Internship offer

Intercomparison of watershed ecosystem services models

Context

Watershed Ecosystem Services (ES) are the diverse freshwater related Nature benefits to people. These are often grouped into five broad categories: improvement of extractive water supply, improvement of in stream water supply, water damage mitigation, provision of water related cultural services, and water associated supporting services (Brauman et al., 2007). This internship will more precisely focus on three watershed ES: water yield, sediment retention and nutrient retention. It will more specifically aim at

1. applying different models to quantify watershed ecosystem services provided by the great Mariño watershed in the Peruvian Andes;
2. comparing models performance and development costs.

Modeling hydrological processes is not a new topic. Several hydrological models have been proposed in the literature including SWAT (Arnold et al., 2012) MODFLOW (Harbaugh et al., 2017) or MIKE SHE (Butts and Graham, 2005; REFSGAARD, 1995). In addition, in the recent years, several ES integrated evaluation tools included hydrological components, such as InVEST (Sharp et al., 2014), ARIES (Villa et al., 2014), Co$ting Nature (2015). Existing studies already compared ES models between them (Bagstad et al., 2013) or with hydrological models (Lüke and Hack, 2017). There are also few studies comparing hydrological models between them (Golmohammadi et al., 2014). However, these studies often overlook the practical implications of model development (such as required expertise, data and workforce), and rather focus on model performance. In addition, they often consider a limited number of models (max 2 3), and usually focus on one single watershed ES.

Objectives of the internship

The objective of the internship is first to apply three different models to map water yield, sediment retention and nutrient retention. The models selected for the analysis are of increasing complexity, and include: contingency tables (i. the ES matrix approach), SWAT, as well as ad hoc Bayesian models. Second, we will compare the outcomes of the different models and assess model performance, using standard performance indicators (Bennett et al., 2013). We will also estimate the development cost of each selected approach, including the required expertise, data and workforce, which will be combined into a single indicator. The potential tradeoffs between models performance and development costs will be assessed using production frontiers (Vallet et al., 2018).

Supervision

The intern will be supervised by Améline Vallet (ESE/CIRED) and Paul Leadley (ESE), with frequent interactions with Bruno Locatelli (CIRAD).

Location and gratification:

The intern will be based at the ESE lab, in Orsay, with frequent meetings in Paris. Depending on the sanitary situation (covid restrictions), it will also be possible to arrange for teleworking. The gratifications correspond to the legal minimum threshold (15,00% of the hourly rate). The internship could start between February and April, ideally for a period of 6 months.

Skills required

The intern should have an interdisciplinary engineer profile, at the interface between environmental sciences, ecology, and modeling. The candidate should also be comfortable with quantitative approaches (statistics) and modeling. More specifically, the following skills are expected:

- Experience in interdisciplinary research and systems approaches

- Interest in environmental modeling

- (Knowledge in hydrology)

- Good knowledge of R and spatial database management (GIS)

- Very good level of written and oral English (international literature in English only)

Contacts and applications:

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