SAVE
RADLEY LAKES

Report No. SRL/WE/003.1

A Comparison of the Biodiversities of ‘Lakes’ A to D and Lakes E and F

An appraisal of the effectiveness of restoring ‘Lakes’ A-D after infilling them with PFA; and an assessment of the conservation values of the Infilled ‘Lakes’, A to D and the Extant Lakes, E and F.

by

R M G Eeles

SUMMARY BIODIVERSITY COMPARISON REPORT

commissioned by

Save Radley Lakes

September 2005

A Comparison of the Biodiversities of 'Lakes' A to D and Lakes E and F

An appraisal of the effectiveness of restoring 'Lakes' A-D after infilling them with PFA; and an assessment of the conservation values of the Infilled 'Lakes', A to D and the Extant Lakes, E and F.

by

R M G Eeles

SUMMARY BIODIVERSITY COMPARISON REPORT

commissioned by

Save Radley Lakes

Summary: Few, if any, 'before and after' studies have been undertaken on the wildlife occurring on sites latterly infilled with Pulverised Fuel Ash (PFA). An opportunity for doing so with certain taxonomic groups (birds and plants) is possible in the Radley Lakes area and this is undertaken here. An assessment is also made between the wildlife 'values' of infilled PFA lagoons, which were once lakes, and nearby areas that are still lakes but which might be infilled with PFA at a later date. Results indicate reductions in species numbers of birds and plants after lakes are infilled with PFA, and virtually complete absences of certain species groups such as fish and fish feeders have occurred due to the loss of waterbodies. No evaluations of population sizes, before and after infilling, are possible due to a lack of data. Examination of current invertebrate species richness data for the infilled 'Lakes' (A-D) and the extant lakes (E and F) show that the conservation 'value' of the former is significantly lower than for the latter. This is apparent after restoration has been attempted.

September 2005

© SAVE RADLEY LAKES 2005

CONTENTS

© SAVE RADLEY LAKES 2005

A COMPARISON OF THE BIODIVERSITIES OF 'LAKES' A TO D AND LAKES E AND F

A summary report prepared by R M G Eeles B.Sc.(hons) Ph.D. with additional contributions by J Cartmell and J Killick

SUMMARY

Few, if any, 'before and after' studies have been undertaken on the wildlife occurring on sites latterly infilled with Pulverised Fuel Ash (PFA). An opportunity for doing so with certain taxonomic groups (birds and plants) is possible in the Radley Lakes area and this is undertaken here. An assessment is also made between the wildlife 'values' of infilled PFA lagoons, which were once lakes, and nearby areas that are still lakes but which might be infilled with PFA at a later date. Results indicate reductions in species numbers of birds and plants after lakes are infilled with PFA, and virtually complete absences of certain species groups such as fish and fish feeders have occurred due to the loss of waterbodies. No evaluations of population sizes, before and after infilling, are possible due to a lack of data. Examination of current invertebrate species richness data for the infilled 'Lakes' (A-D) and the extant lakes (E and F) show that the conservation 'value' of the former is significantly lower than for the latter. This is apparent after restoration has been attempted.

EXECUTIVE SUMMARY

- The conservation value of Lakes E and F far surpasses that of 'Lakes' A-D, according to the data currently available.
- Restoration of the latter site has not increased biodiversity to anything like its previous status. There has been a significant reduction in its value to wildlife.
- The infilling of Lakes E and F with PFA followed by restoration will not result in a level of biodiversity, or conservation value, to anything like their currently high condition.
- The loss of surrounding lakes (A, B, C, D, G, H, I, J and P) and associated habitats in the locality after being infilled with PFA raises significantly the importance of Lakes E and F to wildlife that has no other refuge left of such size and quality in the district.
- In the light of these statements, the wildlife in Lakes E and F cannot be replaced and restoration measures, after infilling Lakes E and F with PFA, will not provide habitats for the majority of organisms living there now, or for the many species that obtain essential resources from these lakes now that all other such habitats have been infilled with PFA.

INTRODUCTION

Habitat restoration after development requires scientific scrutiny, in order to ascertain the suitability and measure the effectiveness of mitigating measures to wildlife in both the immediately affected area and in the wider environment. This report addresses this issue, as RWE Npower has commissioned no such study. Ideally, the suitability and effectiveness of habitat restoration should be part of the overall mitigation strategy and be defined at the outset. Often, however, inappropriate restorations, such as the planting of non-native tree species or the planting of native species in unsuitable soils, are implemented as part of mitigating measures (*pers. obs*. In the locality) and are often imposed for the sake of 'appearance' or 'screening' rather than in terms of any possible

© SAVE RADLEY LAKES 2005

conservation benefits. Mitigation measures take the form of the creation of new habitats where old established ones previously existed. They are, invariably, of a different type to that which was there previously, are frequently smaller than they once were and are rarely placed in the same locations. In no instance is it possible to create a new habitat in the same successional and species condition as occurred previously. Restoration management relies heavily of two activities. Firstly, species introductions (i.e., trees and other plants plus soils/nutrients, in which they can grow) and, secondly, colonisation by species whose introduction would be difficult to facilitate artificially (e.g., invertebrates and vertebrates). Initially, colonisation is determined by the local occurrence of highly mobile generalist pioneer species with high fecundities[1]. Only later do more specialised species colonise a site and only after specific habitat requirements exist[2]. The whole successional and colonisation process on PFA lagoons is analogous to farmland restoration for the benefit of wildlife[3], with the disadvantages that the growing medium is nutrient poor, has a lower capacity for water retention and that there is no seed-bank. The importance of existing reservoirs of species in the locality, which may colonise PFA lagoons, cannot be over-emphasised[4].

A test case situation exists, for certain taxonomic groups, in the ‘Lakes’ A-D area where restoration measures (i.e. following infilling with PFA) can be compared with, firstly, the condition of the site prior to its loss and restoration and, secondly, the current condition of nearby unaffected sites (Lakes E and F) that are under threat from being infilled. The present condition of ‘Lakes’ A-D broadly reflect the likely ecological condition of Lakes E and F if they are infilled with PFA and subsequently restored. However, ‘Lakes’ A-D are unbunded and Lakes E and F will, as proposed, be bunded. This will have direct effects upon which species are able to occupy them. Hydrological regimes, for example, are likely to differ significantly between sites and the proposed loss of the majority of the trees surrounding Lakes E and F and the species dependant upon them (in contrast to their being mostly left around the borders of ‘Lakes’ A-D) will impact on the diversity of late successional species.

METHODS

This report evaluates the conservation ‘values’ of both sites (i.e., PFA ‘Lakes’ A-D versus the lakes that were once situated in the same locations) with respect to birds and plants, and between the invertebrate assemblages currently occurring in the Lakes E and F area versus those present in the ‘Lakes’ A-D area. I use data contained in the reports E1340R2 (2005)[5], E1340R3 (2005)[6] and SRL/WE/001.6 (2005)[7] plus a few recent species additions

---

1 Dennis R.L.H. & Shreeve T. (1991). Climatic change and the British butterfly fauna: opportunities and constraints. *Biological Conservation*, **55:** pp. 1-16. Shreeve T. (1995). Butterfly mobility. In, *Ecology and conservation of butterflies*: (Ed. A.S. Pullin), pp. 37-63. Chapman and Hall, London.

2 Southwood T.R.E. (1977). Habitat, the template for ecological strategies? *Journal of Animal Ecology*, **46:** 337-365. Southwood T.R.E, Brown V.K. & Reader P.M. (1979). The relationships of plant and insect diversities in succession. *Biological Journal of the Linnaean Society*, **12:** 327-348. Brown V.K. & Southwood T.R.E (1987). Secondary succession: patterns and strategies, in *Colonisation, succession and stability*. (Eds. A.J. Gray, M.J. Crawley & P.J. Edwards), pp.315-337. Blackwell Scientific Publications, Oxford.

3 Beckwith S.L. (1954). Ecological succession on abandoned farmlands and its relationship to wildlife management. *Ecological Monographs*, **24:** 350-376. Corbet S.A. (1995). Insects, plants and set-aside. In *Insects, plants and set-aside*. (Eds. A. Colston & F. Perring), pp. 45-51. Botanical Society of the British Isles, London.

4 Hanski, I. & Gilpin M. (1991). Metapopulation dynamics: A brief history and conceptual domain. *Biological Journal of the Linnaean Society*, **42:** 3-16.

5 Bioscan (UK) Ltd, *Radley Ash Disposal Site Lakes E and F Ecological Appraisa*l, Bioscan Report No: E1340R2 (July 2005).

© SAVE RADLEY LAKES 2005

to both sites. Data on water vole activity in the locality are also included. A site location map is given in Appendix 1.

RESULTS

Invertebrate species comparisons between 'Lakes' A-D versus Lakes E and F

An initial examination of the preliminary invertebrate data collected at 'Lakes' A-D, given in the report E1340R3 (2005), and that collected/collated by Save Radley Lakes[8], with some recent additions, show some notable differences. Perhaps of most note is the impoverished nature of the 'Lakes' A-D invertebrate fauna (Table 1).

It should be emphasised, at this stage, that, because of different sampling strategies[9] in the two locations, there will be omissions in the data sets. For this reason, and in order to make a more reliable (and fair) comparison, I have confined this analysis to invertebrate data only. Similarly, I am not using the numerical score given for *common* species (under this system a score of 1 is given to *common* species) as both data sets are incomplete, although as of 17th September 2005 the Lakes E and F data are much more extensive[10]. It is not possible to undertake comparative analyses between the moth data as none have been collected at 'Lakes' A-D (see below).

Table 1 Comparison of invertebrate faunas, by rarity class and total National Conservation Index (NCI) values[11] between Lakes E&F and 'Lakes' A-D

	NUMBERS OF SPECIES	
Rarity Classification	**Lakes E and F**	**'Lakes' A-D**
RDB1 = 64 points per species	0	0
RDB2 = 32 points per species	1	0
RDB3 = 16 points per species	3	0
Na = 8 points per species	5	0 (?)*
Nb = 4 points per species	16	3 (?)*
Local = 2 points per species	65	9
Total number of species	90	12
TOTAL NCI SCORE	**314**	**30**

*Note: The text in E1340R3 (2005) refers to there being 5 Na/Nb species without specifying which. Appendix 2 of E1340R3 (2005)[6] only lists 3 Nb invertebrates and these data are used in Table 1. The 'Lakes' A-D score, therefore, could be raised to 46 (ie, + 2 x 4) if the 'missing' Na/Nb species are in the more rare, Na, class.

---

[6] Bioscan (UK) Ltd, *Radley Ash Disposal Site (Phase 1 Area - Lakes A to D) Interim Ecological Report* Bioscan Report No: E1340R3 (August 2005).

[7] Eeles R.M.G., *Evaluation of the Wildlife and Habitats at Spinage's Field and Thrupp Close/The Bullfield*, Save Radley Lakes Report No: SRL/WE/001.6 (August 2005).

[8] For Lakes E and F; the majority of the data is given in both E1340R2 (2005)[5] and SRL/WE/001.6 (2005)[7]

[9] Light trapping and, I believe, pitfall trapping were not undertaken at 'Lakes' A-D.

[10] The, respective, NCI values including *common* invertebrate species are currently 601 for Lakes E&F and 126 for 'Lakes' A-D. Most of the data for Lakes E and F refer to species occurring in immediately adjacent habitats (which may also be lost) as well as the lakes. Lakes E and F have not been properly evaluated and it would be desirable to do so before an evaluation of the full impact of infilling with them PFA can be accurately assessed.

[11] Pond Action. (1992). Macro-invertebrate study related to Thames Water Utilities Limited (TWUL) reservoir development proposal: Phase 1 survey of the Ock and Thames catchments. A report for the National Rivers Authority and Thames Water Utilities Limited.

© SAVE RADLEY LAKES 2005

The NCI applies values for degrees of rarity. It is evident that, assuming the NCI[12] to be an accurate measure of 'conservation value', lakes E and F have much greater 'significance/importance' for invertebrates. (NCI values are likely to increase in both sites as, e.g. Hymenoptera (Aculeata) surveys are ongoing in both areas). It is not possible to use this system appropriately using past and present data for 'Lakes' A-D because the conservation status of individual species has not remained static over time and there are almost no invertebrate data for 'Lakes' A-D prior to their being infilled with PFA (there was a limited survey undertaken in 1998, i.e., after infilling commenced, by Oxon BRC listing 42 species). This is not the case with other taxonomic groups, however, (see below).

The information in Table 1 does not support the contention, by RWE Npower, that wildlife (invertebrates) is "flourishing" in the 'Lakes' A-D area[13] or that it, in any way, qualifies as a 'County Wildlife Site'[14]. What the data show is that one is dealing with two separate habitats, which have been sampled in different ways but at broadly contemporaneous periods. Entirely accurate comparisons cannot reasonably be made due to different sampling strategies and a fully compatible investigation is necessary before more robust conclusions can be made concerning conservation status or value of the, respective, sites to wildlife. Data on abundance are essential as no diversity statistics are calculable without it. On the basis of the current NCI analysis (see also below) there would be no justification in designating the 'Lakes' A-D area as a 'Wildlife Site' as has been suggested by BioScan (E1340R3 (2005)[6]). The data are not available with which to support such a designation, and if a designation were to be made on the basis of the current data it would make a mockery of the whole process.

Alpha diversity measurements

It is currently not possible to make direct comparisons between the statistical (alpha) diversities of 'Lakes' A-D and Lakes E and F, due to a lack of any abundance data in the former area and with respect to most taxonomic groups in both locations. However, my experience[15] leads me to conclude that some observations can be fairly given with respect to alpha diversities at the two sites. Moth species and abundance data, collected between 2003 and 2005, are available for the west side of Lake F (Bullfield Lake). The composition of the moth fauna contains a sizeable component from the Lakes E and F sites, in my opinion. This site has a high alpha diversity[16] of 40, which is significantly higher than the national British average[17]. It is also a local 'stronghold' for Britain's fastest declining moth[18],

[12] Although NCI scores may provide a mechanism for statistical comparisons, between sites, it should realistically be regarded as an aid in evaluating 'conservation value' and should not be interpreted as an absolute measure. It is not a substitute for alpha diversity indices, which are not possible to calculate without abundance data.
[13] Richard Frost (RWE Npower) private communication (September 2005).
[14] Eric Hobson (RWE Npower) private communication (August 2005).
[15] The author's doctorate is on moth ecology and it contains extensive evaluation and application of diversity statistics in a range of habitat types. Eeles R.M.G. (1997). *Abundance, diversity, community structure and mobility of moths in farmland*. Unpublished PhD thesis, Oxford Brookes University.
[16] Fisher, R.A. Corbet, S.A. & Williams, C.B. (1943). The relation between the number of species and the number of individuals in a random sample of an animal population. *Journal of Animal Ecology*, 12: 42-58.
[17] Barlow H.S. & Woiwod I.P. (1990). Seasonality and diversity of macro-Lepidoptera in two lowland sites in the Dumoga-Bone national park, Sulawesi Utara. In, *Insects and the rainforests of South-East Asia (Wallacea).* (Eds. W.J. Knight & J.D. Holloway), pp, 167-172. The Royal Entomological Society of London.
[18] Parsons M.S., Fox R., Conrad K.F., Woiwod I.P. & Warren M.S. (2005). British moths: throwing light on a new conservation challenge. *British Wildlife*, **16:** 386-394.

© SAVE RADLEY LAKES 2005

the dusky thorn, *Ennomos fuscantaria*, and the only known breeding site, in Oxfordshire, for the waved black moth, *Parascotia fuliginaria*.

This value indicates good habitat quality of the sort one might expect in a nature reserve possessing high habitat diversity and complexity. My experience of sampling sites similar, in many respects, to the habitats occurring at 'Lakes' A-D (e.g., early successional habitats such as marginal areas, arable field boundaries and arable set-aside) leads me to conclude that alpha diversity is likely to be on the low side, approximating a value of between 10 and 20 depending upon whether or not moths are sampled on the PFA surface or in more wooded areas (Appendix 2). I fully accept that no moths have been collected at the 'Lakes' A-D site and acknowledge my conclusion requires scientific confirmation. My conclusion highlights the lack of abundance data for the majority of taxonomic groups and it is this information, above all other types, which is of most importance in the determination of any sites true ecological/conservation value. I cannot emphasise this strongly enough. None of the surveys to-date are adequate.

Plant species comparisons between 'Lakes' A-D versus Lakes E and F

A comparison of the current plant data (Figure 1) shows that species richness is highest at the Lakes E and F site. With the exception of a few aquatic species (*Chara* spp., to be confirmed) populations of most plants growing in the 'Lakes' A-D area, particularly those requiring lake or lakeside conditions, are reduced in number (as is their size in many instances) and/or impoverished in other ways (*pers. obs*. and see Appendix 3). There are a variety of reasons why this might be, but foremost amongst them are likely to be hydrological stress and the low nutrient status of PFA. A few notable species, such as marsh helleborines, *Epipactis palustris* (which may have been introduced) seem to benefit from growing in PFA. These will have habitat requirements matched by conditions occurring in the 'Lakes' A-D area. This need not necessarily mean anything other than that they have a high tolerance to dehydration or potentially polluting elements such as boron, lead, mercury and arsenic. Marsh helleborines are likely to be lost as succession proceeds.

There are three other orchid species in the 'Lakes' A-D area, including the bee orchid, *Ophrys apifera*, which, although present, is not listed in E1340R3 (2005)[6]. At least twice as many species grow around Lakes E and F. These are listed in SRL/WE/001.6 (2005)[7]. In addition, I am awaiting confirmation of the presence of the broad-leaved marsh orchid, *Dactylorhiza majalis*, on the isthmus between lakes E and F.

Examination of plant species density in PFA (Appendix 3 and *pers. obs*.), which can be very low, might indicate that absence of competition is also a significant factor in the occurrence of certain species. Without a local seed source originating from surrounding semi-natural habitats, it is unlikely that, without introductions, the flora currently present at 'Lakes' A-D would contain the numbers of species it currently does.

© SAVE RADLEY LAKES 2005

FIGURE 1: PLANT (AND BIRD) SPECIES RICHNESS

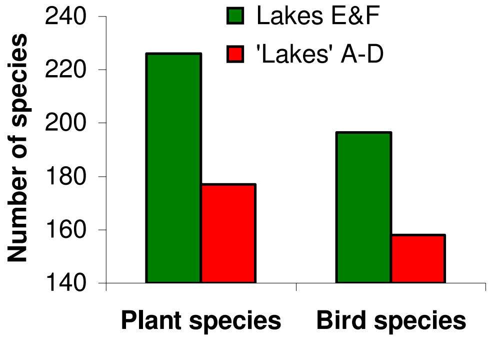

Figure 1: Numbers of plant (and bird, see below) species recorded in the Lakes E and F and 'Lakes' A-D areas. 'Lakes' A-D plant data from BioScan report E1340R3 (2005)[6], Oxon BRC plus two additional species (wild pear, Pyrus pyraster, and bee orchid) recorded by the author. 'Lakes' A-D bird data from Oxon BRC, OOS and David Guyoncourt (a handful of birds are listed in E1340R3 (2005)[6], but none are new site records). Lakes E and F plant and bird data from various sources cited in SRL/WE/001.6 (2005)[7], with a few recent additions from Ivan Wright, Jacqueline Wright, Basil Crowley, David Guyoncourt and the author.

Bird species comparisons between 'Lakes' A-D versus Lakes E and F

A comparison of the current bird data (Figure 1) shows that species richness is highest at the Lakes E and F site. Many species that no longer occur in the 'Lakes' A-D site are water dependant to a greater or lesser extent depending on the species in question.

Restored PFA lagoons in the Radley Lakes area ('Lakes' A-D) provide nesting sites for birds of conservation concern, using as an example here, lapwings, *Vanellus vanellus*. This is for two principle reasons. Firstly, lakes do not provide nesting opportunities for lapwings. Secondly, due to their being surrounded by fences, they do not suffer from excessive human disturbance. A possible third benefit to this species may be the reduced number of terrestrial predators due to a lack of freedom of access (except for in a few locations) to the site although this would need to be investigated further. The population of lapwings in the 'Lakes' A-D area also depends upon surrounding habitats for feeding[19], so restored PFA lagoons do not provide for the full range of requirements for this species, or at least, not for significant numbers of them. Without suitable feeding grounds, present in surrounding semi-natural habitats, there would be few lapwings occurring at 'Lakes' A-D, and hence limited breeding at the site. Lapwings can often be observed in good numbers in surrounding habitats and they also breed off-site. There is no evidence to suggest that lapwing abundance has increased locally due to the creation of PFA lagoons. The population of these (nesting) birds has demographically shifted, partly due to significant habitat losses in the locality. However, if clutch survival is lower in the 'Lakes' A-D area (see below) then the nesting opportunities created by restoration might have a high cost to lapwings in terms of a reduction in the average number of young being reared successfully.

[19] Lapwings require ready access to soil carrying an appreciable biomass of surface and sub-surface organisms. Snow, D.W.. & Perrins, C.M. (1998). *The Birds of the Western Palearctic* (concise edition), Oxford University Press, Oxford. Such conditions are not present or likely to occur over most of the 'Lakes' A-D area for some considerable time, if ever, unless additional and substantial restoration work is undertaken.

© SAVE RADLEY LAKES 2005

Research should focus on survivability of young lapwings and other ground-nesting birds on PFA lagoons before they can be described as a successful alternative habitat for these species. There is a question mark over whether or not young lapwings suffer from greater exposure and also greater visibility to predators where vegetation is sparser, which it is, overall, within the confines of the 'Lakes' A-D site compared to surrounding habitats. Research by the Game Conservancy[20] indicates lapwings are more vulnerable, and clutch survival is lower, in more exposed sites. Similar problems may be apparent with respect to other ground-nesting species, such as skylarks, *Alauda arvensis*.

Restored PFA lagoons do not provide any resources for species such as kingfishers, *Alcedo atthis*, and great crested grebes, *Podiceps cristatus*, (as well as mammals such as water voles, *Arvicola terrestris* and otters, *Lutra lutra*) which require open water bodies and fish on which to feed. These birds would normally be expected to nest next to such habitats. The logic of the argument that fish feeders can find no resources in lakes infilled with PFA is self-evident. The significance of open-water lakes versus PFA lagoons to, for example, overwintering waterfowl is similarly unambiguous. Over 47% of the bird species[21] that once inhabited the waterbodies and associated habitats in what are now 'Lakes' A-D PFA lagoons would find few if any resources there and have been displaced, many likely to have initially dispersed to Lakes E and F. Bird diversity (species richness) is much lower since infilling (Figure 2). In terms of abundance, far fewer individuals of most bird species recorded locally prior to the lakes infilling with PFA can exploit the energy impoverished (assessed as fish biomass in this context) PFA lagoons and there are no resources at all to be found on the bunded PFA lagoons (G, H, I, J and P) on the western side of the Oxford-Didcot railway line.

FIGURE 2: BIRD SPECIES RICHNESS AT 'LAKES' A-D

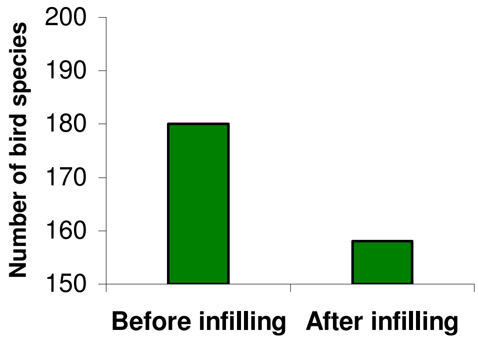

Figure 2: Comparison of bird diversity (species richness) before 'Lakes' A-D were infilled (data courtesy of Oxon BRC, OOS and Roger Wiggins) and after infilling began (data courtesy of Oxon BRC, OOS and David Guyoncourt).

[20] Cited in *British Wildlife* (2005). *Wildlife Reports*, **16:** 6, pp. 428.
[21] Calculated from data collected by David Guyoncourt (47.4% of total) and Roger Wiggins, Oxon BRC and OOS data (47.9% of total).

© SAVE RADLEY LAKES 2005

Water vole surveys, Spring 2005

Water vole[22], *Arvicola amphibious*, surveys were undertaken by Jo Cartmell and David Guyoncourt as part of BBOWT's vole monitoring scheme (Appendix 4). The waterbodies surveyed occur in the vicinity of 'Lakes' A-D (southern boundary) and Lakes E and F (south west). Activity was notably high west of the Oxford-Didcot railway line, indicating population recovery after years of local decline (*pers. obs.*). Longmead Lake is a newly created and recently colonised habitat and only one part of the site was suitable for water voles during the survey period. Evidence from field signs show that activity, and, by inference, water vole numbers are considerably lower along the Pumney Ditch, on the southern side of 'Lakes' A-D. Field signs were least evident in the stretch of the Pumney Ditch downstream of the PFA effluent outfall located at NGR SU 527 974 (Figure 3), which has also suffered a reduction in water quality and invertebrate diversity since 1999[23]. This waterbody, once populated by many thousands of fish, contains very few of them now (*pers. obs.).* In fact the only fish I have seen in this location since 1998 is a small dead perch, *Perca fluviatilis*, found on 13th September 2005. Whilst the water vole surveys cannot indicate the reasons for differences in apparent population sizes in different locations, it does highlight areas where populations are smaller and where 'recovery' is apparently slower.

FIGURE 3: WATER VOLE ACTIVITY

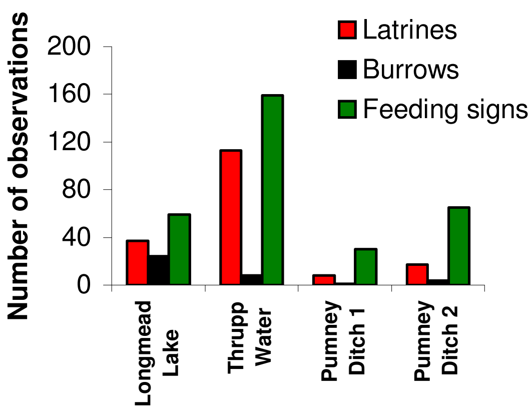

Figure 3: Measurements of water vole activity in the Radley Lakes area. A survey undertaken by Jo Cartmell and David Guyoncourt during Spring 2005. Note that Longmead Lake is a newly established small lake that has only recently been colonised, whereas Pumney Ditch is an old established brook. Colonisation of the latter would be expected to be more extensive.

---

[22] Water voles are present in Lakes E and F (Jo Cartmell, *pers. comm.*; *pers. obs.*) but are absent from 'Lakes' A-D (Bioscan report E1340R3 (2005)[6]).

[23] BMWP score in 1999 was 252, number of species was 51. In 2005 BMWP is in the range 49-55 with only 15 species. Cresswell Associates (2000). *Macro-invertebrate survey of the River Thames and Pumney Farm Ditch, Radley Ash Disposal site*. Report Number C306/99; Eeles R.M.G. (2005) *The Condition of the Pumney Stream: Results of Sampling the Pumney Stream in August 2005*. (Save Radley Lakes Report number SRL/WE/002.1, August 2005).

© SAVE RADLEY LAKES 2005

CONCLUSIONS

The evidence to date does not, in my view, support a claim that the wildlife in the ‘Lakes’ A-D area is “flourishing”. Bird and plant diversity (species richness) are reduced from their former states, and the NCI data demonstrate that invertebrate communities are richer and of far greater conservation significance in the Lakes E and F area. Unfortunately, it is not possible to measure changes in invertebrate diversity before and after infilling, as no detailed surveys exist for the preceding period but it was unlikely to have been as low as is currently measured. There are no comparable studies of invertebrate population sizes in the ‘Lakes’ A-D area, before and after infilling with PFA. Whilst it is self-evident that populations of, e.g., fish (which cannot swim in PFA) and fish feeders have undergone significant reductions, there is no documentary evidence to back this up.

The impact of infilling the ‘Lakes’ A-D area with PFA is measurable beyond the boundary fence. Indications are that invertebrate diversity and water quality have significantly declined in the Pumney Ditch (NGR SU 527 974) since infilling commenced[23] and water vole numbers (measured using field signs during research by surveyors trained by BBOWT) are apparently lower downstream of the outfall into Pumney Ditch than they are upstream or than at the other sites investigated in the locality.

The critical importance of Lakes E and F to a host of rare and more common species should be enough to guarantee their protection from infilling with PFA. Appropriate mitigation and compensation should take into account the whole development in the Radley Lakes area and should not be evaluated exclusively with reference to Lakes E and F. Therefore, rejecting the application by RWE Npower[24] to infill Lakes E and F with PFA and conserving the site in its current condition would ensure appropriate mitigation and compensation for the entire Radley Lakes area and not just within the immediate boundaries of this wildlife-rich habitat that is, at least, of countywide if not regional importance. The destruction of Lakes E and F will result is significant wetland habitat loss and there are no replacement habitats in the district of sufficient size and quality for displaced species to retreat to.

The attempt to demonstrate the benefits to wildlife of restoration of the ‘Lakes’ A-D area (E1340R3 (2005)[6]) has failed on the basis that the current species composition is demonstrably poorer than it used to be and is nothing like as species rich as Lakes E and F. Claims of substantial wildlife interest for ‘Lakes’ A-D after restoration are wholly unfounded and misleading. The infilled PFA lagoons in the Radley Lakes area are amongst the poorest habitats for species and numbers of individuals I have ever experienced[25]. The infilling of other lakes in the area with PFA has undoubtedly had a drastic and detrimental impact on populations of a host of species dependent upon waterbodies, many of them legally protected.

[24] RWE npower, *Application for approval of development of lakes E and F and for planning permission* … as detailed in the supporting *Environment Report* reference number ENV/019/2005 (June 2005).

[25] The author is a lifelong naturalist (and trained ecologist) who has been regularly visiting and researching the wildlife in the Radley Lakes area for over 25 years, as well as further afield.

© SAVE RADLEY LAKES 2005

Summary and Recommendations

The following summarises the conclusions and recommendations of this report:

- The conservation value of Lakes E and F far surpass that of ‘Lakes’ A-D according to the data currently available.
- Restoration of the latter site has not maintained the level of biodiversity to anything like that which once occurred there. There has been a significant reduction in its value to wildlife.
- The infilling of Lakes E and F with PFA followed by restoration will not result in the development of biodiversity to anything like the level it currently enjoys.
- The loss of surrounding lakes (A, B, C, D, G, H, I, J and P) and associated habitats in the locality after being infilled with PFA raises, significantly, the importance of Lakes E and F to wildlife that has no other refuge left of such size (a critical deterministic feature of diversity[26]) and quality in the area.
- In the light of these statements the wildlife in Lakes E and F cannot be replaced and restoration measures will prove ineffective or inappropriate for the majority of organisms in the locality.
- More appropriate restoration of ‘Lakes’ A-D, incorporating native and locally occurring plants should be implemented if the conservation value of the site is to be raised.

ACKNOWLEDGEMENTS

The author has received considerable help from the following persons: Jo Cartmell, Basil Crowley, Karen Durkin, Andy Durkin and David Guyoncourt. The quality of their ecological observations and data has meant a more informed and wider-scoped report has been made possible. I am very grateful to the following organisations and individuals who have given their data freely: Jeremy Biggs, Wayne Bull, Jo Cartmell, Basil Crowley, Rachel Everett, Peter Gent, David Guyoncourt, Lynda Pasquire, Nick Stewart, Roger Wiggins, Penny Williams, Emma Wiskin, Ivan Wright, Jacqueline Wright, Oxon BRC (Steve Gregory) and the Oxford Ornithological Society (numerous individuals).

[26] Large areas are more important than smaller ones for maintaining many more species and individuals. This relationship is not simply a function of size as there are matters such as habitat complexity and stability, which are of equal or greater importance. See, for example, Connor E.F. & McCoy E.D.. (1979). The statistics and biology of the species area relationship. *American Naturalist*, **113:** 791-833. Kohn D.D. & Walsh D.M. (1994). Plant species richness; the effect of island size and habitat diversity. *Journal of Ecology*, **82:** 367-377.

© SAVE RADLEY LAKES 2005

APPENDIX 1: Map showing Lake Locations

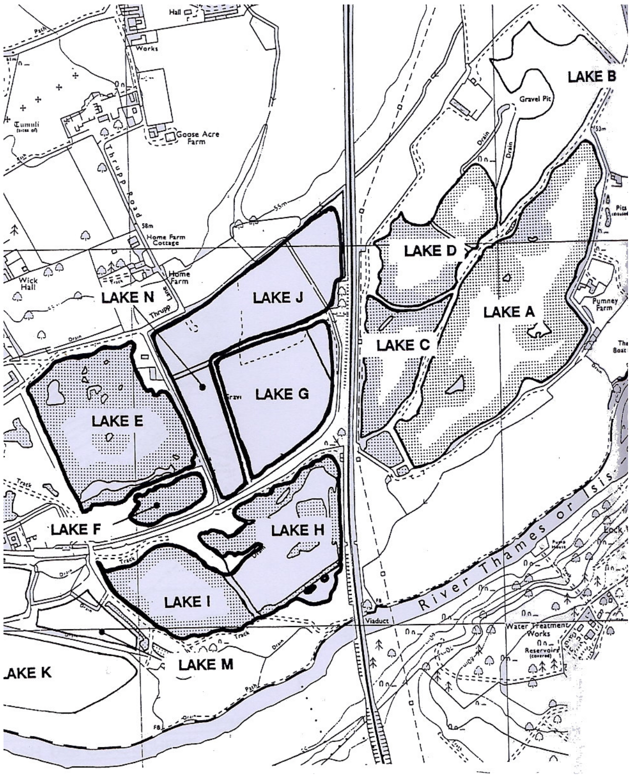

Figure 4: Locations of 'Lakes' A-D and Lakes E and F as referred to in the text.

© SAVE RADLEY LAKES 2005

APPENDIX 2: Alpha diversities for various habitat types in Oxfordshire

Location	Alpha diversities	Habitat type
College Farm, Long Wittenham 1993-1995	Range 11.74 – 18.78	Barley field (3 light traps)
College Farm, Long Wittenham 1993-1995	Range 16.23 – 24.53	Linear ditch and scrub (3 light traps)
College Farm, Long Wittenham 1993-1995	Range 16.03 – 18.52	Set-aside (3 light traps)
College Farm, Long Wittenham 1993-1995[27]	Range 12.09 – 21.36	New tree plantation (3 light traps)
Long Wittenham Village 1993-1995	37.30	Garden (2 light traps)
Culham Hill Wood, Abingdon 2002[28]	27.31	Mixed woodland and bracken
Swift Ditch, Abingdon 2002[28]	25.95	Marshy, scrubby river margins

[27] Eeles R.M.G. (1997) *Abundance, diversity, community structure and mobility of moths in farmland.* Unpublished PhD thesis, Oxford Brookes University.
[28] Wilkins A. (2002) *Species comparisons of moths in two different vegetation communities*, unpublished BSc (hons) thesis.

© SAVE RADLEY LAKES 2005

APPENDIX 3: Botanical Assessment of PFA 'Lakes' A – D at Radley in 2001

John Killick

Note: I (Eeles) have added scientific names only to this report by John Killick, which is otherwise reproduced here in its entirety. The suggestion of a possible pollution influence is entirely that of the original author.

Wet PFA

The most distinctive community is on PFA wet enough to support only marsh plants. Big areas dominated by gipsywort, *Lycopus europaeus*, (with numerous seedlings) and often water mint, *Mentha aquatica*, and often little else e.g. marsh yellow-cress, *Rorippa palustris*, purple loosestrife, *Lythrum salicaria*, (small and sometimes unthrifty), pale persicaria, *Polygonum lapathifolium* (pink flowered), redshank, *Polygonum persicaria*, and in patches annual beard-grass, *Polypogon monspeliensis*, (with numerous seedlings). Here and there willow saplings about 40 cm - *Salix cinerea* and less often *Salix alba* and *Salix viminalis* which, if they continue to grow, will take over this area and produce willow carr in a few years. A damp depression has some silverweed, *Potentilla anserina*. A deep pit contained some healthy pink-flowered pale persicaria.

Dry PFA

A widespread less homogeneous community grows on drier PFA, which was wet enough in the past to encourage innumerable seeds, nearly all windborne, and bryophytes. Recent wet weather has allowed the latter, especially *Marchantia* spp., to flourish, but the drier, hotter days of summer shrivelled nearly all the flowering plants - the PFA discourages root growth in many species. The successful ones include willowherbs (great, *Epilobium hirsutum*, and hoary, *Epilobium parviflorum*, but few if any of other species), which typically reached 60 cm and fruited, big patches of annual beard-grass up to 15 cm high, which have now mostly fruited, occasional healthy creeping thistle, *Cirsium arvense*, and broad-leaved dock, *Rumex obtusifolius*. Saplings were mostly small willow usually *Salix cinerea*, and the odd birch, *Betula pendula*. Numerous oraches (*Atriplex prostrata* more than *Atriplex patula*) and some red goosefoot, *Chenopodium rubrum*, are very stunted, often only 10 cm. Some of the willowherbs grew in straightish lines, following cracks in the PFA; these could have been man-made scrapes or cracks formed in drought. One of the rare slender centaury, *Centaurium pulchellum*, was flowering among the *Marchantia* spp; there had been good local colonies earlier. This is a species-poor but very unusual community; if the PFA and summer drought permit, it should be gradually taken over by the willowherbs, thistles and docks above and then probably by willows and perennial grasses. A low-lying adjacent area is almost solidly annual beard-grass and greater plantain, *Plantago major*, rosettes.

Lagoon adjacent to the dry PFA

Some chemical in the PFA is clearly inimical to nearly everything; oraches grew, as they often do, along the strandline, but were few and very stunted, and the sandy-looking floor of the ditch leading into it, also supported little else. This contrasts with a lagoon near the NW entrance, which contains healthy water milfoil, *Myriophyllum* spp., while the ditch leading to it has plenty of bulrush, *Typha latifolia*, and club-rush, *Scirpus lacustris*.

Willow carr

The area to the right of the track going south from the NW entrance is willow carr- used for rearing of pheasants, with mostly healthy trees of grey willow, *Salix cinerea*. Several willows are represented including the less common almond-leaved willow, *Salix triandra*. As one goes south along the track the willows are younger and mixed with coarse grasses etc, a younger stage in the development of willow carr, and not examined in detail.

Native grasses

One area to the west of the reserve comprises PFA with perhaps a little normal soil and a flora almost entirely made up of native grasses. Yorkshire-fog, *Holcus lanatus*, and rather poor false oat grass, *Arrhenatherum elatius*, are the most obvious, with rough meadow-grass, *Poa trivialis*, and patches of creeping bent, *Agrostis stolonifera,* and the odd meadow fescue, *Festuca pratensis*. Almost none are flowering, so others could have been missed. Rabbit activity is evident in a few places, and in one, long-lying water, recently dried up, and had inhibited grass growth.

© SAVE RADLEY LAKES 2005

Unusual plants

The are at least 3 species rare in this area: the annual beard-grass and slender centaury mentioned above, and, in gravel near the NW entrance, red hemp-nettle, *Galeopsis angustifolia* agg., which had almost disappeared in Oxfordshire (recent records only near Ditchley in the 1990's and Stonesfield quarry in 1987). One colony of wild liquorice, *Astragalus glycyphyllos*, not now flowering, grows by a gravel causeway to the SW. Blue fleabane, *Erigeron acer*, near the hemp-nettle and elsewhere, is not very common.

Evidence of pollutants

The most remarkable feature is how restricted the flora is that grows directly on PFA. There are also cases of obviously unhappy plants with brown shrivelled leaves on plants that are often otherwise normal. Examples include grey willow (though the majority are alright), some introduced Italian alders, purple-loosestrife and horseradish.

© SAVE RADLEY LAKES 2005

APPENDIX 4: Water Vole Baseline Surveys 2005 at Longmead Lake, Thrupp Water and Pumney Ditch

Jo Cartmell

Note: I (Eeles) have added scientific names only to this report by Jo Cartmell, which is otherwise reproduced here in its entirety. The suggestion of a possible pollution influence along the Pumney Brook is entirely that of the original author.

Introduction

Survey results of these areas were very interesting and have made me wonder about the impact of water quality on water vole populations. There are few areas with industrial, residential or agricultural run-off, which undoubtedly helps water voles to thrive, even though they are known to tolerate poor water quality – to a degree. No one is sure why the Abingdon area water vole populations seem to be thriving whilst other areas of the UK have seen a dramatic decline and even extinctions of local populations. Otters are now known to be in the area of Longmead Lake at Swift Ditch and in the Lower Radley area. I think that there may be a link between the otters in this area and the plague of water voles that we have in Thrupp Water and Longmead Lake at present. There has also been a Himalayan balsam, *Impatiens glandulifera*, removal project, initiated by Marjorie White, (Warden of the Abbey Fishponds NR) in nearby nature reserves at Abbey Fishponds and Barton Fields, which has increased plant diversity and is likely to have facilitated water vole recovery in these areas.

Longmead Lake (NGR SU 512972)

The whole of Longmead Lake was surveyed (apart from one small overhanging section) on the 25th April 2005, with Dee Brooks who assisted. Water quality in Longmead Lake appears to be very good: there is unlikely to be any residential, agricultural or industrial run-off. Water depth is variable around the margins from a cm or two to 3 metres further out. Even at the start of the water vole survey season, when the breeding season had just got underway and with vegetation around the lake still establishing itself after the gravel extraction process, there were a good number of latrines and burrows, indicating a good number of water voles present in this apparently ideal habitat. There are plenty of steep, earth banks for water voles to burrow into and the lake edge has many areas of reed and willow. The survey revealed:

- 37 latrines
- 24 burrows
- 59 feeding signs
- 3 areas of coppiced willow around the lake

The willow was coppiced so extensively around the lake (one inch diameter branches had been gnawed clean through at some points) that Bob Eeles considered that it indicated a water vole 'plague' and the survey along Thrupp Ditch (Radley Brook) which runs along the southern end of Longmead Lake proved that there was, indeed, a very high abundance of water voles.

Two water voles were seen on the southern bank on the 30th April 2005.

Bob Eeles informed me recently that coppicing of willows is now occurring along the entire northern edge of Longmead Lake (3rd September 2005), which indicates that there are still high numbers around the lake.

Thrupp Water (Radley Brook) NGR SU 515972

Only one side of this approximately 500-metre long ditch was surveyed along this water vole 'plague' stretch. Latrines were very frequent. Water quality in Thrupp Water appears to be extremely good; water depth is approximately 1.5 metres in the centre. There is currently no intensive agriculture on the north side and the land is under Countryside Stewardship. The ditch itself has a high density of reed sweet-grass, *Glyceria maxima,* and there are good field margins on either side of the ditch with plenty of greater willowherb, *Epilobium hirsutum*, purple loosestrife, *Lythrum salicaria*, and meadowsweet, *Filipendula ulmaria*. There is an absence of steep banks, but there are signs that the reeds are woven into nests in the middle of the ditch, where the water voles feed and raise young. There are very few burrows along this stretch. Water vole signs were as follows:

© SAVE RADLEY LAKES 2005

- 113 latrines
- 8 burrows
- 159 feeding signs

Three water voles were seen on the 1st May 2005 at the western end of the surveyed ditch, by the Thames Path.

Pumney Ditch

I surveyed two (approximately 500 metre) stretches along Pumney Ditch with my co-surveyor David Guyoncourt: on one side only, as advised by BBOWT when water depth is too deep and the bed to silty to safely stand in, as was the case with both stretches here.

Pumney Ditch 1: NGR SU 527971

The first survey on the 2nd June 2005 started at the confluence with the River Thames, heading northeast to a footbridge, which crosses the ditch. Water quality appears to be poor in this ditch, which may be related to the discharge of fly-ash leachate along this stretch. Its depth ranges from 1 metre to 1.5 metres. This discharge, as analysed by the Environment Agency over a period of six years, has contained a cocktail of dissolved elements: arsenic, boron, chromium and vanadium all of which have exceeded permitted levels on frequent occasions under Environmental Quality Standard: EQS2 (a less stringent quality standard for rivers). The herbage was very tall and dense along the edge of the ditch (similar conditions to an earlier survey at Thrupp Water) so I 'scalloped' in at two metre intervals in the same manner as the Thrupp Water survey. There was good cover on both sides of the ditch, but the denser areas of *Glyceria maxima* were on the far side. There were few signs of water voles prior to the outflow from the settling pond areas, in spite of there being a reasonable amount of *Glyceria maxima* for the water voles to feed on in the ditch, and plenty of herbage along the bankside. For this stretch up to the bridge there were:

- 8 latrines
- 1 burrow
- 30 feeding signs

I was surprised at the low number of latrines along this stretch, which is undisturbed and has areas along the banks that have dense patches of greater willowherb, meadowsweet, purple loosestrife and hemp agrimony, *Eupatorium cannabinum*. About 20% of the ditch is overshadowed by trees resulting in very little vegetation: no aquatic and very little bankside cover. The water quality did not look good. Water voles are known to be able to tolerate poor water quality, but they do not thrive in such conditions and their population numbers are low, in my experience.

Pumney Ditch 2: NGR SU 528974

My co-surveyor and I continued the second survey stretch from the footbridge on the 16th June 2005. It was very difficult to survey because the herbage had grown considerably in the fortnight between surveys and was very difficult to push through. Again, we 'scallop' surveyed. The stream became notably better beyond the outflow from the settling ponds: the bed of the stream had very dense *Glyceria maxima* cover and was an excellent water vole habitat providing good cover in the ditch. The bankside also had dense herbage and plenty of greater willowherb, meadowsweet, purple loosestrife and Hemp agrimony. We were unable to complete the survey of this ditch due to time constraints, but managed to survey (possibly 85%, it was difficult to tell exactly where we finished).

Along this stretch there were

- 17 latrines
- 4 burrows
- 65 feeding signs

My co-surveyor and I wondered whether water level control at the weir had washed some of the latrines away, because, when the bank profile changed and there was a raised bank, there were latrines along it and burrows where previously there had been less latrines, but obvious water vole tracks alongside the bank.

We both noted a marked changed between the area of ditch below the outflow which flows from the settling ponds to the River Thames and the area upstream of the outflow which was much better. We intend to revisit the first area to see if there are any water voles on the opposite bank in a reed/marsh area.

© SAVE RADLEY LAKES 2005