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A mass-measurement of 137-Cs in biological samples

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The present work reports on a citizen science project which is in progress during the autumn 2018. 240 secondary school classes (pupils of age 13-16) participate by collecting mushrooms, soil samples and animal droppings and perform preliminary analyses before submitting their samples and results to Uppsala University (UU) and the Swedish University of Agricultural Sciences (SLU) for further compilation and analysis

Scientifically, the project deals with radioactivity accumulated in the environment. In Sweden, the Chernobyl accident in 1986 together with fallout from nuclear tests in the 50s and 60s, have left radionuclides in the environment and some of them can still be found in food (such as game and mushroom) consumed by humans. Measurements of the most significant radionuclide, 137-Cs, was undertaken by the Swedish Radiation Authority after the Chernobyl accident, and since then measurements have been performed at irregular intervals. Recently, the topic of measuring more frequently and coordinately has gained new attention, as meat from wild boars have been found to have high levels of 137-Cs. Wild boars were rare in the Swedish fauna in the 80s; but have since then established a solid population in southern Sweden. The relationship between how the concentration of 137-Cs was in 1986 and how it is today is not straightforward. Biological systems interact with, and redistribute, materials in an efficient manner, and consequently the distribution of the 137-Cs concentrations will be affected. Also, the forest type, soil type, land use, precipitation, hydrology and other environmental factors play significant roles in how the 137-Cs is redistributed. We therefore conclude that more measurements of the presence of 137-Cs in the Swedish environment would be of interest both for several scientific disciplines and for the general public.

In this project, gamma radiation from the samples collected by school pupils will be measured carefully with a HPGe detector. In order to facilitate fast and accurate measurements, one must take into account samples that are extended, inhomogeneous, and vary in mass, form, size and composition. We will here report on the ongoing work to set up a detector and analysis environment that can perform a measurement of up to 500 biological samples in a time frame of 2-3 months. The tight time frame is part of the citizen science idea; our public collaborators need feedback on their samples not too long into the future.

However, the large amount of samples and data collected opens possibilities for interesting interdisciplinary research long after the school-project is reported and finished. The long-term scientific goal is to create a geodatabase with the 137-Cs activity (Bq/m2) present in the Swedish environment, where radioactivity data also can be linked to the biological species (fungi, competing species, animals foraging), forest type, soil parameters and other environmental factors. To this end, there are many research questions about the role of 137-Cs in ecology and biological food chains that can be investigated.

Primary author: Dr LANTZ, Mattias (Department of physics and astronomy, Uppsala university)

Co-authors: Dr HJAMLARSSON, Anders (Department of physics and astronomy, Uppsala university); Dr GUSTAVSSON, Cecilia (Department of physics and astronomy, Uppsala university); Dr ANDERSSON SUNDÉN, Erik (Department of physics and astronomy, Uppsala university); Dr LUNDÉN, Karl (Department of Forest Mycology and Plant Pathology, SLU)

Presenter: Dr LANTZ, Mattias (Department of physics and astronomy, Uppsala university)

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