover relevant patterns in the SEC conflicts, consistent with the current prior knowledge in the field, and considering the semantics of certain qualitative terms in the comparisons, like the resources in conflict or the consequences of the conflict. Finally, post-processing tools, like Traffic Lights Panels (Gibert 2015) are used to interpret, understand and conceptualize the obtained clusters and identifying what kind of resources provide conflicts with certain impact patterns and certain kinds of outputs and in what way they promote (or hinder) the appearance of violence, crisis or conflicts, and what's their scale of influence. The knowledge obtained in this work is suitable to propose strategies for increasing resilience and create more sustainable futures.

Keywords: *Socio-Environmental Conflicts, Ecuador, preprocessing, data mining, postprocessing, policy-making, prior knowledge, intelligent decision support.*

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