years of the CRP. The second RCM is expected be held in Nanning, China, during the first quarter of 2020. This CRP will be featured in a new European Geosciences Union (EGU) Session HS2.3.3 on '*Identification of agro-contaminants in surface and groundwater using stable isotope techniques' during the upcoming EGU meeting on* 7-12 April 2019, Vienna, Austria. The Conveners are Gwenaël Imfeld, Joseph Adu-Gyamfi Lee Heng, Yong Li, Grzegorz Skrzypek. For more details on the meeting please see the website: https://meetingorganizer.copernicus.org/EGU2019/session/31030

Developments at the Soil and Water Management and Crop Nutrition Laboratory

Tracing sediment sources in an agriculture and livestock catchment of Argentina through the use of geochemical fingerprints

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A mixing modelling approach (CSSIAR v2.00), using Energy Dispersive X Ray Fluorescence (EDXRF) and Total Organic Carbon (TOC) data as fingerprints for sediment sources and sinks, was applied for identifying critical hot spots of erosion in a typical Argentinian agro-ecosystem. The selected study site is the Estancia Grande catchment, covering 1235 hectares, which is located 23 km north east of San Luis (in the center of Argentina). The studied catchment, which is characterized by highly erodible Haplic Kastanozem soils, is currently being used for agriculture (*crop rotation*), and livestock (*free grazing* and *feedlots*), and some fields are used for growing *nut trees* (walnuts and almonds) (Figure 1). Further *fallow land* is found in between the agriculture land and in the upper part of the catchment.

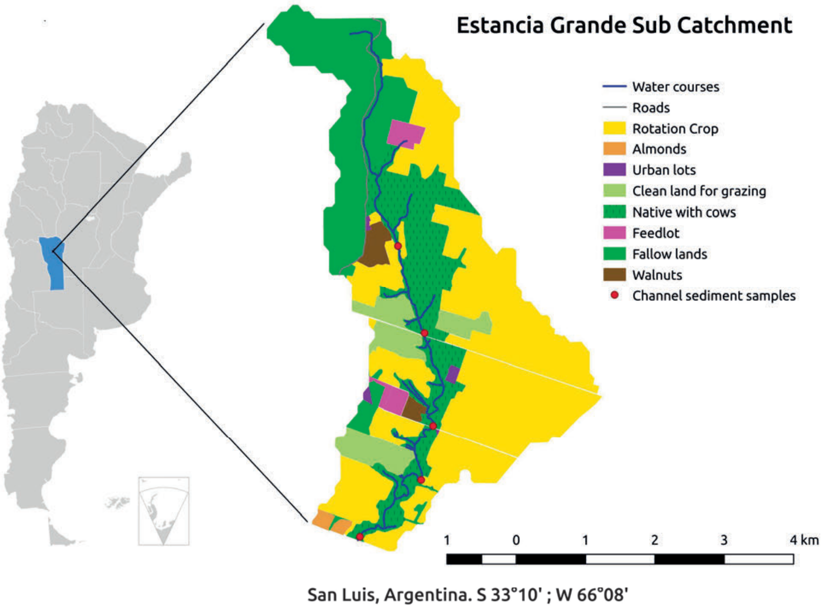

Figure 1. Landsue and location of sediment samples in the studied sub-catchment.

From the above land uses (i.e. sediment sources), composite samples of superficial soils (0 to 2 cm deep) were collected, whereas sediment mixtures (sinks) were collected from deposition zones along the stream channel (i.e. red points in Figure 1). A sample of 2 cm deep was collected at five positions along the stream channel and at three different moments in time: (1) end of rainy season, when crops had been already harvested, (2) end of dry season, and (3) middle of rainy season. Mixtures 4 and 5 were not sampled at the end of the rainy season (time 1).

Soil and sediment samples were prepared for EDXRF analysis at the Nuclear Science and Instrumentation Laboratory (IAEA) and for TOC determination at the FAO/IAEA SWMCN Laboratory.

The first step needed for applying the mixing modelling approach was the selection and validation of geochemical fingerprint elements. This task was done using artificial mixtures (Torres Astorga et al., 2018*), with known proportions of four sediment sources. The proportions of these mixtures were then estimated by the mixing model, whose result was then compared with the true values of the apportionment. The selected fingerprint elements were P, Ca, Fe, Ti and Ba, which then were used as tracers of sediments, and so to identify their sources. Total Organic Carbon was used as the sixth tracer for two of the five mixtures as this addition parameter improved the accuracy of the results without changing the resulting proportions.

Results on sediment apportionment of three out of five channel mixtures are shown in Figure 2. Uncertainties are not included in the charts for clarity. The average uncertainty in the proportions for mixture 5, 4, 3, 2 an 1 is 2%, 5%, 7%, and 7%, respectively.

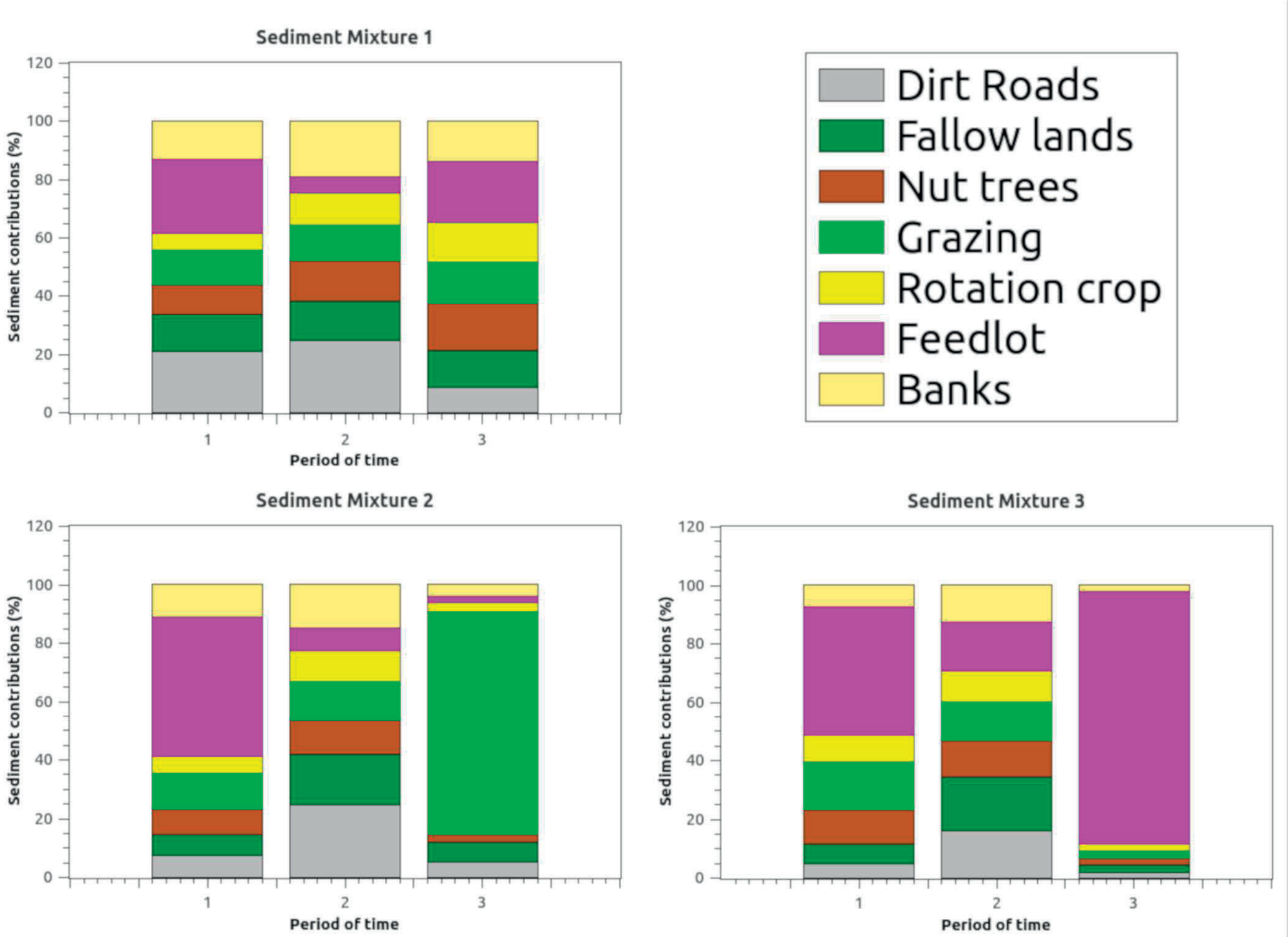

Figure 2. Sediment apportionment in three out of five channel sediment mixtures. Mixtures were collected at (1) the end of rainy season, after harvesting; (2) the end of dry season; (3) middle of rainy aseason.

Feedlots were identified to be the main source of sediments in 7 out of all 13 channel sediment mixtures analysed. This result is worrying due to the very small area this land use has compared with the size of the entire catchment. Feedlots represent only 1.7% of the catchment area. However, this result was expected since according to an important number of land owners this land use increased the sediment load in the channel over the last few years.

River banks and dirt roads together are the second most important source of sediments, and this in particular at the end of the dry season (period 2). Both sources jointly, which consist of subsoil material, are the main source of sediments in all three downstream mixtures at the end of dry season. The limited vegetation cover during every dry season, favours sediment movement. In fact, the lower part of the studied catchment is affected by gully formation. Banks and dirt roads represent an area even smaller than feedlots in the catchment, then the erosion of these sources is also a reason for concern with farmers and policy-makers.

Free grazing is the main source of sediments in only two channel sediment mixtures. This type of land use represents 25% of the catchment area. In the sediment mixtures where this source is the major contributor the proportions are high (76% and 60%). This might be explained by a larger number of animals living in that area and their proximity to the water channel.

On the other hand, the rotation crops occupy most of the area (47%) and this land use is the main source of sediments in only one sediment mixture (mixture 5, which is not shown), and this value represents the wet season. One of the reasons why the rotation crops need not to be a concern in this study might be the land management practice which the farmers apply on their fields: direct seeding known to reduce soil erosion. In mixture 5 the location of the cultivation land is exceptionally close to the channel, that might explain the high contribution of this source to the sediment mixture.

Other important outcome is the low contribution of the sources *Fallow land* and *Nut trees*, which at most contribute only 22% and 16%, respectively. In certain way this behaviour is expected as there is no soil removal in these zones. Bushes of the fallow land and short grass vegetation under the trees protect the soil.

Through the identification of major sediment sources, this study is key for improving soil conservation strategies and selecting land management practices and land uses that do not contribute much to sediment redistribution.

As a future perspective, it would be highly helpful to quantify the sediment budget for the periods of times in which the sediment load increases in the catchment.

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Soil bacterial and fungal diversity as soil quality indicator to complement soil erosion information derived from $^{239+240}$Pu

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Methods to quantify soil erosion are crucial for agro-environmental assessments as well as for optimization of soil and water conservation practices. However, erosion also affects soil quality, and the microbial community of the soil in particular. It has been widely reported in the literature that microbial community is a key indicator of soil ecosystem health, which is responsible for the regulation of biogeochemical soil nutrients cycling, promoting plants growth and maintaining ecosystem stability, and could significantly influence soil conditions (Mabuhay et al. 2004; Xiao et al, 2018).

New research has been initiated by the SWMCN Laboratory on the link between bacterial and fungal diversity and soil erosion at the Grabenegg research site in Austria. This work complements the on-going work on the use of radio-isotopes (e.g. Plutionium-239+240) as soil redistribution tracer.

Topsoil samples (i.e. 0-15 cm) to determine soil microbial diversity were collected at 5 locations along the slope of our Grabenegg experimental agricultural field (Figure 1). At each location, a soil pit was dug and four soil replicates were taken along the four exposed walls of the pit using bulk density cylinders (Figure 2). For each sample, one part of the material extracted was freeze-dried for future soil properties and stable isotope analysis, and the rest was stored at -20 °C for DNA extraction and high throughput sequencing analysis.