

Investigations of the medium scaled spatial distribution of radiocaesium contamination of wild boar (*Sus scrofa*) in Rhineland-Palatinate, Germany

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Radiocaesium ground deposition is caused by fallout from atmospheric nuclear weapon tests and from nuclear power plant accidents like in Chernobyl in 1986 (De Cort 1998). Especially in forest ecosystems this nuclide is easily introduced into the food chain. Although radiocaesium concentration in many forest-dwelling species tend to decrease 18 years after the Chernobyl nuclear accident, radioactive contamination of wild boar keeps unchanged in many contaminated forested areas of Germany.

In Rhineland-Palatinate, radiocaesium contamination of wild boar meat (venison) is found mainly in the Palatinate Forest (Landesuntersuchungsamt Rheinland-Pfalz 2002). Considering the location of sampling in this area, we found that occurrence of contaminated wild boar was restricted to the western parts (Anonymus 2003, Hohmann & Huckschlag 2004a, Fig. 1). It is assumed that this east-west gradient of wild boar contamination in the area is based on an east-west-gradient of the radiocaesium fallout, following the Chernobyl accident.

In order to test this hypothesis surface radiocaesium activity was measured in-situ gamma spectrometrically in the year 2004. A measurement vehicle of the Landesamt für Umwelt, Wasserwirtschaft und Gewerbeaufsicht (Mainz) with a portable hyperpure germanium (HPGe) coaxial detector (p-type; measured efficiency: 10 %; Detector Systems GmbH, Mainz) and a multi-channel analyser was used. First the relaxation length of the radiocaesium was found out in a pilot study (Anonymus 2004a). Measurements were taken along three east-west transects in the north, centre, and south of the Palatinate Forest. Each transect consisted of 8 – 9 measurement points (Fig. 1). Because no soil variables were ascertained and for minimizing their variance all measurement points had comparable conditions (Anonymus 2004a):

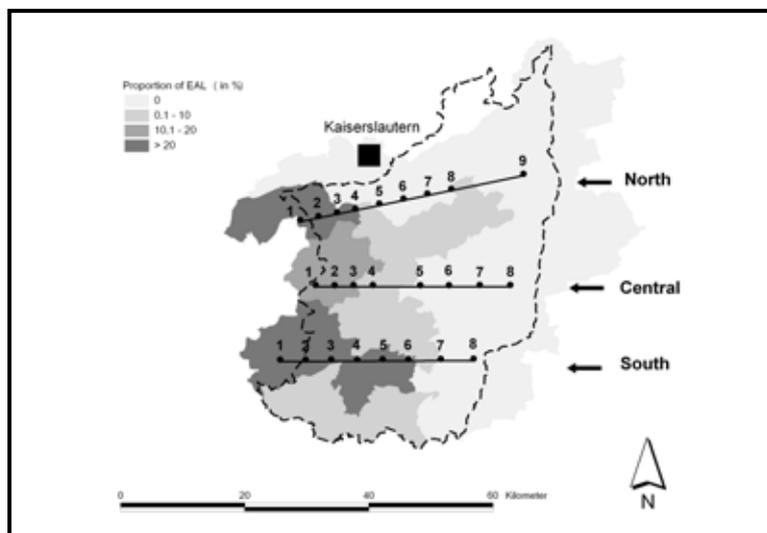
Tree stand: 80 - 120 year old beech forest (*Fagus sylvatica*) with a closed canopy in 1986

Geology: New Red Sandstone

Topography: no hill top, no valley bottom, no steep slopes

The soil surface activity measurements along the three transects indicate an increasing radiocaesium ground deposition from east to west (Fig. 2). The mean surface activity over all 25 measurements was 5.100 Bq/m² (maximum 16.100 Bq/m²; minimum 700 Bq/m²).

Fig. 1. Proportion of hunted wild boar (December 2000 – February 2002; n = 2.132, according to Anonymus 2003, modified) Exceeding the Accepted Level (EAL) for radiocaesium activity with > 600 Bq/kg (fresh matter) in the Palatinate Forest (broken line). Shaded areas: Area of Forest Districts of the Palatinate Forest Lines: Transects "North", "Central" and "South" (each transect with the measurement points) for in-situ gamma spectrometry of soil surface radiocaesium activity.



The western focus of radiocaesium ground deposition in the Palatinate Forest fits well into the local weather conditions after the Chernobyl accident with higher precipitation levels in the western areas (De Cort 1998, Fig. 2) causing a higher wash out of nuclides during the phase of elevated air activity between the 1. – 3. May 1986 (Ministerium für Umwelt und Gesundheit Rheinland-Pfalz 1986).

The data presented here support the hypothesis that medium scaled geographic differences in radiocaesium ground deposition are reflected by contamination levels of forest dwelling ungulates (Palo and Wallin 1996). The spatial resolution to which contamination levels of an animal species reflect differences in radiocaesium ground deposition, is strongly linked to its roaming behaviour. The more sedentary and the smaller the home range of a given species, the higher the spatial resolution will be to mirror ground deposition differences, like it is the case in the roe deer (*Capreolus capreolus*, Fielitz 1992, Haffelder 1995, Schwind et al. 2002). Wild boar are not regarded as strictly territorial and have home ranges of several 100 ha to over 1000 ha (e. g. Boitani et al. 1994). Because of this, contamination differences of this species might reflect ground deposition differences only on a broader medium scaled level considering forest districts encompassing several thousand hectares as sampling units.

On the other hand, it has to be taken into account that other spatial parameters may influence the spatial variation of radiocaesium contamination levels in wild boar and might overlap or even outweigh the influence of ground deposition differences:

a) Access to open land along the edge of the Palatinate Forest lowers contamination levels due to low radiocaesium transfer factors from soil into the food chain in agriculturally used land (Hecht and Honikel 1997). So e. g. measurement point 1 of the southern transect is located outside the closed forest (Fig. 1). Although we measured here the second highest level of ground deposited radiocaesium (14.000 Bq/m^2) not a single wild boar that had been shot close to this point exceeded the accepted level for radiocaesium activity ($n = 64$ for 2001 - 2004).

b) Availability of (parts of) food organisms with different radiocaesium transfer factors (Hecht and Honikel 1997, Hohmann and Huckschlag 2004a). In a previous study we found that especially deer truffle (*Elaphomyces granulatus*) functions as the most important radiocaesium source for wild boar in the area (Hohmann and Huckschlag 2004a), but this fungus is likely to be distributed over the whole Palatinate Forest (Anonymus 2004b).

Consequently we conclude that medium scaled geographic differences of wild boar contamination levels within the Palatinate Forest is mainly based on radiocaesium ground deposition differences.

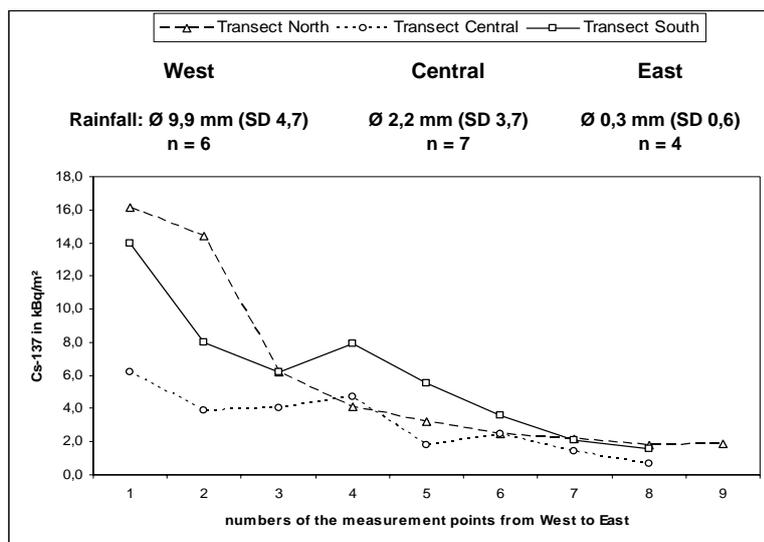


Fig. 2. Soil surface radiocaesium activity (here Caesium-137) measured with an in-situ-gammaspectrometer 2004 indicating higher levels of radiocaesium ground deposition after the Chernobyl accident 1986 in the western Palatinate Forest. On top of the graph: average sum of daily precipitation measured by western, central and eastern weather stations in the Palatinate Forest for the period 1. to 3. May 1986 (period of elevated air activity in Rhineland-Palatinate). SD: standard deviation n: number of measurement stations considered.

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Quellenverweis

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