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National Conservation Plan

Species action plan



Action plan **Red Kite - Milan royal** ***Milvus milvus***

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The Red Kite

Distribution and population

The Red Kite *Milvus milvus* has a small breeding area which is almost completely limited to Europe. The core area covers western, southwestern and central Europe.¹ The global population is estimated at 20-25 000 breeding pairs and appears to have been in decline for several decades (BirdLife International 2004).

The 2009 monitoring of the ‘territorial season population’ revealed a total of 66 Red Kite territories and a density of 2.6 territories/100km². Previous counts were conducted in 1997 and 2003; between 1997 and 2009, the population increased by 43% (20 pairs) (Biver & Konzemius, 2010). The increase was due not to any substantial expansion of breeding range, but rather to greater population density in areas which were already well populated, like the east of Luxembourg and the high plateau in the north of the country.

The Attert region and the southwest of Luxembourg are also important ranges.²

Protection status

Species of European Conservation Concern	Birds Directive	Bern Convention	Bonn Convention	European Red List	Red List of Luxembourg
SPEC 2	Annex I	Annex II	Annex II	NT	EN

Under the “Règlement grand-ducal du 9 janvier 2009 concernant la protection intégrale et partielle de certaines espèces animales de la faune sauvage”, the Red Kite enjoys full protection in Luxembourg. Under the Nature Conservation Act “Loi modifiée du 19 janvier 2004 concernant la protection de la nature et des ressources naturelles”, it is not allowed to disturb, kill, persecute, catch, keep in captivity or stuff animals that are completely protected at any phase of development. Any deliberate destruction, egg collecting in the wild, and any damage or destruction of nests, or of nesting or roost sites is also forbidden. It is also not authorized to disturb wildlife, in particular during the breeding period, as well as during the winter or migration time.

¹Annex 1

²Annex 2

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Pursuant to the Birds Directive (2009/147/EC), EU member states are required to maintain or restore suitable habitats for all wild bird species in sufficient area size, and to declare protected areas and adopt protection measures (Article 3). Particular attention is given to the species of Annex I (Article 4-1). It is evident that most Red Kite territories in Luxembourg are outside the Natura 2000 network and outside national nature reserves.³

The Red Kite has been classified by BirdLife International in category SPEC2 (SPEC = *Species of European Conservation Concern*), i.e. species where over 50% of the global population is concentrated in Europe and which have an unfavorable nature conservation status in Europe.

Under the Bern Convention on the Conservation of the European wild plant and animal species and their natural habitats, the Red Kite is listed in Annex II. For those species, strict protection regulations are applied: it is not allowed to disturb, catch, kill or trade in them.

Under the Bonn Convention on the Conservation of migrating wild animals, the protection of species listed in Annex II should be regulated by regional agreements concluded among the countries concerned. On 19th July, Luxembourg signed the international declaration of commitment of the Bonn Convention for the protection of migrating animal species (*Memorandum of Understanding on the Conservation of Migratory Birds of Prey on Africa and Eurasia*), with the result that Luxembourg is obliged to protect migrating raptor species like the Red Kite. The Red Kite is listed in category 1 as a species of the highest priority for implementation of the agreement.

On the Luxembourg Red List, the Red Kite is listed in category 3 as “EN” (= *endangered*), even though the number of Red Kites has increased steadily since the 1960s; this is because of the residual risk in the light of alarming global population trends. On the IUCN Red List, the Red Kite is classified as “NT” (= *near threatened*). This category covers species which might soon be endangered if the population does not increase over the coming years.

³Annex 3

Habitat and feeding

The Red Kite inhabits open agricultural areas and the richly structured local countryside, interspersed with copses and deciduous forests. On the other hand, the Red Kite avoids densely forested regions like the “Grünwald”, the middle of the Oesling, the “Valley of the Mamer and the Eisch” and the urban centres of human settlement (Luxembourg City and its environs, the Minette region, the lower Alzette valley, and the “Nordstadt”).

The nests are often situated on the edge of forests, in light old patches of woodland or in copses. Red Kites prefer beech and oak trees, but also use other tree species. The nests are often used for several years. As hunting areas, they prefer open agricultural landscapes which they can fly over in slow hunting flights. They also frequent areas with a rich texture of landscape elements and rich grasslands including pastures, meadows, in particular during and shortly after mowing. Sometimes arable land with low vegetation and untreated field-margin strips are used. In addition, they also visit rubbish dumps and stockyards and farms.

Red Kites eat mainly small mammals (fieldmice and voles), but birds and invertebrates are also important prey items. As opportunists, they eat whatever they can find, including carrion and waste.

Major threats

Habitat loss

Red Kites benefit from the frequent cuts of silage or hay, but the intensification of agriculture is reducing grazed areas and the ancient mosaic of varied land uses, and increasing the areas under maize. Maize fields provide next to no food for Red Kites at the beginning of the breeding season. With the increased input of fertilizers, plant communities tend to be uniform and dense, and fast growing crops prevent Red Kites from finding their prey. Another point which has a negative impact is the asphaltting of dirt field tracks.

The consolidation of small parcels of land into large fields eliminates the old food-rich field-margin strips and the constant switching from one field use to another.

Other habitat losses are due to land-use changes and building development. Potential hunting areas are reduced, making it harder for the Red Kites to find sufficient food.

Disturbances

One of the major threats to large birds is disturbance during the breeding season near the nest. Forestry work and leisure use in particular can disturb breeding or feeding for these species. Where adult birds are absent repeatedly or for long periods because of human disturbance, breeding success is significantly affected, and the risk of predation of the eggs or the young birds increases markedly.

Poisoning

As opportunists, Red Kites are particularly vulnerable to ingesting poisonous substances. Certain groups of products in current use constitute direct risks (bioaccumulation) as well as indirect risks (reduced food resources). These products include rodenticides, anticoagulants, insecticides and herbicides. Red Kites are at the top of the food chain, so they take up high concentrations of different noxious substances in their food. The most harmful group are the rodenticides, which are used to curb cyclical peaks in the vole population and the resulting economic damage.

Red Kites are also threatened by lead poisoning (saturnism), due to ingesting metallic lead or lead compounds, mainly in the form of lead shot.

Persecution and shooting

In Luxembourg, as elsewhere, Red Kites are sometimes subject to persecution because they are, mostly unjustifiably, considered a threat to small wildfowl and domestic poultry. Though rare, there have been cases in recent years of breeding animals or nests of Red Kites being shot at. The illegal installation of corvid traps can decimate the local Red Kite population and other raptors. Current cases are known for Luxembourg.

Closure of open waste dumps

Red Kites also visit open waste dumps and composting plants. The closure and decline of such plants can have serious consequences for many scavengers (see EU directive 1999/31/EC European Council Directive of 26th April 1999 concerning landfill sites intended to reduce rubbish dumps by July 2002).

Electrocution and collision with power lines

According to Newbery, P., J. Knott & B. Barov (2009 and VDE 2011) overhead power lines and their supporting masts constitute a major threat to Kites and other large bird species. They can substantially affect the behaviour and movement pattern of the birds and result in direct losses due to electrocution or collision with the power lines. Power line masts in particular attract large bird species, because they use them as vantage points. Electrocution results from the short-circuiting of voltage potential. This happens where there is a grounding fault between live conductors and earthed components. The danger here comes mainly from medium-voltage power lines, because they have relatively small insulated sections which can easily be bridged by

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large birds' long wings. The worst structures are those where there are wires above the crossbeams, or elements which are placed above the mast tops. Cases of electrocuted Red Kites are also known from Luxembourg.

Collisions with overhead power lines can generally happen with any kind of power line. Horizontal structures of this kind do not occur naturally, and birds' vision and behavioural patterns are not geared to this kind of obstacle, particularly when visibility is poor.

Collisions with wind turbines

Richarz, Bezzel and Horman (2001) point out that wind turbines affect Red Kites more than any other bird species. Due to their species-specific hunting technique, Red Kites are particularly liable to collide with the rotors of wind turbines. Red Kites tend to scan the ground in a slow hunting flight. Studies have shown that half of this hunting time is spent in the dangerous altitude range of 50 to 100 meters. Something like a quarter of all dead raptors found under wind turbines are Red Kites, a particularly worrying statistic considering how relatively rare Red Kites are.

Red Kites fail to develop any natural wariness or fear of rotors because nearly every collision has fatal consequences. Most victims are adults and not young inexperienced birds. The waste land at the foot of the turbine towers and the access routes to the towers exert a particular attraction over Red Kites and entice them into the danger zone because they seem likely to harbour prey items.

Objectives of the Action Plan

The aim of this programme is essentially to implement the European Red Kite conservation programme in Luxembourg.

- Turnaround from negative to positive development of the Red Kite population in the EU (2018 objective: 30 000 pairs), and in member states with negative population trends.
- To secure a stable distribution pattern in the EU and a sustained positive trend in member states where the population is currently stable or positive, especially when these member states border countries with negative population trends.
- Reduced levels of poisoning, persecution and other threats to the Red Kite.
- To secure adequate habitats and sufficient food resources throughout the distribution area.
- Development / continuation of monitoring and research projects to boost knowledge and understanding of population dynamics and distribution, movement patterns, productivity and threats.

In addition, this conservation programme also gives expression to the declaration of commitment under the Bonn Convention for the protection of migrating raptor species (the Red Kite being Luxembourg's top priority).

In the short term, the objective of the programme in Luxembourg is to ascertain where the species occurs, to reduce the threat level, to improve our knowledge of population dynamics, and to pinpoint the most important feeding grounds in the breeding, migration and wintering periods.

Current measures

The current national measure is the work done to record the territorial population; this is carried out every six years (1997, 2003, 2009) by the Field Ornithology Working Group reporting to natur&ëmwelt's Centrale ornithologique. In addition, a research site was set up in 1991 in eastern Luxembourg, where territories and breeding success are recorded annually.

Red Kites also benefit from a range of other nature conservation measures, e.g. the creation of a varied mosaic of different land usage types, low-growth openland sites, especially grazing and mowing, and the installation of high-nutrition fallow and grass strips within low-growth habitats.

Known breeding sites receive particular attention, with a view to boosting the population up to minimum 80 territory-holding pairs (which would correspond to the German mean density of 3 pairs/100km²).

Measures

Habitat optimization measures

Optimization of core areas, by making feeding areas more attractive for breeding:

- Preserve a rich mosaic of farmed countryside elements.
- Increase crop variety, (re)establish field-edge lines of trees, and counter the consolidation of small fields into large prairie units.
- Boost the forest-edge effect by the deliberate creation of low-input fallow and grass strips.
- Regular but staggered mowing regimes, if possible linked to a reduction in fertilizers.
- Preservation and creation of regularly mowed meadows, especially directly adjacent to the breeding site (within 1000 meters of the nest); within that 1000 m radius, ground cover should be at least one third grassland.
- Support for traditional, low-input livestock and arable farming.
- No rodenticides.
- Preservation and encouragement of field copses, tree rows and a richly structured deciduous forest edge.
- Give consideration to bait sites and/or to leaving game animal carcasses.

Nest protection programme

All large raptor nests should be covered by a nest protection programme. Especially in woodland and at the forest edge, and in field copses, there should be a disturbance-free area around the nest sites. Within a minimum radius of 200 meters, all forestry work should be halted during the breeding season. The construction or expansion of forest tracks or hiking trails should cease for the breeding season; nor should hunters make use of nearby cull seats or towers. No changes should be made at any time in the year within a radius of 50 meters of the nest, and the nest tree itself should be preserved.

Preventing electrocution

When new medium-voltage power lines are build or renewed, bird-friendly structures should be specified. Crossbeams, insulator supports and other components should be such that birds cannot alight in the dangerous environment of live or grounded parts. Existing masts can be modified or upgraded. Some technical detail can be found in the annex.

Preventing collision with overhead power lines

For power line sections with a high risk of collision, the wires should be clearly marked to warn off large birds. Studies have shown that optical marking can reduce the risk of bird strike. In sensitive areas, e.g. where large numbers of raptors tend to gather, there should be no power lines.

Reducing the collision risk with wind turbines

The following points should be borne in mind.

- No licences for new wind turbines situated within a 1000 m radius of a nest.
- The vegetation at the foot of the turbine tower should be unattractive to Red Kites searching for food (e.g. dense vegetation and/or crop farming close to the foot of the tower).
- No grassland with grazing or regular mowing regime beneath the turbine tower.
- Creation of regularly mowed meadows and grazing land away from the wind turbines to entice the birds away.
- When rough vegetation around the turbine towers has to be mowed, the turbines should be switched off for five days.
- No crop growing underneath the wind turbine should be harvestable before mid-July.
- The turbines should be switched off for five days during and after harvesting of the crop beneath.

Monitoring and research

In addition to the ongoing monitoring of territorial populations at 6-yearly intervals, areas should be identified in the main distribution areas where the territories and breeding success are recorded every year. Breeding success and the number of fledged juveniles is the main parameter for assessing the status of the Red Kite population.

In addition, attention should focus on wintering Red Kites, as the trend of Red Kites overwintering in central and western Europe is upward. There should be a specific mid-winter count.

Luxembourg should start a localization and marking programme with a view to: acquiring better information on the use of space and habitat during the breeding season; taking specific Red Kite protection measures; obtaining information on migratory behaviour; collecting arguments for conservation efforts in habitats that are used year-round by Red Kites, GPS-tracking technology now makes it possible to determine a bird's position to within a few meters and even the flight altitude. As a result, it is now possible to analyse the way sites are used in the breeding season, to see how the Kites come and go, and to monitor the exact migration routes and wintering areas.

Examination of Red Kites that are found injured or dead

Any Red Kite that is found injured or dead should be taken to the natur&ëmwelt wild animal care and rescue centre in Dudelange, where they can be examined to ascertain the reason for the injury or demise, e.g. gunshot, collision, electrocution or poisoning.

Regulatory measures

- No further field consolidation projects in core Red Kite areas; or at the very least, specific protection measures to secure feeding grounds and field margins.
- Make the basic farming premium dependent on a minimum percentage of semi-natural areas in the farmed countryside.
- Introduction of a nest protection zone of 50 meters around nest sites: no felling of nest trees and preservation of trees used as resting sites (trees with multiple and low branches on the edge of the nesting zone that are used as vantage points).
- Introduction of a nest protection zone of 200 meters around the nest sites: no forestry work, maintenance activities or logging during the breeding session (beginning of March to mid-August).
- Introduction of regulations on overhead wires and especially power lines and their operating conditions in the interests of large raptors.
- No licensing of wind turbines that are within 1000 meters of the nearest nest.
- Formulation of a national wind power plan to conserve important areas for species that are sensitive to wind turbines.
- Designation of areas with the highest concentration of Red Kites as European bird reserves.
- Soften the veterinary regulations on bait sites and on game carcase dumps to help carrion feeders.

Professional support

- Monitoring of the national territorial population at 6-yearly intervals.
- Regular checks on known nest sites by conservation authorities and NGOs, foresters and/or the *Centrale ornithologique*. It is important to pinpoint and mark up any gradual, creeping changes to habitats.
- A 'Red Kite' working group should be set up, comprising the *Centrale ornithologique*, the nature and forest administration, conservation authorities and NGOs, farming consultants and representatives of the wind energy and electricity supply industries etc., for the exchange of information and for the scientific supervision of measures in the areas concerned.

Budget

It is not realistically possible to quantify the costs of a national Red Kite species protection programme, focused on current population status. The most important aspect of the programme is to maintain and implement the protective regulations designed to benefit the Kites themselves, their nest sites and their environs, and to eliminate, or at least regulate for, potential sources of danger.

Staff salaries and attendant costs have to be added to the budget.

The main current priorities are to monitor the territorial population at 6-yearly intervals, and to conduct an annual monitoring of most of the known territories.

Monitoring of the territorial population at 6-yearly intervals, fieldwork and evaluation:

10 000 €

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Appendix 1:

Distribution range of the red kite *Milvus milvus* (from Aebischer, 2009)



Appendix 2:

The ‘territorial season population’ of the Red Kite *Milvus milvus* in Luxembourg – Monitoring from 2009 and comparisons to 1997 and 2003 – Identification of most important distribution ranges

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Zusammenfassung

Die Erfassung der „territorialen Saison-Population“ des Rotmilans *Milvus milvus* von 2009 ergab für Luxemburg insgesamt 66 Reviere und eine landesweite Dichte von 2,6 Revieren/100 km². Im Vergleich zu den vorigen Erfassungen von 1997 und 2003, ist der Bestand in der Periode 1997-2009 um 43% (20 Paare) angestiegen. Dabei kam es nicht zu einer wesentlichen Arealausbreitung, sondern die Siedlungsdichte stieg in den ohnehin im Landesvergleich am dichtesten besiedelten Gebieten, etwa im Osten und auf dem Öslinger Hochplateau. Regional liegen die Höchstdichten 2009 im Osten bei 6,8 und auf dem Öslinger Hochplateau bei 6,0 Revieren/100 km². Die höchste lokale Siedlungsdichte wurde für die Umgebung der offenen Müllhalde von Flaxweiler (100 km²) errechnet: 9 Reviere/100 km². Aus Naturschutzgründen sind die Kernräume des Rotmilans in Luxemburg festzulegen und als Schutzgebiete nach der Vogelschutz-Richtlinie 79/409/CEE auszuweisen.

Résumé: La « population territoriale en saison de reproduction » du Milan royal *Milvus milvus* au Luxembourg – Prospection de 2009 et comparaisons avec 1997 et 2003 – Identification des régions de distribution les plus importantes

La prospection de la « population territoriale en période de reproduction » du Milan royal *Milvus milvus* en 2009 a montré un total de 66 territoires pour le Luxembourg et une densité nationale de 2,6 territoires/100 km². En comparaison avec les prospections antérieures de 1997 et 2003, l'effectif de la population a augmenté dans la période 1997-2009 de 43% (équivalent à 20 couples). L'aire de distribution n'a pas changé fondamentalement, mais la densité a augmenté dans les régions du Luxembourg déjà les plus densément peuplées, tels l'Est et le plateau de l'Oesling : en 2009 la densité dans l'Est a été de 6,8 et sur le haut-plateau de l'Oesling de 6,0 territoires/100 km². La plus forte densité locale était notée dans les environs de la décharge à ciel ouvert de Flaxweiler (100 km²): 9 territoires/100 km². Conformément aux buts de conservation de la directive « Oiseaux » 79/409/CEE, les zones à haute densité du Milan royal sont identifiées afin d'être désignées comme Zones de Protection Spéciale.

Abstract: The territorial population of the Red Kite *Milvus milvus* in Luxembourg during the breeding season – Census of 2009 and comparisons with 1997 and 2003 – Identification of the most important regions of its distribution

During the 2009 breeding season, 66 territories of the Red Kite *Milvus milvus* were found in Luxembourg. The national population density was 2.6 territories/100 km². Since the first national census in 1997, the population of Red Kites has increased by 43% (corresponding to 20 territories). The distribution range of the species has hardly changed, however, in already previously densely populated areas, the numbers of

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territories have further increased. In the east of Luxembourg, the density reached territories/100 km² and on the plateau of the Oesling 6.0 territories/100 km². The highest density with 9 territories/100 km² was calculated for the area surrounding the open air dumping ground of Flaxweiler (100 km²). The regions with a high density of Red Kites were identified. For conservation purposes, these are proposed to become Special Protection Areas according to the birds' directive 79/409/CEE.

Introduction

The Red Kite is listed on Appendix I of the birds' directive 79/409/CEE and listed as SPEC2 (*Species of European Conservation Concern*), making it a species whose main distribution territory is concentrated within Europe and whose nature conservation status is classified as "unfavourable" (BirdLife 2004). As such, for conservation purposes, it is imperative even in Luxembourg that the populations be monitored regularly in order to counteract any negative developments. In addition, in accordance with the Habitats Directive 92/43/CEE, since 1997 populations of both kite species have been recorded every six years. In 2009, the Field Ornithology Working Group of the Lëtzebuerger Natur- a Vulleschutzliga (LNVL) charted the 'territorial season population' of the Red Kite *Milvus milvus* and the Black Kite *Milvus migrans* (Biver & Conzemius 2010) in Luxembourg for the third time.

Given that the field work in Luxembourg used the same methodology for the individual counts (Norgall 1995), the data obtained can be compared and allow statements to be made as to the development of the population between the surveys in 1997, 2003 and 2009. The results of the three instances of monitoring should enable the Red Kite density of the various regions of Luxembourg to be examined and the core distribution zones for Red Kites in Luxembourg to be determined.

Method

Details on the method used for field work and for evaluating the data are outlined in Conzemius (1998). The chosen method is known as monitoring of the 'territorial season population'. The goal is not to monitor the breeding pairs, but to chart all territories occupied during mating and breeding seasons. The territorial season population includes breeding and territory-holding pairs, as well as territorial solitary birds (Table 1). Adult solitary birds without a territory, second-year and sexually immature birds or mixed groups of summer visitors should be identified, but not withheld for evaluation.

Table 1: Structure of the Red Kite population in spring

Territorial season population			Non-territorial birds	
Breeding pairs	Territory-holding pairs	Territorial solitary birds	Summer visitors (groups, solitary birds, second-year birds or adults)	Migrants

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In a simplified form, the following definitions apply for the subdivisions of the territorial season population:

- **Breeding pair:** The minimum condition was the observation of a brooding adult bird or a young bird that recently left the nest in the vicinity of a breeding spot (May-July),
- **Territory-holding pair:** The ascertainment of a pair in the occupied territory at least twice during the mating season displaying territorial behaviour (March-April) and/or with suspected breeding behaviour during breeding season in connection with a potential nesting area,
- **Territorial solitary bird:** The observation of an adult bird at least twice during the mating and breeding season in a breeding territory identified in previous years.

The aim was to record the national population, so the investigated region comprised all of Luxembourg with an area of 2,586 km². The total investigated region was divided into various sub-regions with several people responsible for each.

The period from 1 March to 15 July was determined for charting the territory. This period was split into several sections:

- a. **Mating period** from 1 March to 20 April, split into three sections,
- b. **Breeding period** from 21 April to 20 May – confirmation of the territories with breeding pairs,
- c. **Rearing period** from 21 Mai to 15 July – confirmation of the territories with breeding pairs.

The main focus was on the mating period during which three inspections of the entire research site took place.

Thanks to the two previous monitoring instances in 1997 (Conzemius 1998) and 2003 (Lorgé 2006), there was already a good level of knowledge on the distribution and population of the Red Kite in Luxembourg prior to the monitoring in 2009.

In order to potentially initiate targeted protection measures for the Red Kite in Luxembourg, the different regions of Luxembourg have to be inspected as regards their territory density. The core Red Kite zones have to be identified and differentiated from uninhabited regions. Conzemius (1998) defined nine different zones in Luxembourg so as to compare the density ratios and draw conclusions regarding the habitat requirements of the Red Kite. Municipal boundaries were used to define the limits of these zones, as land use was statistically recorded at a municipal level in Luxembourg at that time.

Although these zones defined by municipal boundaries were well suited for the analysis at that time, minor changes to the border delineation were necessary following the third monitoring. Additionally, GIS programmes now make it possible to use environmental variables across the entire area, which can be readily combined with all possible research sites. These mean that municipal boundaries, which are not always well suited to the limitation of territories or density centres, can be disregarded, while other, more suitable border delineations for the relevant situation can be chosen.

EFOR (1994) established a natural landscape classification for Luxembourg into growth districts based on climatic, topographic, geological, pedological and landscape-based parameters. However, this division into 18 growth districts is too detailed for a large bird species like the Red Kite. In addition, information on settlement density is only meaningful when the research site within the research regions is sufficiently large (Kostrzewa 1985). Therefore, the results from the three surveys were placed on top of one another

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cartographically, using ArcView (GIS software) to create a proposal for species-related zones. For the creation of sites within the zones defined for the Red Kite several growth districts with similar conditions were merged, but also, where necessary, smaller boundaries adapted according to the Red Kite incidences. This resulted in 11 defined zones for the Red Kite in Luxembourg (Map 2). The territories were matched to the different zones and densities in territories were recorded per monitoring and per zone.

Where there is a spacial concentration of breeding spots and feeding grounds for the Red Kite, in contrast to surrounding regions, this is a density centre, and thus also a potential protection area for this species. As such, the density centres within the more densely inhabited zones need to be identified. A range of software products is available that are well suited to modelling the distribution of species, which can illustrate the boundaries of the most suitable territories for the Red Kite. The software product in this instance was Maxent, which is freely available software product and used for predicting the potential distribution (habitat modelling) of animal and plant species on the basis of specific distribution information and certain environmental factors. Knowledge about the distribution of the Red Kite and understanding of its demands on its habitat are important when suitable protection areas are to be created (Biver et. al 2010).

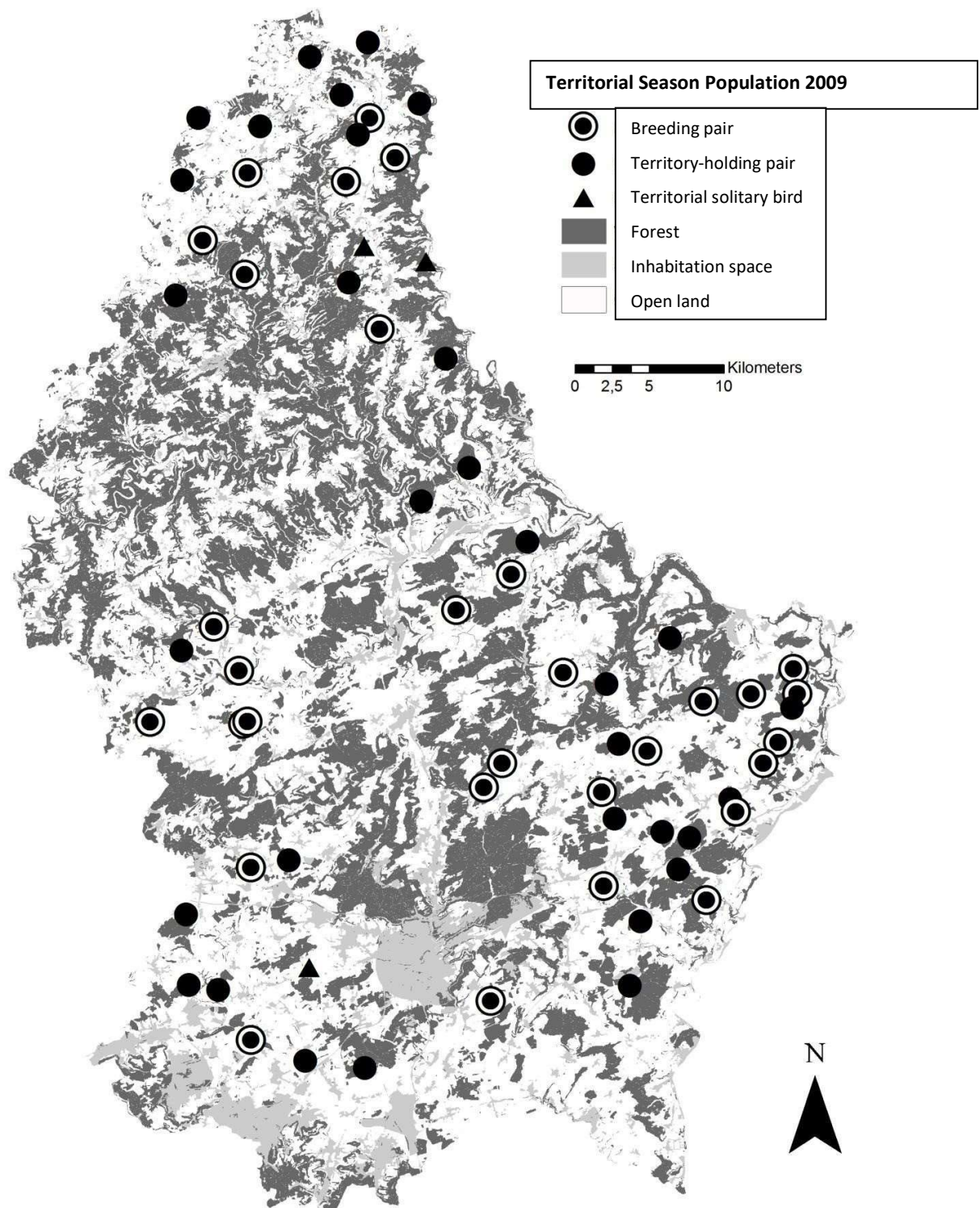
Georeferenced data were needed as input variables for Maxent; this included both distribution information about the Red Kite as point information (X and Y coordinates, here in Gauss-Krueger), and also suitable environmental variables (e.g. land use, geology, climate factors such as precipitation and temperature, information about the altitude etc.). The construction of the model using Maxent was carried out on the basis of the maximum entropy method (Steven et al. 2006). The software created a map with grid squares (1 km²), which depicted the probability of the incidence of a Red Kite in each grid square for the whole of Luxembourg, and also provided additional statistical interpretation aids. Data preparation and visualisation of the results was performed using ArcView.

Results

Monitoring 2009

The monitoring of the territorial season population of the Red Kite revealed a total of 66 territories. This relates to a Red Kite density of 2.6 territories/100 km² (T/100 km²) for Luxembourg. Map 1 illustrates the distribution of the territories of the Red Kite in Luxembourg in 2009. The distribution of the territories is not uniform. As in the previous monitorings the high plateau in the north of the country and the east of Luxembourg particularly stand out as Red Kite density centres. The Attert region and the southwest are, however, also well inhabited.

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Map 1: Distribution of the Red Kite territories in Luxembourg in 2009.

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Table 2 represents the breakdown of the recorded territories according to the criteria mentioned above. This clearly shows that in most cases (95%) of the territories the pair was accounted for through territory-indicative behaviour or through brooding or breeding attempts.

Table 2: Conclusion of the Red Kite population charting 2009

	N	%
Breeding pairs	31	47%
Territory-holding pairs	32	48%
Territorial solitary birds	3	5%
Total	66	100%

Territories with evidence of breeding (nesting finding)

In 31 territories (47%) an occupied nest during breeding season or young birds during rearing season could be observed. Overall, however, 2009 appears to have been a relatively bad breeding year for Red Kites (as for other birds of prey). Several employees reported abandonment of nests that were still occupied in May, even in well-known breeding territories. However, the breeding success was not observed in all territories as this was not the primary objective of the monitoring. As such it cannot be quantified for 2009.

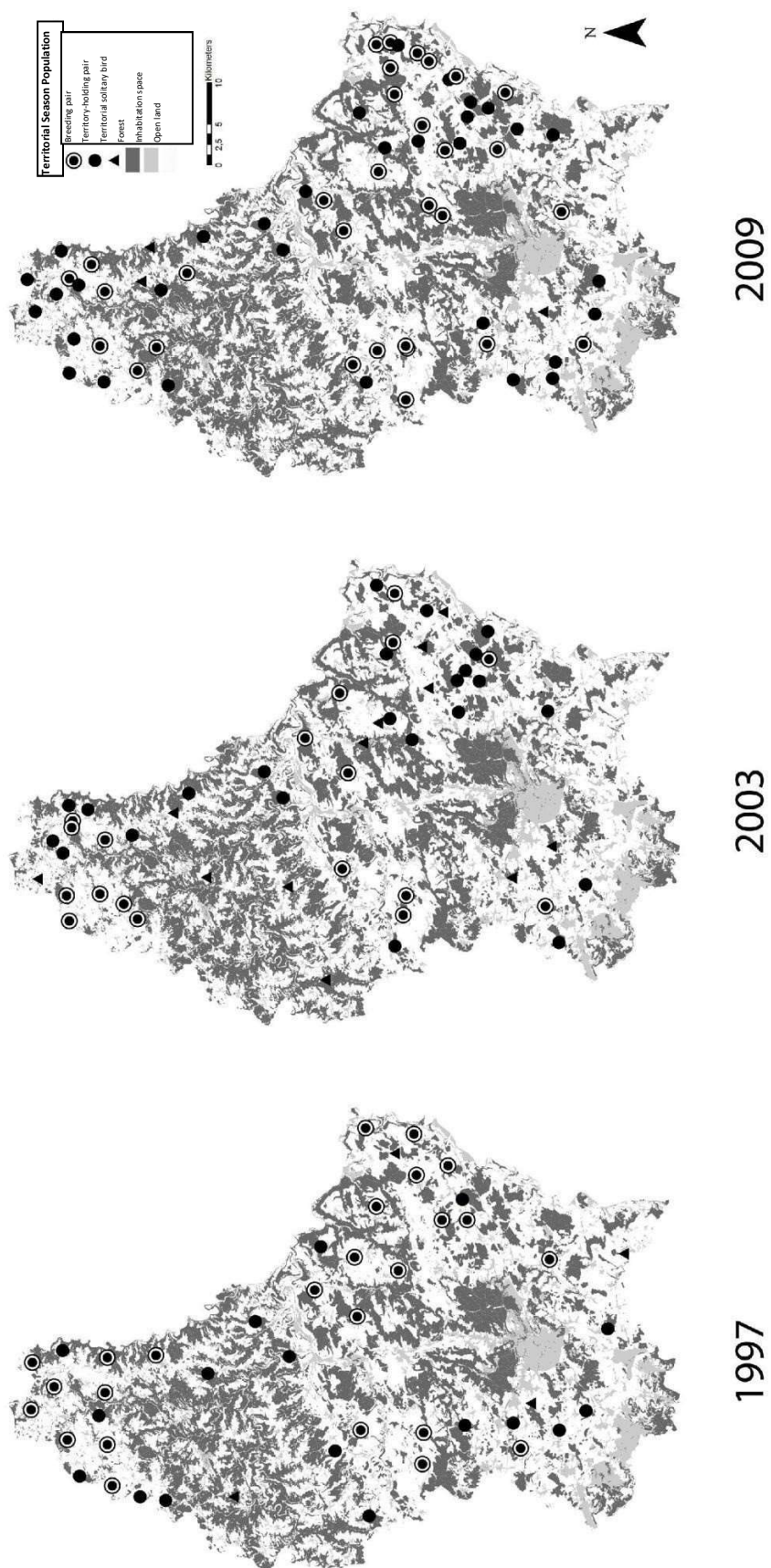
The territory centres and nests of the Red Kites in Luxembourg were largely at a distance of 1000 m or greater to the next neighbour (Conzemius 1998, Kiefer 1998, Lorgé 2006). Between Rippweiler and Schwebach, however, two occupied Red Kite nests at a distance of 300 m apart were found. One of those nests had been abandoned, while the other pair was breeding successfully (Paler – personal communication).

Territories with territory-holding pairs

In a further 32 territories (48%) a territorial Red Kite pair was found. Since the methodology did not call for nest searching and breeding confirmation, breeding could not be excluded for the territory-holding pairs, so not all pairs were territorial non-breeders. Additionally, the relatively early appearance of leaf shoots in 2009 made nest searches considerably more difficult, which could partially explain the relatively high number of territory-holding pairs in comparison to the breeding pairs. In several of those territories there was suspected or confirmed breeding activity in previous years.

Territorial solitary birds

In three cases there were observations of territory-indicative behaviour with solitary birds. It is possible that these three birds belonged to territory-holding pairs or even breeding pairs. In all three cases these had been occupied breeding territories in previous years.



Graph 1: Development of the distribution of the Red Kite between 1997, 2003 and 2009

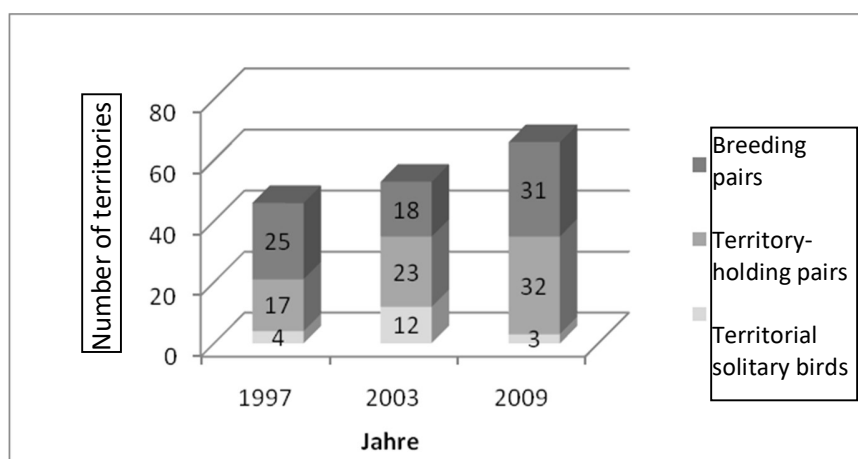
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Additional observations of solitary birds did not comply with the minimum criteria and were therefore not maintained for the evaluation. For example, this was the case for an immature individual (second year) in Canach during the breeding season, or with several observations of an adult solitary bird in Frisange that had been attributed to a territory-holding pair in Lorraine.

Comparisons between the monitorings in 1997, 2003 and 2009

The distribution of the Red Kite within Luxembourg did not change in principle between the three monitorings. On the contrary, the distribution of the Red Kite territories can be considered more or less constant. The main distribution areas were and remain the high plateau in the north of the country, the eastern part of Luxembourg, the southwest and the Attert region. Open, agriculturally active regions of Luxembourg that are interfused with small forest areas tend to be occupied. In contrast to this forest-rich regions, e.g. “Grünwald”, central Oesling, the Mamer-Eisch valley, and also urban centres of human settlements such as Luxembourg City and its environs, the Minette region, lower Alzette valley and Nordstad tended to be avoided.

Graph 2 illustrates the increase in the Red Kite population between the monitorings of 1997, 2003 and 2009: in 1997 there were 46 territories, 2003 already saw 53 territories (+15% compared to 1997) and in 2009 66 territories (+25% compared to 2003). This corresponds to an increase between 1997 and 2009 of 20 territories or 43%.



Graph 2: Development of the territory population of the Red Kite between 1997, 2003⁴ and 2009

For Luxembourg, the Red Kite territory density rose from 1.8 in 1997 to 2.0 in 2003, then to 2.8 T/100 km² in 2009. However, the Red Kite population rose primarily in the already more densely occupied zones, particularly in the eastern part of the country and in the high plateau region.

⁴ Erratum: In the text on the monitoring of the “Territorial Season Population” of 2003 in Lorgé (2007) several errors were recorded in the result data. The correct results in the simultaneously published maps were used for this article.

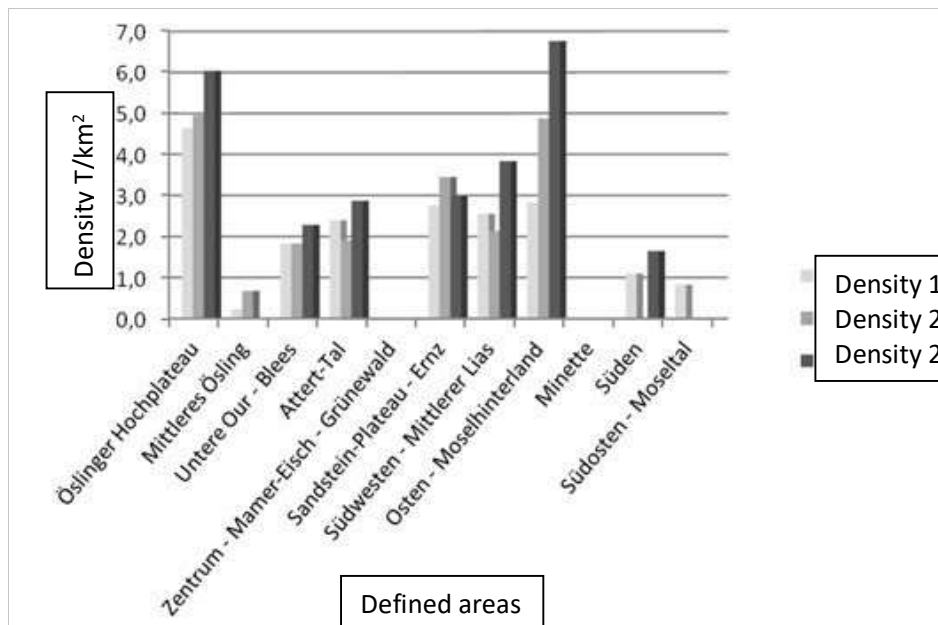
Development of the settlement density and identification of the density centres

In the evaluation of the breeding distribution of the Red Kite in the 1970s, Peltzer (1977, 1978, 1981) defined the main distribution area of the Red Kite in Luxembourg. Conzemius (1998) and Lorgé (2006) indicated different territory densities of the Red Kite between the different regions of Luxembourg. The distribution of the Red Kite is in no way uniform, as illustrated in Map 1 and Graph 1; rather there are density centres.

Map 1 shows that the highest densities in 2009 were found in the plateau region in the north and the eastern Moselle region. Moreover, the southwest, Attert-tal and the sandstone plateau exhibited above-average densities for Luxembourg.

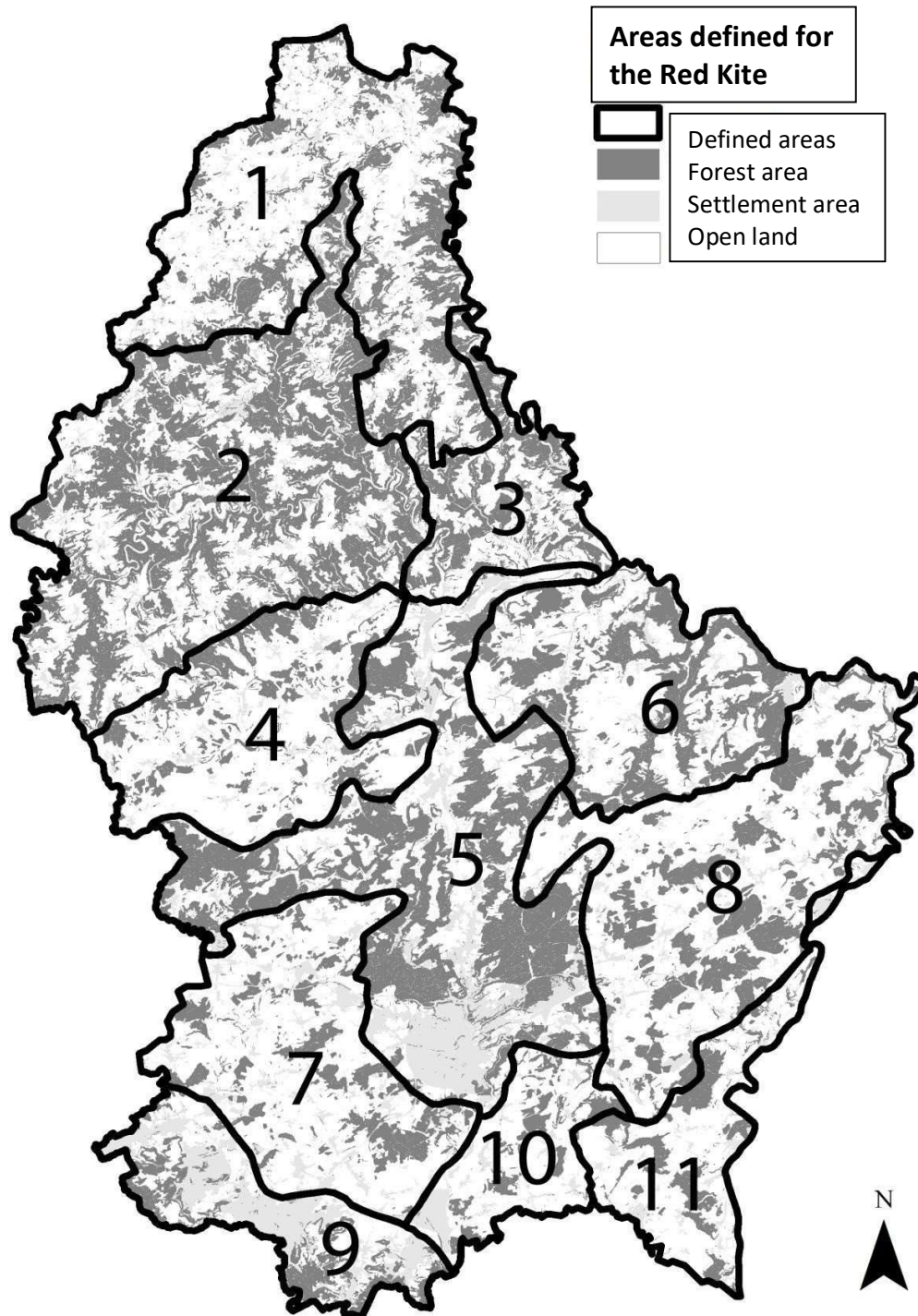
In 1997 and 2003 the high plateau region in the north had the highest densities with 4.6 and 5.0 T/100 km², and then reaching 6.0 T/100 km² in 2009. The greatest increase was in the eastern Moselle back country: in 1997 there was already an above-average density of 2.8 T/100 km², then rising in 2003 to 4.9 T/100 km² and in 2009 6.8 T/100 km². This was the highest density of the Red Kite that was ever determined in any area of Luxembourg. Within this area there were even locally higher densities, e.g. 7 T/100 km² as described in Kiefer (2010). The highest density in 2009 was found around the rubbish dump in Flaxweiler: within a radius of 5.6 km around the rubbish dump, which corresponds to an area of 100 km², there were 9 T/100 km².

The density development of the Red Kite in all areas is illustrated in Graph 3. This makes it clear that not all areas saw the same increase in the population density over the previous monitoring and that in individual cases there were even declines. Lorgé (2006) already highlighted the similar variety in developments.



Graph 3: Density development in the defined areas for the Red Kite.

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Map 2: The defined areas for the Red Kite in Luxembourg.

1 Eastern high plateau, 2 Central Oesling, 3 Lower Our - Bleeps, 4 Attertall, 5 Centre – Mamer – Eisch – Grünwald, 6 Sandstone Plateau - Ern, 7 Southwest – Central Lias, 8 East – Moselle back country, 9 Minette, 10 South, 11 South East – Moselle valley

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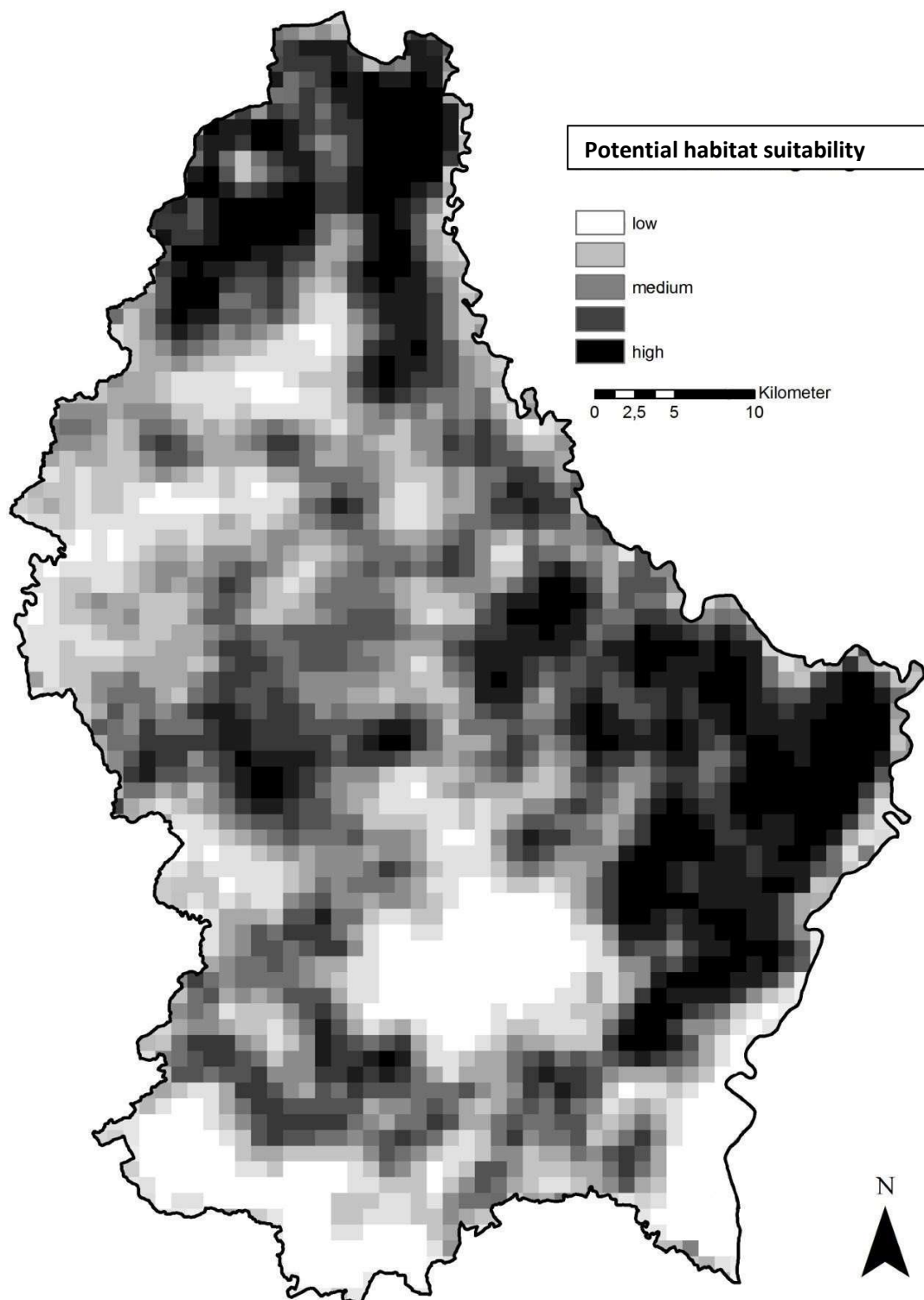
The habitat analysis showed that almost all more densely inhabited areas of Luxembourg for Red Kite had a grassland proportion of over 40% of the area, and even an overall agricultural proportion of over 60%. In light of these figures it is inexplicable why the southeast with 60% agriculture is not inhabited by Red Kites. In particular the Filsdorf-Burmerange-Trintingertal region would provide sufficient nutritional basics.

Table 3: Development of the territory density and area proportion of the land use within the defined areas (Area data derived from: Minitère de l'Environnement 1999).

Area defined for the Red Kite	Area in km ²	Density in T/100 km ²			Area proportion			
		1997	2003	2009	Forest	Grass land and farml and	Grassland	Other
High plateau region	322	4.6	5.0	6.0	30%	63%	41%	7%
Central Oesling	443	0.2	0.7	0.0	51%	40%	24%	9%
Lower Our – Blee	109	1.8	1.8	2.3	44%	45%	28%	11%
Attert	208	2.4	1.9	2.9	24%	69%	46%	7%
Centre - Mamer-Eisch – Grünewald	407	0.0	0.0	0.0	46%	34%	20%	20%
Sandstone plateau – Ern	217	2.8	3.4	3.0	40%	52%	33%	8%
Southwest - Central Lias	234	2.6	2.1	3.8	20%	67%	43%	13%
East – Moselle back country	317	2.8	4.9	6.8	28%	62%	40%	10%
Minette	118	0.0	0.0	0.0	27%	28%	20%	45%
South	91	1.1	0.0	1.6	20%	64%	40%	17%
Southeast – Moselle valley	120	0.8	0.0	0.0	22%	60%	25%	18%

Although Red Kites can be observed almost nationwide, only six of the 11 areas are inhabited with a certain degree of regularity. The area of these six areas adds up to 1498 km² and represents 58% of the country's surface area. The areas of "East-Moselle back country" and the high plateau region represent just 25% of the total country area, but contain around 77% of the Red Kite territories in Luxembourg.

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Graph 4: Representation of the Red Kite core areas in Luxembourg, created with Maxent

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Graph 4 illustrates the habitat suitability of each grid square of 1 x 1 km in Luxembourg for the Red Kite. Density centres in the five most important areas are clearly shown, and the density centres in the “East – Moselle back country” and in the high plateau area in the north are particularly notable.

Discussion

Remarks on the population rise 1997 and 2009

Comparison of the surveys from 1997, 2003 and 2009 enables us to evaluate the population development and distribution of the Red Kite in the past 12 years in Luxembourg. The population development in the previous decades can be read in Peltzer (1981) und Conzemius (1998). The increase between the monitorings from 1997 and 2009 amounts to 20 territories or 43%.

The good state of knowledge from the monitorings from 1997 and 2003 undoubtedly had a positive effect on the number of territories recorded in 2009. However previous monitorings were performed with similar outlay and the same diligence as the monitoring in 2009. Additionally, the observer feedback entered in the LuxOr file confirms a quantitative increase in Red Kite numbers in recent years, and in a long-term study between 1991 and 2008 in a sub-section of eastern Luxembourg, Kiefer (2010) also reported an increase for the same period.

Furthermore, similar population increases for the Red Kite are also being determined in the neighbouring regions of Wallonia (Paquet, personal communication) and Saarland. The population information for Wallonia is based on atlas work from 2003-2008, and accounts for 150-200 breeding pairs (Jacob et al. in press). In comparison with the bordering eastern cantons of Wallonia, described in Defourny et al. (2007), the population in the high plateau region reaches similarly high densities and belongs to a cross-border density centre for the species. In Saarland the monitoring of the “territorial season population 2009-2010” produced an interim figure of around 60 territories, and the trend in recent years was slightly positive (Süßmilch, personal communication), compared with information from the atlas (Bos et al. 2005). For Rheinland-Palatinate no recent region-wide monitoring is available. The population is estimated at 600 breeding pairs (Dietzen, personal communication). For Lorraine, the data basis is incomplete: based on region monitoring (Thiollay et al. 2004) the population was estimated at around 100 breeding pairs at the start of the 2000s. It is presumed that the population has continued to decline in recent years (Malenfert, personal communication), similarly to the whole of northeast France (LPO 2010). For declines in France and also Lorraine the causes are often cited as poisoning by rodenticides (in particular Bromadiolon) and also persecution. Thus, we find in the larger region around Luxembourg trends contrary to those observed in Europe for some time (Aebischer 2009, BirdLife 2004).

In trying to explain the population growth in Luxembourg, it seems as if the Red Kite might paradoxically benefit from the intensification of agriculture. In fact, in recent years Red Kites in Luxembourg have systematically been observed searching for food on freshly worked fields, e.g. following preparation for corn planting at the start of the breeding season (April). However corn fields, and also other cultivated crops such as winter cereals and rapeseed in May, June and July, offer no food source as they are effectively closed off to foraging Red Kites during the rearing season. This is confirmed in a variety of habitat use studies (Gelpke et al. 2009, Stubbe et al. 2009).

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However, Red Kites are often observed foraging on silage areas during and in the days following mowing (own observations). This new source of food extraction supplies invertebrates, dead rodents or unlucky ground breeders in large quantities, and these remain available throughout the whole breeding season. Although the grassland is becoming more species-poor through silage use and phytosanitary measures (Blver 2008), on the other hand larger grassland areas are regularly open for the rearing season from May, and therefore food sources are more accessible for the Red Kites than hay meadows with late mowing programmes. As such, Voscamp and van Rijn (2009) report a regional decline in the Red Kite population following larger extensification programmes and closure or late mowing of wet areas surrounding St. Vith, the density centre of Red Kite in eastern Belgium. This is presumably due to lower food availability. Pfeiffer (personal communication) explains that, in eastern Germany, the Red Kite used to benefit from grassland use in which smaller grassed areas were mown for direct use. Since rapeseed fields and winter wheat replaced grassland use there has been a decline (Stubbe et al. 2009). These reports support the assumption that silage areas in relatively small-scale open land areas, primarily grassland interfused with farmland, have a positive effect on the food conditions of the Red Kite, so that food sources are constantly available from the breeding to the rearing period. This assertion is substantiated by habitat use studies (Nachtigall 2010). Yet, grassland, and in particular livestock pastures, appear to remain important to the Red Kite, as already described by Conzemius (1998) as land that is almost entirely farmland is rarely inhabited.

As an opportunistic feeder and scavenger the Red Kite uses open rubbish dumps in Flaxweiler and Diekirch, and also a composting facility in Mamer: organic waste and increased rodent supplies offer additional food sources. Some birds have even been observed covering ground of more than 8 km (e.g. between the Flaxweiler rubbish dump and the nest in Brouch) to bring food back to the nest. How important rubbish dumps for the population development of Red Kites could in part be is illustrated by examples of closures of rubbish depots in Lower Saxony (Gelpke et al. 2009, Klein et al. 2009).

Red Kites have been increasingly sighted in rural regions on the edge of villages, around farms and even over gardens searching for food. This indicates a redevelopment of living spaces and, with it, an increase in food supplies, possibly however only due to temporary food scarcity in open land. Voscamp und van Rijn (2009) confirm this development: in eastern Belgium built-up areas, and particularly farmsteads, are some of the most typical food habitats in addition to the Greenland important to Red Kites.

Moreover, illegal persecution appears to have reduced throughout the country, as instances or suspicion of shooting or poisoning are very rare, although still severe. That said, the decline in persecution has undoubtedly contributed toward population growth.

Without additional investigations into habitat use during breeding season, population ecology parameters such as breeding success (Defourny et al. 2007, Kiefer 1998), survival rate and settlement distance or area of origin of the breeding birds, further causes for the population development in Luxembourg cannot be identified. It is also unclear whether and to what extent the Luxembourg population is based on migration from other regions in which a population surplus arose or the habitat worsened.

In this sense the interaction between Black and Red Kites, two species with a positive tendency in Luxembourg and similar habitat requirements, and also their population development, needs to be studied in greater detail.

Requirements for protecting the Red Kite

The maximum densities calculated for Luxembourg in East – Moselle back country and the high plateau in the north are still far from the population density reported by Nicolai und Mammen (2009) of 22 T/100 km² in the northern Harz foothills. Yet this is the highest known density in Europe, and therefore represents the density centre of the world population of Red Kites. The values of Luxembourg's density centres correspond more closely to the population densities calculated by Voscamp und van Rijn (personal communication) in the eastern cantons of Wallonia of around 9 T/100 km² (locally over 12 T/100 km²) and are therefore above the average density value for Germany.

In light of Europe's responsibility for the preservation of Red Kite populations, identification of density centres in Luxembourg are also important. The population growth in recent years in some countries and regions should not take away from the fact that in several other European countries worrying declines have been recorded (BirdLife 2004, Cardiel 2006, LPO 2010, Mionnet 2009). No country can deny the European "Red Kite" species protection programme, which also needs to be implemented in Luxembourg, even if the species appears temporarily not to be at threat. Six areas are regularly inhabited by Red Kites here: the total area represents 1498 km² or 58% of the total land area. Targeted measures in these areas of Luxembourg which are important for the Red Kite are called for. A complete designation of such a large part of the country as a bird protection area for the Red Kite would, however be almost impossible to implement. The two most important Red Kite core areas in Luxembourg, the "East – Moselle back country" and the high plateau region contain around 77% of our Red Kite territories, cover however barely 25% of the land area. Special protection measures and designations of bird protection areas should be carried out in the density centres in these two areas. Information about density centres of the Red Kite in the "East – Moselle back country" and the high plateau region can be incorporated into the identification of the most important ornithological zones of Luxembourg (Biver et al. 2010) and help to fill the gap in zone designations as bird protection areas pursuant to the Birds Directive 79/409/CEE, as already mentioned by (2007).

The investigations mentioned here with a six-year cycle will, however, not be sufficient to warn of short-term declining developments and to take quick actions to remedy this. For this reason, in particular the Red Kite density centres should be studied annually, as described by Kiefer (2010) for eastern Luxembourg. National monitoring of the population development should also belong to the national wildlife conservation programme "Red Kite".

To obtain better information on the habitat and space use during breeding season, to take targeted protection measures in Red Kite territories in Luxembourg and expand our knowledge on migratory behaviour, and to collect natural protection arguments for the habitats used by Red Kites over the whole year, a suitable telemetry programme (Meyburg & Pfeiffer 2009) should also be started in Luxembourg.

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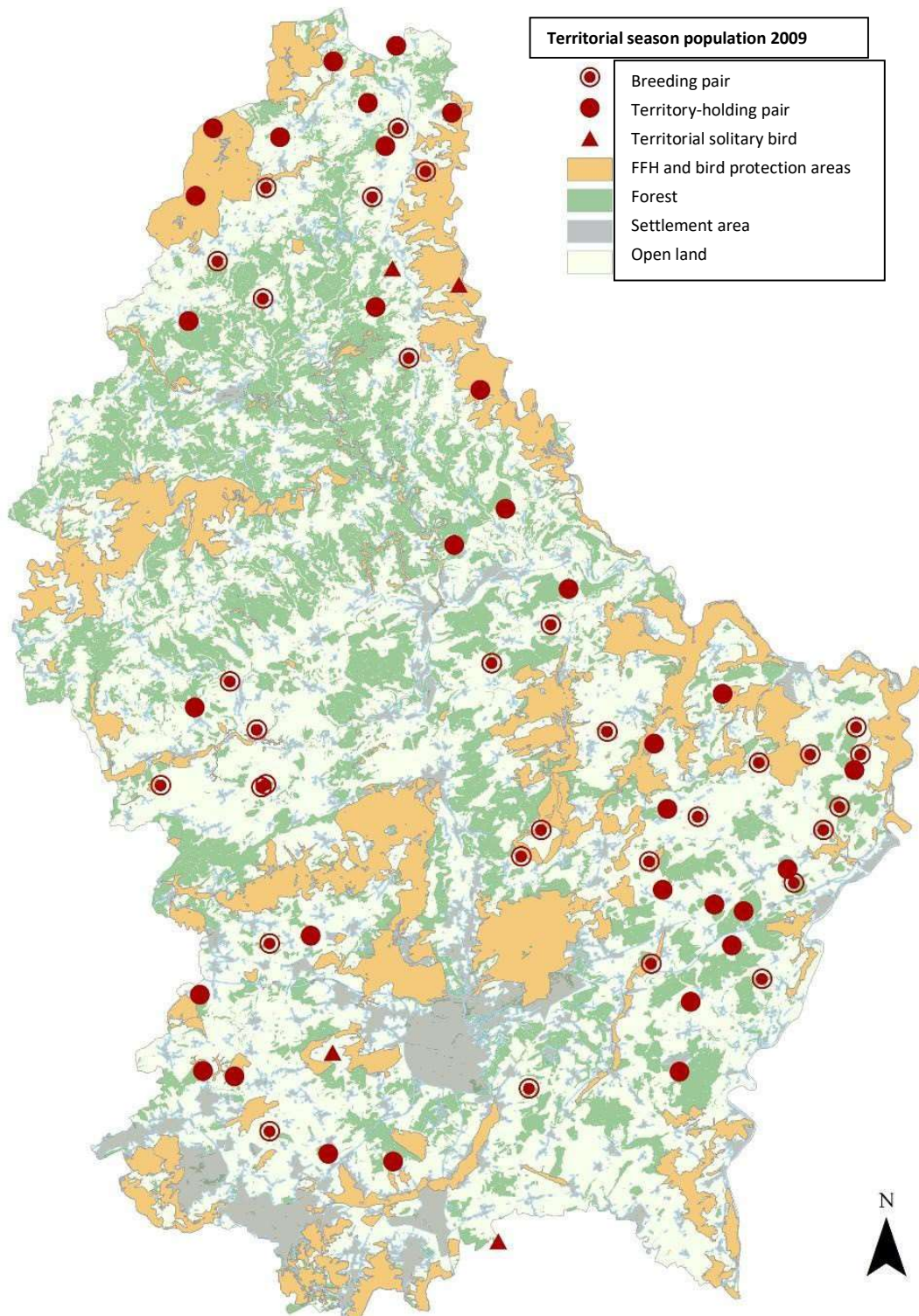
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Appendix 3:



Distribution of Red Kite territories with reference to the Natura 2000 network (FFH and bird protection areas)