

USE OF ⁷Be MEASUREMENTS TO ASSESS THE EFFECTIVENESS OF WOODY TRASH BARRIERS IN REDUCING SOIL LOSS AFTER FOREST CLEARCUTTING

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In the paper the method of measurements of ⁷Be in soil is described. The technique is successfully utilised to investigate soil redistribution in recently clearcut forest areas.

Key words: ⁷Be measurement, soil redistribution, forest clearcutting.

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ВИМІРЮВАННЯ КІЛЬКОСТІ ЯДЕР ⁷BE ДЛЯ ОЦІНЮВАННЯ ЕФЕКТИВНОСТІ ПРОТИЕРОЗІЙНИХ ПРИЛАДІВ ІЗ ДЕРЕВНИХ ВІДХОДІВ, ЯКІ УТВОРЮЮТЬСЯ ПІСЛЯ РУБКИ ЛІСУ

Робота присвячена вимірюванню ядер ⁷Be у ґрунті. Даний метод добре себе зарекомендував при дослідженні перерозподілу ґрунту на нещодавно вирубаних територіях.

Ключові слова: ⁷Be-вимірювання, перерозподіл ґрунту, вирубка лісу.

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ИЗМЕРЕНИЕ КОЛИЧЕСТВА ЯДЕР ⁷Be ДЛЯ ОЦЕНКИ ЭФФЕКТИВНОСТИ ПРОТИВОЭРОЗИОННЫХ УСТРОЙСТВ ИЗ ДРЕВЕСНЫХ ОТХОДОВ, СОЗДАВАЕМЫХ ПОСЛЕ ВЫРУБКИ ЛЕСА

Работа посвящена измерению ядер ⁷Be в почве. Данный метод уже успел хорошо себя зарекомендовать при исследовании перераспределения почвы на недавно вырубленных территориях.

Ключевые слова: ⁷Be-измерение, перераспределение почвы, вырубка леса.

The export of forest products from Chile has increased by about 70 % during the last five years and accounted for approximately 10 % of the total exports in 2008. The associated intensification and expansion of forest plantations and resulting soil erosion problems have put pressure on the forest companies to promote soil conservation practices. In order to support the development of improved guidelines for the design and use of woody trash barriers installed along contour lines, to reduce soil erosion and sediment loss after forest clearcutting, a study has been undertaken to assess the efficiency of such trash barriers and to establish the optimum spacing for the barriers.

The study sites were located within harvested forest areas situated close to the city of Valdivia in south-central Chile (39°44'S, 73°10'W; mean annual rainfall 2300 mm). Attention focussed on an area exposed to a sequence of highly erosive precipitation events immediately after final forest clearcutting and the installation of the woody trash barriers.

The potential for using the cosmogenic fallout radionuclide ⁷Be ($t_{1/2} = 53.3$ d) to document short-term soil redistribution on agricultural land has been reported by several researchers, including Blake et al. (1999), Walling et al. (1999), Matisoff et al. (2002), and Wilson et al. (2003). Measurements of ⁷Be in soil have also been successfully utilised to investigate soil redistribution in recently clearcut forest areas (Schuller et al., 2006). After clearcutting, ⁷Be fallout inputs will not be influenced by canopy interception and can therefore be assumed to be spatially uniform within a local area receiving the same rainfall amount.

Soil erosion associated with periods of heavy rainfall was investigated on a series of plots 7.5 m wide and respectively 10, 15, 18 and 30 m long. The plots were oriented parallel to the slope and the predominant direction of surface runoff and bounded up- and downslope by woody trash barriers. A newly developed approach for employing ^7Be measurements to quantify soil redistribution over an extended wet season (Walling et al., 2009) was used to document the soil redistribution.

The results obtained, relating to the effects of ~1000 mm of rainfall occurring during a three month period in autumn 2006, show that the construction of appropriate linear trash barriers can be effective in reducing sediment delivery to watercourses, and indicate that a barrier spacing of 15 m was considerably more effective in reducing net erosion than a greater spacing. However, soil redistribution observed during a five month period during 2008 extending into winter, which included the autumn period and experienced an extremely high total rainfall of 2090 mm, suggests that *under extreme rainfall and low soil density conditions*, the woody trash barriers are unable to retain the large amounts of sediment mobilized from the upper part of the slope and that much of this sediment passes through the barrier, increasing the net soil loss and the sediment delivery ratio. Nevertheless, in the absence of the lower trash barrier the soil loss is even greater, showing that the barriers are still effective.

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