Available online at www.sciencedirect.com
SCIENCE DIRECT®
Agriculture, Ecosystems and Environment 108 (2005) 189–204
Agriculture Ecosystems & Environment
www.elsevier.com/locate/agee

Effect of ecological compensation areas on floristic and breeding bird diversity in Swiss agricultural landscapes

F. Herzog [a,*], S. Dreier [a], G. Hofer [a], C. Marfurt [b], B. Schüpbach [a], M. Spiess [b], T. Walter [a]

[a] *Agroscope FAL Reckenholz, Swiss Federal Research Station for Agroecology and Agriculture, Reckenholzstrasse 191, CH-8046 Zurich, Switzerland*
[b] *Swiss Ornithological Institute, CH-6204 Sempach, Switzerland*

Abstract

In the 1990s the Swiss agricultural policy was reformed and new environmental objectives were formulated. The aims of the reform were to halt the loss of agro-biodiversity and to enable the spread of endangered species. As a result, the utilised agricultural area (UAA) is now interspersed with low input ecological compensation areas (ECA), making up 13% of the UAA (extensified grassland 90,000 ha, traditional orchards 25,000 ha, hedgerows 3000 ha, other elements 23,000 ha). To assess whether ECA contribute to the enhancement of biodiversity, plant composition was recorded on 1914 ECA of the Swiss plateau and 1966 territories of 27 bird species, which typically breed in open and semi-open farmland, were mapped and related to ECA. Eighty-six percent of ECA litter meadows and 50% of ECA hedgerows were of good ecological quality and attracted wetland and hedgerow birds. Most ECA hay meadows and traditional orchards, on the other hand, still reflected their former intensive management with only 20 and 12%, respectively, being of good ecological quality. Hardly any benefits for grassland and orchard birds were observed. Ecological quality of ECA was generally higher in the bio-geographical region 'Basin of Lake Geneva and Upper Rhine Valley' than in the other two regions of the Swiss plateau and it was higher in the agricultural production zone 'Pre-alpine Hills' than in the 'Lowland Zone'.

Keywords: Agri-environment scheme; Biodiversity; Grassland; Hedgerow; Orchard; Policy evaluation; Breeding birds; Vegetation

1. Introduction

Modern, industrialised agricultural production has boosted food security, but to a great extent it has done so at the expense of the environment. In the early 1990s the increased awareness of environmental damage caused by agriculture together with the growing costs for the regulation of agricultural markets led to the introduction of agri-environment schemes. In Switzerland as in other countries, there was an animated public debate on the cost of government expenses for the support of agriculture

* Corresponding author. Tel.: +41 1 377 74 45; fax: +41 1 377 72 01.
E-mail address: felix.herzog@fal.admin.ch (F. Herzog).

0167-8809/$ – see front matter © 2005 Elsevier B.V. All rights reserved.
doi:10.1016/j.agee.2005.02.003

and about undesirable effects of agricultural production on landscapes, biodiversity and water quality. This resulted in the Swiss agricultural and agri-environmental policy being re-framed. A transition occurred from a post World War II, production oriented policy to a more comprehensive policy based on the perception that agriculture has multiple functions (Günter et al., 2002). In 1996 a revised constitutional article, which tied direct income payments to minimum ecological management requirements, gained a large (78%) majority in a popular referendum.

Today, the Swiss agri-environmental policy is comprised of three components. The cornerstone is the fact that since 1999, farmers have to prove that they meet a number of environmental standards in order to qualify for area-related production subsidies (cross compliance; Schmid and Lehmann, 2000). In 2002, 86% of the farmers – who together farm 96% of the utilised agricultural area (UAA) – fulfilled these requirements (BLW, 2003). The most important measure with respect to biodiversity has been that each farmer has to convert 7% of their farmland to ecological compensation areas (ECA) (Table 1). The management of ECA is regulated (late cut of meadows, restrictions in fertilisation, pesticide use, etc.) in order to achieve environmental goals (BLW, 1998a). As approximately 80% of the country's UAA is grassland (SAEFL and FOA, 2000), hay meadow and litter meadow ECA make up the largest part of ECA. The other types are far less important in area. Still, namely perennial woody elements (hedgerows,

Table 1
Major types of ecological compensation areas (ECA) in Switzerland, area and share of utilised agricultural area (UAA) (BLW, 2003)

ECA types	Area in 2002 (ha)	Share of UAA (%)	Criteria for ecological quality[a]
Low intensity hay meadows: meadows with minimum size of 0.05 ha, restrictions on fertilisation and mowing (late cut, specific dates for agricultural production zones according to altitude)	82,999	8.11	Required plant indicator species present in the plot core area (edge excluded)
Litter meadows: meadows with minimum size of 0.05 ha for traditional litter use, prescriptions on mowing, no use of fertiliser	6,571	0.64	As for low intensity hay meadows
Hedges, field and riverside woods: hedges with grassland buffers of ≥3 m on both sides	2,929	0.29	≥2 m width (excluding buffer), no invasive species, ≥5 shrub or tree species per 10 m length, ≥20% of thorny shrubs, alternatively one native tree every 30 m (stem perimeter ≥170 cm at 150 cm above ground)
Traditional orchards: standard fruit and nut trees, mostly on grassland	24,201[b]	2.43	≥0.2 ha with ≥10 trees, 30–100 trees/ha, combination with another ECA within ecological effective distance (stipulated as 50 m in the implementation of the by-law)
Others: extensively managed and wooded pastures, wild flower strips and arable fallows, isolated trees and alleys, water ditches and ponds, ruderal areas, stonewalls, naturally covered field tracks, species rich vineyards	23,321	2.28	(Not included in the by-law and not investigated)
Total	140,021	13.75	

[a] Criteria for ecological quality of the vegetation according to the by-law on the regional improvement of the quality of ecological compensation areas in agricultural landscapes (BLW, 2001). The detailed criteria are listed in the by-law, which is available in French, German and Italian at http://www.bk.admin.ch/ch/d/sr/c910_14.html. The list of plant species is indicated at: http://www.blw.admin.ch/rubriken/00330/.
[b] Estimated from the number of trees assuming 100 trees/ha.