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Soil biota indicators for monitoring the Estonian agri-environmental programme

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Abstract

The mandatory implementation of agri-environmental programmes (AEP) during the accession to the EU was a major policy development in the countries of Central and Eastern Europe. In Estonia the development of the AEP began in 1997 and the implementation of the AEP in pilot areas was launched in 2001. By this time, evaluation and monitoring methodologies of AEP had been elaborated. This paper summarises the Estonian AEP applied in 2001–2003 and presents selected indicators of biodiversity. The main focus is on the analysis of selected indicators of soil biota. Soil bioindicators (abundance, diversity, and ecological composition of earthworm communities and hydrolytical activity of the microbial community) were measured in 2001 and 2002. Two pilot areas of the AEP (Palamuse, representing a municipality with intensive agriculture, and Kihelkonna–Lümanda, representing extensive agriculture) and two reference areas where the AEP was not implemented (Mustjala and Saare municipalities) were investigated. Ten farms in both pilot areas and five in both reference areas were studied. There were differences in the abundance and number of earthworm species between Palamuse (intensive agriculture) and Saaremaa (extensive) pilot areas, but these were not statistically significant. However, the differences in the hydrolytical activity of the microbial community between Palamuse and Saaremaa pilot areas were statistically significant ($p < 0.05$). It is concluded that soil bioindicators are suitable for monitoring human pressure as well as the effects of AEPs. AEPs may increase the abundance and diversity of earthworms, decrease the dominance of *A. caliginosa*, and increase the activity of the microbial community.

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1. Introduction

The development and implementation of agri-environmental programmes (AEP) is a legal requirement for all EU Member States since the agri-environment

regulation, Council Regulation No. (EEC) 2078/92, accompanied the reforms of the common agricultural policy in 1992. The mandatory implementation of AEPs during the accession to the EU was a major policy development in the countries of Central and Eastern Europe (including Estonia), and is likely to have a significant impact on farm management practices and the patterns of land use. In Estonia, the development of

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the AEP began at the end of 1997 with the “Agri-Environmental Programmes in Central and Eastern Europe” (MATRA) project (Avalon Foundation, 1998). Preparations continued under the PHARE projects “Development of the Agri-environmental Scheme in Estonia” and “Action Plan for Implementation of the Agri-environmental Programme for Estonia, N°ES 9620.01.01”. The structure of the Estonian agri-environmental support scheme, the measures and the requirements for eligibility, and the administration and training system were elaborated during these projects, and a plan was drafted for the implementation of the scheme. The main activities and measures with their intended positive effect on biodiversity and landscape protection are presented in Table 1. For example, the aim of the “Environmentally Friendly Production Scheme” is to encourage the use of environmental planning by farmers and to reduce the risk of water pollution by nitrogen, while maintaining and increasing soil fertility. Farmers are required to have a Nutrient Management Plan and a Crop Rotation Plan. The total application of nitrogen (mineral fertiliser and manure/slurry) must not exceed an average of 170 kg/ha of cultivated area, and the total application of nitrogen as mineral fertiliser must not exceed 100 kg/ha of cultivated area. The crop rotation must meet the following requirements: at least 15% of the cultivated area must be under legumes or a mixture of legumes and grass species, and cereals must not be grown on the same field for more than three subsequent years.

Estonia started to implement agri-environmental support in 2000, when assistance for organic farming and Estonian cattle breeding was made available

nationwide. In the following year, nationwide assistance was granted, in addition, to the production of endangered crop varieties. The Ministry of the Environment began to support the management of semi-natural habitats in protected areas. At the same time, several additional agri-environmental measures were initiated in three pilot areas. The specific objectives of this pilot project for agri-environmental measures were:

- testing the practical implementation of the AEP in the Estonian context;
- evaluating the effectiveness of the proposed AEP;
- refining the management prescriptions of the AEP in order to better meet the objectives of the scheme;
- gaining an indication of the average AEP payments per farm;
- demonstrating and promoting the concept of the AEP in Estonia amongst farmers, policy makers, politicians and the general public;
- developing a control, monitoring and evaluation system;
- elaborating evaluation indicators for the AEP and testing them in the pilot areas.

2. Material and methods

2.1. Approaches for the selection of indicators in the Estonian AEP

2.1.1. Biodiversity indicators

Indicators are partial and imperfect reflections of reality. For the evaluation of the agri-environmental

Table 1
Pilot agri-environmental measures in Estonia (2001–2003)

Scheme	Main activities and measures favourable for biodiversity and landscape protection
Environmentally friendly Management Scheme (EMS)	Minimum requirements with respect to crop rotation Restricted nitrogen fertilisation Establishment of non-cultivated field margins Limitations of field size
Supplementary Measures Scheme (SMS)	Maintenance of landscape elements, semi-natural and natural habitats Restoration and management of semi-natural habitats Planting of hedges Restoration and management of stone walls Creation of ponds and wetlands
Abandoned Land Scheme (ALS)	Preservation of endangered local breeds, organic farming Shrub clearance and annual mowing starting from a certain date
Training and Demonstration Scheme	Training and demonstration

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