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Nuclear techniques for determining the sources and temporal dynamics of sediment in upland agro-ecosystems: An overview of the mid-term achievements obtained under the IAEA coordinated research project D1.50.17.

Lionel Mabit, Arsenio Toloza , Amelia Lee Zhi Yi, and Lee Heng

Soil and Water Management & Crop Nutrition Subprogramme, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, International Atomic Energy Agency, Vienna, Austria

It is expected that upland agro-systems will face three main challenges related to food security and climate change in the coming decades: increasing food production while protecting and optimising soil and water use efficiency, adapting to climate change impacts on soil and water resources, and contributing to climate change mitigation. Adapting to climate change in the uplands requires agricultural soil and water management practices that make agricultural production systems resilient to drought, floods and land degradation, to enhance the conservation of the natural resource base for sustainable upland farming. This create an urgent need for reliable quantitative data on the extent and magnitude of soil and water resource degradation over several spatial and time scales.

Since the end of the 1990s, the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture through the activities of the Soil and Water Management and Crop Nutrition (SWMCN) subprogramme has contributed in developing efficient isotopic techniques for tracing sediment and for combating soil erosion.

In the middle of 2016, the IAEA funded a five-year Coordinated Research Project (CRP) that aims to further develop nuclear techniques to assess the impacts of changes in soil erosion occurring in upland agro-ecosystems, and to distinguish and apportion the impact of climate variability and agricultural management on soil resources in upland agro-ecosystems. In the frame of this recent CRP D1.50.17, fallout radionuclides (FRN), Compound-Specific Stable Isotope (CSSI) techniques as well as cosmic ray neutron probe (CRNP) are being used to achieve the two specific research objectives of the project by the 13 CRP contractors from 12 participating countries (Austria, Canada, China, Iran - Islamic Republic of, Italy, Madagascar, Morocco, New Zealand, Spain, Switzerland, UK, USA).

During the first phase of the project life cycle, significant progress was made in developing and/or refining FRN and CSSI techniques to deepen our understanding of erosion processes affecting upland agro-ecosystems, in testing the use of plutonium isotopes as new soil tracer versus other more mature FRN techniques such as Cs-137. In addition, new guidelines allowing the knowledge transfer of isotopic approaches would be available by the end of 2019: an open-access handbook providing guidance on the assessment of recent soil erosion rates using Be-7 as well as an IAEA publication detailing step-by-step usage of delta C-13 signatures of fatty acids in the CSSI technique.

This EGU contribution will highlight the main achievements as well as the latest activities conducted within the IAEA CRP D1.50.17.