Open Archive TOULOUSE Archive Ouverte (OATAO)

OATAO is an open access repository that collects the work of Toulouse researchers and makes it freely available over the web where possible.

This is an author-deposited version published in: [http://oatao.univ-toulouse.fr/](http://oatao.univ-toulouse.fr/)

Eprints ID: 17126

The contribution was presented at iEMSs 2016:


To cite this version: Chapotat, William and Houssou, Lionel and Saqalli, Mehdi and Gaudou, Benoit and Lerigoleur, Emilie and Maestripieri, Nicolas and Bouadjio Boulic, Audren An Agent-Based Model of the Amazonian Forest Colonisation and Oil Exploitation: the Oriente Study Case. (2016) In: 8th International Environmental Modelling and Software Society: Supporting Sustainable Futures (iEMSs 2016), 10 July 2016 - 14 July 2016 (Toulouse, France).

Any correspondence concerning this service should be sent to the repository administrator: staff-oatao@listes-diff.inp-toulouse.fr
An agent-based model of the Amazonian forest colonization and oil exploitation: The Oriente study case

W. CHAPOTAT, L. HOUSSOUL, M. SAQALL, B. GAUDOU, E. LERIGOLEUR, N. MAESTRIPIERI, A. BOUADJO - BOULIC

(a) UMR 5505 GEODE, CNRS, University of Toulouse 1 Jean Jaurès, Toulouse 31062, France
(b) UMR 5602 GEODE, CNRS, University of Toulouse 2 Jean Jaurès, Toulouse 31058, France

Context:

Implementation of the model:

- UML language.

- Pollution data (MONOIL project, work in progress).

- An agent-based model of the Amazonian forest colonization and oil exploitation on the Oriente (Ecuadorian Amazon).

- Computation of the fertility and flooding dynamics on the study areas using USDA (United States Department of Agriculture).

- Definition of soils characteristics of our study area.

- Calculation of pollution accidents per period according to their effect area and persistency on the environment.

- Selection of rainfall data for each study site (Ypamasc, et al., 2005).

- Classification of the pollution sources according to their effect area and persistency on the environment.

- Calculation of pollutants accidents' periodicity and variable variability.

- Processing demographics data.

- Definition of soils characteristics of our study area using USDA (United States Department of Agriculture) data.

- Computation of the fertility and flooding indices of our study area’s soils.

- UML diagram of biophysical module.

Aim:

To reproduce the environmental and socio-economic impacts of colonization and oil exploitation on the Oriente (Ecuadorian Amazon).

- Integrating:
  - colonization & oil exploitation impacts
  - microeconomics behaviors of the population
  - public policies & goods' prices

To simulate the possible futures of this territory by the means of a scenario-based exploration tool.

Two main steps:

- Retrospective simulation to replicate the past colonization of the environment and its effects on the environment.

- Simulate the actual and possible future situations with the social structuration of agents and their difficulties to deal with oil contamination.

To use the results obtained as decision-support tools.

Method:

- Data gathering.

- Extraction of socio-economic behaviors and public policies rules.

- GIS data processing to identify the environment's characteristics.

- Agent based module construction.

- Model calibration and validation.

- Simulation of the defined scenarios.

Construction of the MONOIL model:

Steps of the project:

- Data processing:
  - Building a meaningful GIS dataset for running the model.
  - Creation of watersheds and rivers.
  - Demarcation of the study areas (Parish of Boyacá, Magdalena, in Colombia, using the DEM (Digital Elevation Model) including the upstream watersheds).
  - Selection of rainfall data for each study site (Ypamasc, et al., 2005).
  - Calculation of pollution accidents' periodicity and variable variability.
  - Processing demographics data.
  - Definition of soils characteristics of our study area using USDA (United States Department of Agriculture) data.
  - Computation of the fertility and flooding indices of our study area's soils.

- Model building and implementation:
  - Conceptualization of the model entities using UML language.
  - Implementation of the model:
    - Implementation of the elevations using the DEA.
    - Implementation of the rainfall, watersheds and rivers. Computation of the water flow.
    - Implementation of the flooding dynamics.
    - Implementation of pollutants and their spreading over rivers and soils.
    - Implementation of the agents dynamics.
    - Implementation of the model rules.

- Model calibration:
  - Using external data to calibrate the environment and the agents behaviors.
  - GIS land use data (GAD, Gobierno Autonómico Departamental de Boyacá, Programa de Reparación Ambiental y Social).
  - Perception based map of pollution (Janssens & Saqqal, 2011).
  - USDA (United States Department of Agriculture) precipitation data.
  - Pollution data (MONOIL project, work in progress).

- perspectives:
  - A field mission is scheduled in October. During this mission we will discuss about our model with experts and MONOIL project actors.
  - Does the model look like they expect?
  - Does the dynamics of the model fit with the reality?
  - It will also be an opportunity to define Oriente future development scenarios with the project stakeholders:
    - survey local population and project stakeholders on the future of the territory.
    - create with them plausible future scenarios and simulate these scenarios to help stakeholders in decision making process.
  - This work is still on progress until the end of October 2016.
  - We also hope funding to feed a thesis on "Simulating retrospective and prospective modelling over the colonisation of Amazonian forest: the ecuadorian case."