



Quantifying aeolian soil loss after forest conversion in the Chaco ecoregion

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The Chaco ecoregion (NW Argentina) is characterized by the highest forest loss rates worldwide, as a result of agricultural expansion at agro-industrial scale. The conversion of dry forests to agricultural plots enhances the soil erosion vulnerability by exposure of bare soil after deforestation. The unconsolidated loess-type sediments are particularly susceptible to wind erosion during the prolonged dry season.

In this study, the role of land use and management on soil erosion will be analysed. All investigated plots are characterized by flat topography. For this reason it is very likely that observed soil losses will be largely due to wind erosion, since such low gradients are not amenable to efficient water erosion. We hypothesise that changes in land use have a high impact on the mobilization of sediments in the Chaco ecoregion. We posit that a transformation from forest into crop/rangelands, will lead to enhanced mobilization of sediments by wind, whereas the establishment of no-tillage farming in this region might slow translocation rates down to near natural levels.

Within this study we are using fallout radionuclides - a product of the atmospheric nuclear weapon testing era of the 1950s and 1960s - to investigate the impacts of wind erosion. This is possible since the used fallout radionuclides Plutonium ($^{239+240}\text{Pu}$) and Caesium (^{137}Cs) predominantly bind on small particle sizes, which can be transported by wind. Based on soil samples taken in three individual study regions, we examined the losses of fallout radionuclide inventories, from six agricultural plots per region, differing only in cultivation time (0-39 years). To gauge local fallout input, we further sampled two adjacent reference sites – so called stable surface - in each study region.

For this study we measured the remaining activities of the radionuclide pair $^{239+240}\text{Pu}$ via AMS and of ^{137}Cs using a γ -spectrometer. The results for both radionuclides suggest that > 25 % of the initial inventory is lost within the first five years after forest conversion. We link these high magnitude soil losses to the prolonged dry season during which accelerated wind erosion is observed. Concerning our second hypothesis the Pu inventories do not show a clear trend during the following years of cultivation. This can suggest that wind erosion is reduced during no-tillage crop management.