Cherwell District Council Planning Application 22/01682/F

Full Development of Land North of Manor Farm Noke

Response to Planning Application 22/01682/F

From:

Professor David J. Rogers M.A., D.Phil. (Oxon)
Professor of Ecology (retired), University of Oxford

Professor Fritz Vollrath
Professor of Zoology (retired), Universities of Basel, Aaarhus and Oxford

Jonathan Kingdon
Silver Medal, Royal Geographical Society; Stamford Raffles Medal; Cherry Kearton Medal.
Professor/Visiting Professor, Makerere University, Uganda; CSIRO, Australia; Skidmore College, New York; Duke University, North Carolina; Kyoto University, Japan. Author of more than 20 books.

We request refusal of planning permission on three grounds:

- **The contribution to low- or zero-carbon Cherwell/Oxfordshire is minimal** and the site is chosen only because of its claimed unique location on an electricity grid already at almost full capacity. This capacity will have to be increased in the very near future if we are to reach any zero-carbon target, in which case there will soon be other places for such a Solar Farm which do not threaten the unique landscapes and wildlife of Otmoor.
- **The impact on the landscape of Otmoor, its wildlife and amenity value for the citizens of Oxfordshire and elsewhere.** A solar farm of this size cannot be hidden in the landscape. If approved it would be the largest man-made structure on Otmoor, easily visible from space. The site also falls within the category of BMV land as per the joint 2015 guidance from DEFRA and MHCLG that followed on from a huge increase in solar farm developments when subsidies were available. This guidance, which puts ALC Grade 3B land into the BMV category, still stands and was confirmed by George Eustice, Secretary of State for Environment, Food and Rural Affairs, during an Environmental Audit Committee meeting in June of this year.
- **The potential impact on the birds of the RSPB Otmoor Reserve** is unknown but could be severe. Mortalities of birds within Solar PV arrays are commonly recorded in the USA. We review the literature on this subject and conclude that a precautionary principle should be applied here. Oxfordshire is blessed with the unique water-meadows of Otmoor, the only habitat of this type in the South-East of the country and, along with the Somerset levels, the only inland areas of any size for migrating waterfowl in the South of England. The proposed Solar Farm could not be nearer to the RSPB Reserve without actually being inside it.

Please find below further explanations for our recommendation.

1 Contribution to low- or zero-carbon Cherwell/Oxfordshire

Can a solar farm in the Green Belt at Noke be justified through the 'exceptional circumstances' claimed in the application, based on short-term electricity grid restrictions?

1.1 Power Output

The planning application is for a 25MW solar array providing electricity into the Headington substation with a maximum capacity of 18MW.

The application claims that a 25MW capacity facility could provide electricity for c. 7,000 homes. This is based on the applicants' own figure that a 1kW facility provides 1,000kWh power per annum[1]; thus, a 25MW facility could provide 25,000MWh of power per annum.

According to Government figures[2] the average household in the UK consumes 3,760kWh of electricity per year. This is at the upper end of the range quoted on the website (of between 3,100 and 3,650kWh per year). The same website also quotes Ofgem's[3] rather different figures for the average UK household (2.4 persons) of 2,900kWh of electricity per annum and 12,000kWh of gas.

Thus, at construction, the Noke Solar Farm could provide electricity for between about 6,600 (Govt' average) and 8,600 (Ofgem figures) households. We will use the applicants' 7,000 figure, bearing in mind the many assumptions in the above calculations and their variability.

The maximum output of the 25MW array at Noke cannot be handled by the Headington transformer with a current 'spare' capacity of 18MW. Solar power inverters convert solar PV$_{DC}$ output to grid $_{AC}$ input at efficiencies of between c. 92 and 97% (%output power-dependent[4]), so that Noke's power output will still be limited by the Headington transformer, reducing the number of households supplied by Noke from c. 7,000 to c. 5,000 households (= 7,000*18/25).

If Cherwell is to go carbon neutral, all household needs will have to be met by zero-carbon sources, much of it appropriately (i.e. zero-carbon) generated electricity. The Ofgem figures quoted above show that currently only c. 20% of household energy consumption is electricity and 80% is gas. Replacing gas as an energy source with electricity at current rates of usage would mean that Noke (with the current restrictions at Headington) could power only c. 1,000 all-electric homes in Cherwell.

Even with the ambition of halving the power consumption of all household devices, Noke could power only c. 2,000 all-electric houses, just 3% of the District's present total number (65,900 in 2021[5]).

Less electricity is produced as the solar panels age; by year 40 efficiency will be 84-90% and therefore the number of houses supplied fewer.

We question whether the above figures provide the 'exceptional circumstances' that justify putting such a large solar farm in the present location in Otmoor.

1.2 Location and Grid Restrictions

The Solar Farm application points out that 21 of the 22 electricity substations in or near Cherwell at present are either unsuitable for the Noke SF or are already near capacity, and so cannot accept Noke's output.

This is a dire situation which must change – and very quickly – if the District is ever to achieve its zero-carbon ambitions (2030 for both the Council's own activities and the entire District). Once the national grid is improved, there will be many other places in the District for Solar PV arrays.

Fig. 1 shows the national grid network – the major 'spine' of the entire UK electricity supply[6].

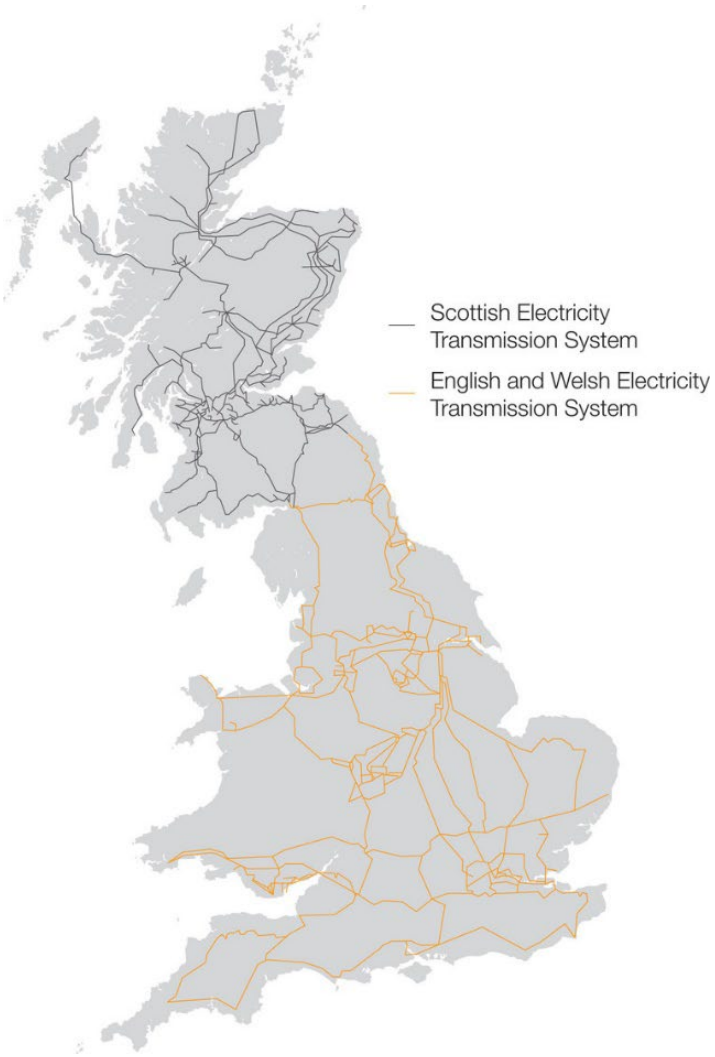


Fig.1. Network Route Maps of the National Electricity Grids of Great Britain (from 6).

Fig,. 2 shows this national grid (thick green line with blue dots – for the pylons) in relation to the southern part of Cherwell District. The base map is a satellite image on which is superimposed the map in the applicants' Site Viability Assessment[7] Figure 3 (the white area in Fig. 2).

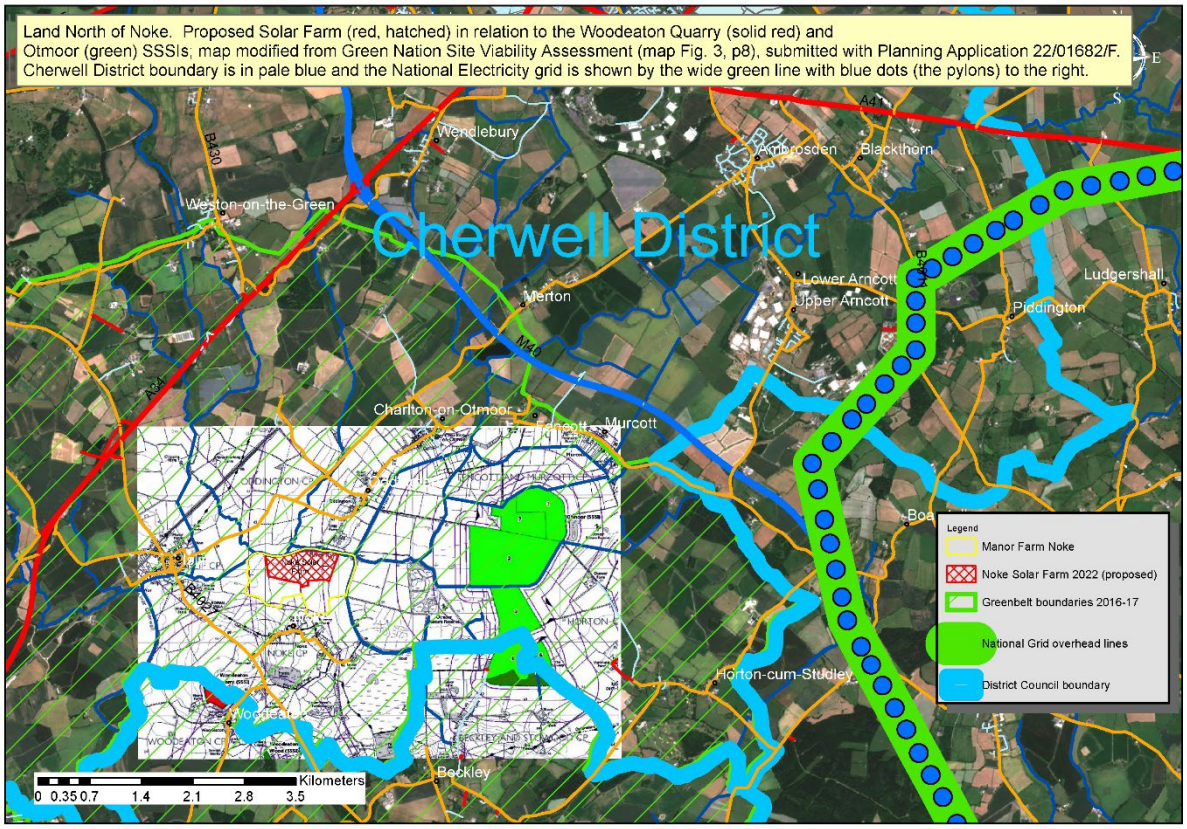


Fig.2. Location of the proposed Noke Solar Farm (red, cross-hatched area within the white map), Cherwell District boundary (pale blue) and part of the national grid shown in Fig. 1.

The national grid power lines have far more capacity than any local branches off them. New sub-stations will be needed as a first step to increasing Cherwell's total electricity capacity. Some of these could be near, or even within Cherwell itself (Fig. 2), offering many more possibilities for Solar Farms in or near the District in the very near future.

We do not believe that a Solar Farm in a location forced by the current limited grid capacity should over-ride landscape and wildlife considerations (sections 2 and 3 below) when grid capacity must be increased quickly in the very near future to meet Cherwell's zero-carbon aims.

1.3 Does all 'Green Energy' have to be generated locally?

Finally in this section we query the need for an all-electric or zero-carbon Cherwell to generate all of its electricity within its District Boundary. At present, all our electricity and most of our water come from outside Cherwell. Electricity can be generated anywhere and distributed everywhere; water falls more in some places than in others and is distributed across the nation.

We should no more 'expect' all of Cherwell's electricity to be generated locally than we should expect all of its water requirements to be met locally.

By a similar token, any electricity generated by a Solar Farm at Noke would not be to the benefit only of the citizens of Cherwell. It would go into the National Grid and would be distributed nation-wide, according to need. To claim that the Solar Farm would supply '7,000 households in Cherwell' is therefore being disingenuous; '7,000 households nation-wide' would be more accurate.

If there are other, better places to generate electricity, and without the impact of the Noke Solar Farm proposal, we should use them. We believe this will happen in the very near future, as grid capacity is increased[8].

2 Impact on the landscape of Otmoor

2.1 Visual impact

Otmoor's is a relatively open landscape with excellent views from the surrounding higher land. Its historic setting, essentially unchanged for at least two centuries, provides peace and beauty to hard-pressed City dwellers living just over 4 kms – a short walk or bike-ride - away.

The outer perimeter of the proposed Solar Farm would be c. 2.6kms long. It would be a combination of a 2.1m metal fence with security cameras on posts 3.2 m high, with a mixture of 'native species' of trees. The trees will take some time to grow to the 3+m height that will be needed to obscure the immediate view of wire fences and solar panels rising to 2.8m above ground height (the LVIA Report suggests it will take 10 years for the trees to grow sufficiently tall). They include the coniferous Scots' pine and yew to form an ever-green barrier during winter, mixed in with deciduous species for summer variation. Scots pine and yew, though native species, are rare on Otmoor. A 2.6 km long, high wall of these species will obviously draw attention to the site from any distance. It is unclear how the stated mix of 5% coniferous and 95% deciduous trees will hide the solar panel array in Winter, when the deciduous trees have no leaves. Even if they 'hide' the solar panels, they cannot hide the solar farm.

The applicants' Consultation Statement[9] shows that on initial engagement with Cherwell District Council its officers advised that (2.3)

"very special circumstances would be required in order to justify the proposed development in this location (within the Green Belt)….. The advice highlighted the constraints of the Site relating to landscape & visual impact, including in relation to views from the surrounding public right of way network, as well as potential ecological impacts. The Council also raised concerns with the scale of the proposal the subject of the pre-application enquiry."

The Council also advised that it wanted to see evidence of the need for such a scale of development and for the stated limited Network Availability (*i.e.* at Headington sub-station) as well as a detailed assessment of the wider public benefits and the local community benefits. It said that:

"provision of solar arrays within the identified Otmoor Conservation Target Area (indicated on the Development Framework Plan – Drawing No. P19-2636_003_1 Rev A contained at Appendix A) should be avoided where possible, unless detailed evidence of the need for the provision of the arrays is provided, along with evidence of the ability of the Conservation Target Area to function in a way that allows it to meet its objectives for being designated"

Subsequently the applicants removed solar panels that were originally proposed for 'Field 4', which is within the Oxfordshire Conservation Target Area (CTA) (and should never have been suggested for PV panels in the first place), and this field contributes to the biodiversity improvements in the final, submitted plans. A virtue is being made of a necessity here.

These Council reservations are acknowledged by the applicants in[9,] section 4.6:

"In summary, as set out in the Planning, Design & Access Statement, it is accepted that the proposal would cause 'harm' to the Green Belt by reason of inappropriateness and because of the reduction in openness it would involve, and that this should be given substantial weight, having regard to the

specific wording of national and Development Plan policy. In addition, there would be a limited degree of inevitable 'harm' to the landscape, to which moderate weight is attached, in line with the conclusions of the accompanying Landscape & Visual Impact Assessment."

Nevertheless, the applicants claim ([9], Section 4.6) that the following 'very special circumstances' apply in the submitted application:

i. The generation of renewable energy would assist with delivering the Council's commitment under its Climate Emergency and Climate Action Framework 2020,
ii. There is no alternative site outside the Green Belt that has a suitable grid connection,
iii. A new permissive footpath will benefit local people,
iv. The project will ensure the viability and stability of a local rural business (i.e. Manor Farm),
v. The use of Best and Most Versatile Agricultural Land is avoided,
vi. The development is non-permanent and could be removed after 30 to 40 years,
vii. Designated ecological enhancements at the site will promote ecological conservation, and
viii. There will be minimal impacts on heritage, transport, flood-risk and residential amenities, and an increase in new tree hedge and shrub planting.

The application concludes (Section 4.7):

"The considerable benefits of the proposal, as outlined above and within the Planning, Design and Access Statement, clearly outweigh the identified harm to the Green Belt and any other harm, and therefore constitute the necessary very special circumstances required to accord with Development Plan and national Green Belt policy."

We find the above list i) to viii) unconvincing and reject that it constitutes the 'very special circumstances' claimed. Items i) and ii) were addressed in the previous section here; items iii) and viii) would not be necessary, or would not occur, without this development; item iv) benefits only the applicant and not the community to which he belongs; item v) is incorrect (next section) and item vi) is being disingenuous: on some time scale all human structures are temporary. A landscape feature persisting for 40 years would be 'semi-permanent' or 'permanent' for most people and could set a precedent for other applications for similar 'temporary' schemes elsewhere in the Green Belt.

2.2 Other recent local experiences

In 2015 South Oxford District Council (SODC) rejected an application for a 5MW Solar Farm on an 11.6ha part of Wadley Hill Farm, Elsfield[10], a site 3.7kms away from the proposed Noke site, and 2.7kms closer to the Oxford ring-road. The SODC delegated Report[11] on this contains a series of responses which can be summarised as follows:

Countryside Officer: *Overall the application includes proposals for mitigation and enhancements which are appropriate and should serve to increase the biodiversity value of the site overall when compared to the existing arable farming use.*

RSPB: *No objection. We manage Otmoor RSPB reserve a short distance to the north* (in fact between 1.3 and 4.3kms away) *and consider this proposal will have no adverse effect on wildlife associated with the nature reserve.*

CPRE: *Objection. On the grounds of harmfulness to the Green Belt, Oxford Heights character area, and settings of Oxford and Elsfield, and of the unjustifiable and unnecessary loss of agricultural land. Unacceptable and massive industrialisation in the countryside, inappropriate use of land which would be better employed for the production of food, unnecessary and unacceptable landscape harm especially on open green field sites. Unacceptable use of higher-grade land.*

Oxford Green Belt Network: *The site is in the Oxford Green Belt and within a particularly attractive area of elevated countryside. The solar arrays, together with all the additional infrastructure would introduce an industrial element that would be an intrusive and alien feature in this otherwise unspoilt area between Elsfield and Beckley.*

There is much in the supporting documentation about screening which, it is suggested, overcomes any problem relating to the reduction of openness. We reject this argument as wrong. Openness is still reduced even when the offending panels are not visible from the ground and what about views form the air? Furthermore, to attach importance to screening is to admit that the solar arrays and the infrastructure are visually offensive, contrary to one of the aims of the Green Belt to protect visual amenity.

Oxford Preservation Trust: *This scheme will negatively affect the setting of the Green Belt that was designated to keep these villages separate….. The essential characteristic of the Green Belt is its openness, and the fencing and screening of this solar farm will have a negative impact on the views across this area. Solar Farms come with more than just the large panels and together these all detract from the rural character of this area.*

More or less all of the above comments apply equally to the Noke SF proposal which is almost four times larger in area. We note that converting arable land to grassland below solar panels can increase local biodiversity (Countryside Officer response), and that sites well over 1km away from a bird reserve may have no impact on it (RSPB response). But, along with the Oxford Green Belt Network (OGBN), we believe that screening does not overcome problems relating to the reduction of openness. Following OGBN and CPRE we also suggest that the Noke Solar Farm represents a 'massive industrialisation' in some of the nation's most beautiful countryside.

Figure 3 shows a 2022 satellite image from Google Earth, with the seven Otmoor Towns indicated (Noke, Oddington, Charlton-on-Otmoor, Fencott, Murcott, Horton-cum-Studley and Beckley) and forming a ring around the Otmoor 'basin'. The RSPB Reserve is shown outlined in blue and the Noke Solar Farm in red. The latter is the area that would be covered with >47,000 solar PV panels (and is therefore not the full extent of Manor Farm).

If the Noke Solar Farm is approved, it would be by far and away the largest man-made structure in or near Otmoor.

2.3 The national experience

Harrison et al (2017)[12] reviewed the impact of solar farms on birds, bats and general ecology and examined 49 applications for Solar PV developments in NW England between 2011 and 2015. Only 32 of this total had been processed before Harrison et al's study, of which 12 had been refused (Harrison et al 2017, p. 37). The refusals were for solar farms of 16MW size or smaller. Reasons for refusal included disruption of the green belt (6 applications), effects on the local landscape character (6), impact on amenity value (4), impact on protected species (2) and the agricultural quality of the land (2).

Most of the above reasons for refusal apply also to the proposed Noke Solar Farm which is 50% larger than any of those refused by other Local Authorities.

Fig.3. Google Earth map showing the Otmoor basin surrounded by the 'seven towns' of Otmoor (Noke, Oddington, Charlton-on-Otmoor, Fencott, Murcott, Horton-cum-Studley and Beckley). The RSPB Otmoor Reserve is outlined in blue and the proposed Noke Solar Farm in red. There are no man-made structures anywhere in or near Otmoor that are as large as the proposed Solar Farm.

Dame Fiona Reynolds, erstwhile Master of Emmanuel College Cambridge and Director General of the National Trust, now *inter alia* Chair of the Governing Council of the Royal Agricultural University in Cirencester and Chair of the Bennett Institute for Public Policy in Cambridge, describes Otmoor as 'the majestic Oxfordshire landscape'. At the time that the proposed Oxford to Cambridge Expressway (part of the Ox-Cam Arc proposals) threatened to cut right through the middle of Otmoor she asked;

"How can this precious place be once more in the line of fire?"[13]

(a reference to an earlier plan to route the M40 through Otmoor in the 1970s).

Placing a large solar farm – effectively an electricity factory – so close to Otmoor puts it under threat again.

We repeat Dame Fiona's question: "How can this precious place be once more in the line of fire?"

2.4 The Agricultural Quality of the proposed Noke SF land.

The Noke SF proposal's Agricultural Quality of Land Report[14] concludes:

"The land has either shallow soils over limestone, or heavy soils with restricted drainage over clay or clayey alluvium. The land is dominantly limited by wetness or droughtiness to subgrade 3b agricultural quality."

The Planning, Design and Access Statement[15] states (in 2.1) that

"The Site consists of predominantly Grade 3b agricultural land, and therefore does not fall within the definition of 'best and most versatile agricultural land', in line with the National Planning Policy Framework (NPPF)"

..and later claims (in 7.13) that such land is not protected by planning policy.

Others have queried whether this land should be classified as 3B, based on the crops that are grown upon it.

But on 29th June of this year, George Eustice, then Secretary of State for Environment, Food and Rural Affairs, appeared before the Environmental Audit Committee and was questioned about the use of land for solar power. He pointed to guidance issued to Local Authorities in 2015 jointly by his Department and the Ministry of Housing, Communities and Local Government (MHCLG) that "created a strong presumption against solar farms on Best and Most Versatile land, and that is classified in law as grade 3B or above."[16] This guidance followed a surge in applications for ground mounted PV array as developers clamoured to take advantage of subsidies before they were cut. Eustice stated it "resolved the problem of development on agricultural land for some time". Queried about this again by the Committee in June, Eustice said "So Grade 3B is classified as BMV Land", going on to point out that several Local Authorities have since ignored this guidance but should not have done so[17].

Following this guidance, the Noke Solar Farm application should be rejected because it is on land classified as BMV for this purpose.

CPRE has recently warned of the loss of productive farmland to housing and other non-farming activities[18], calling for a national land strategy in the face of a looming food crisis.

3 Impact on the RSPB Bird Reserve on Otmoor

Solar Farms do not seem to fall within the requirements of Schedule 2 of Environmental Impact Assessment…

"to protect the environment by ensuring that a local planning authority when deciding whether to grant planning permission for a project, which is likely to have significant effects on the environment, does so in the full knowledge of the likely significant effects, and takes this into account in the decision making process."[19]

…but the proposal for Noke covers well in excess of the area and power output specified in that schedule for other forms of energy generation (albeit those other forms involve heat or hydro-power). Solar PV Energy Generation is notable for its absence from the EIA specifications at present.

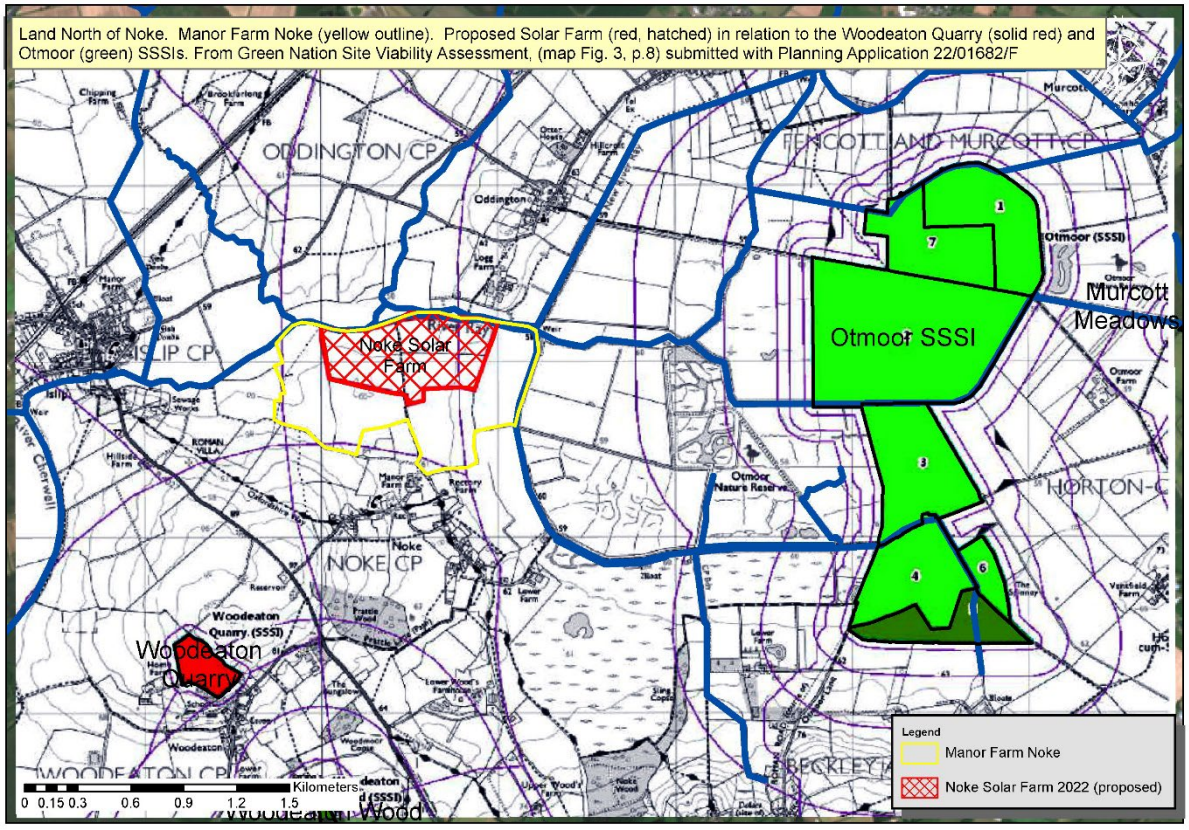
Our feeling is that a broader Environmental Impact Assessment should have been requested in this instance because of the scale and location of the proposed Solar Farm. Instead, Cherwell District Council requested *inter alia* an 'Ecological Impact Assessment'[9], section 2.6. The Ecological Appraisal carried out by BSG appears to be the response to this request.[20]

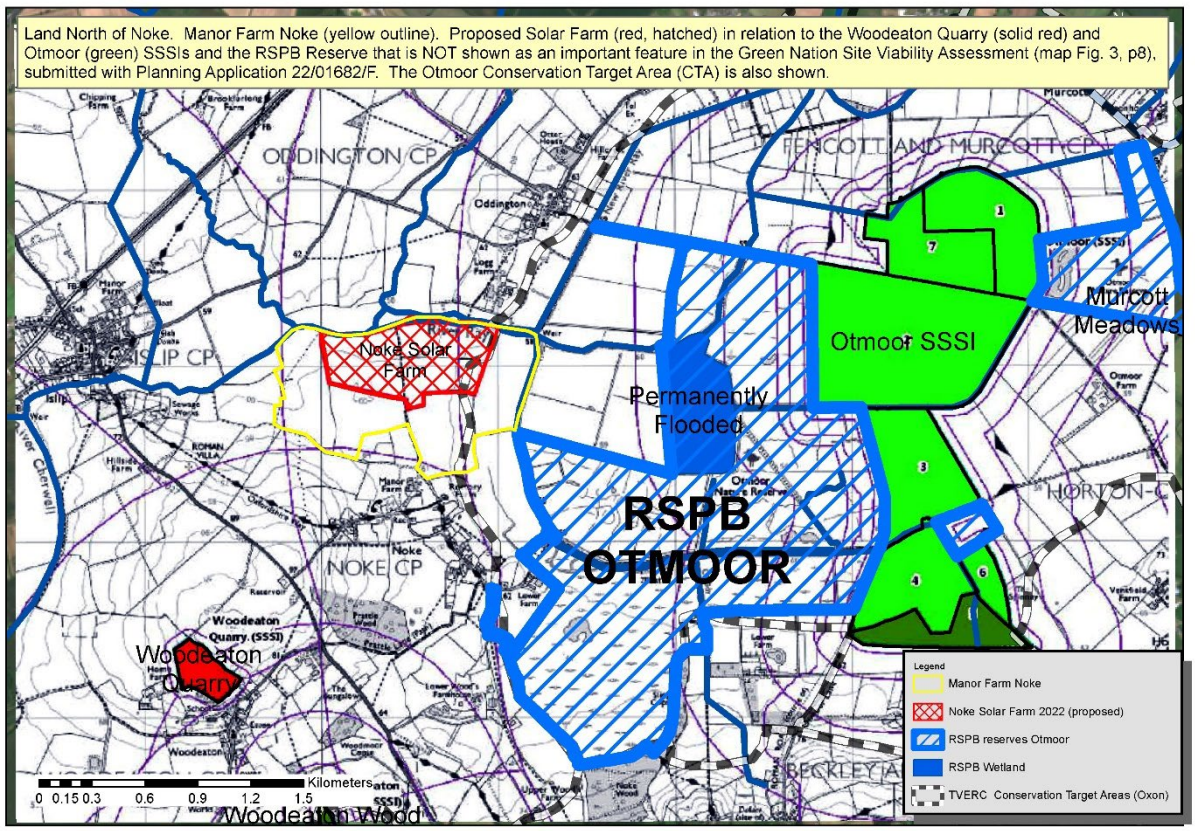
The Ecological Appraisal is limited in its scope by the Terms of Reference set by Mr Ken Pelton (in[20], 1.1) "to carry out a range of surveys on a part of the land in his ownership" (our emphasis). That part is the area to be covered with solar panels plus part of the rest of Manor Farm which will be used for access purposes, collectively called the 'Survey Area' of the Report.

A desk study also produced a list of statutory and non-statutory sites up to about 2kms away. Emphasis is placed on the two statutory SSSIs, one 1.2 kms South of the Survey Area (Woodeaton Wood SSSI) and the other 1.5kms East of it (Otmoor SSSI), and only these two sites are shown in the map, Fig. 3, in the Site Viability Assessment Report[7], p. 8, reproduced here (with slight modifications, for clarity) as Figure 4. The Report section 4.3 states:

"The proposed development avoids the proximity of SSSI sites, remaining outside the zones of influence, therefore would not have any adverse impacts on any of the designated sites in the surrounding area."

Whilst this is true of the only statutory sites in the area, it glosses over potential adverse impacts on the non-statutory RSPB Reserve immediately adjacent to Manor Farm, as shown in Figure 5.





The site map as shown in the Site Viability Assessment Fig. 3 (**Fig. 4**, above) and with the RSPB Reserve and Oxfordshire Conservation Target Areas (CTAs) added (**Fig 5**, below). The proposed Noke Solar Farm is the red cross-hatched area.

3.1 A review of the impact of PV arrays on birds

Because BSG Ecology wasn't asked to, it did not consider the possible effects of solar panels on birds outside the Survey Area, in and from the RSPB Reserve and elsewhere. The only relevant reference cited is Montag (2016)[21] who recorded skylarks foraging in solar farms. Montag's study – one of very few carried out in the UK - looked at the abundance and diversity but not mortality of both vertebrates and invertebrates within solar PV sites.

A later communication from the applicants in response to comments made at the meeting in Noke Church on 7th July pointed out that BSG Ecology had previously produced a Report for other purposes on the ecological impacts of ground-mounted PV solar panels[22] and stated:

"The report concluded that the majority of studies on this topic have taken place in the USA, and that bird mortalities have been seen there almost exclusively on large concentrated solar systems. These systems are a completely different technology from the solar PV system proposed in this application. In particular, they include high towers that are heated to a very high temperature by reflective panels, causing some risk to birds through collision or singeing."

Concentrated Solar Power (CSP) in the USA was one of the earliest solar technologies and provided over 69% of the total of 470MW of solar power in 2007. By Q1 2022 it provided only 1.3% of the total of 126,137MW of solar power[23]. The American literature on the effect of solar facilities on birds and other animals reflects this shift from CSP to PV arrays; early studies were on mortalities of birds within CSP facilities (e.g. McCrary et al, 1986[24]), later studies shift the balance to include PV facilities (e.g. Kagan et al, 2014[25], Walston et al, 2016[26]). All recent studies have been only on the latter (e.g. Kosciuch et al 2020[27]).

The rest of this review refers to research in PV facilities unless otherwise stated and can be summarised as follows.

Birds die and/or are killed in PV arrays. There is direct evidence of blunt-force trauma (indicating direct impact on panels, detected by x-rays of carcasses found on PV sites) and other evidence that birds simply stunned by the panels are then picked off by predators (Kagan et al 2014). No cause can be attributed to some deaths or to commonly recorded 'feather-spots' (collections of feathers but no bones or tissues).

A key site for several PV studies has been the Desert Sunlight 1206 ha, 550MW facility in the Mojave Desert of California, along a migration route for birds to and from the Californian coast (Fig. 6).

Waterbirds seem to be relatively over-represented in PV farm deaths, especially when near lakes or ponds and/or along migration routes. Some waterbirds (e.g grebes) can only take off from water (Kosciuch et al's 'water obligates' see below) so, if they end up in a solar panel array, they are easily picked off by predators. Of the 56 identifiable remains (from a total sample of 61) in Kagan's study 27 were of water birds and 38 were classified as migrant species. The time over which these birds were collected is not specified; the sample suggests a mortality rate of 0.11 birds/MW over that time.

More recent studies have tried to standardise mortality estimates for searcher efficiency, carcass duration (size dependent) and possible carcass removal by predators between searches. Kosciuch et al 2020 examine results from 11 PV facilities (some immediately adjacent to each other) in the American SW for the period 2013 to 2018. Fig. 7 shows the geographical distribution of the study sites and Figure 8 the estimates of mortality rates, which range from 0.23 to 9.26 birds per MW p.a. For comparison, a South African study in the Northern Cape 96MW Jasper Field PV facility gave an estimate of 435 bird fatalities per year, or 4.53 birds per MW p.a. (Visser et al 2018[28]), thus in the middle of the range of the USA study.

Nobody has yet quantified the on-site PV mortality rates in relation to the general bird populations around the PV farms, and therefore the overall impact of the above rates on the bird populations. This would be very difficult to do in the case of migrant species.

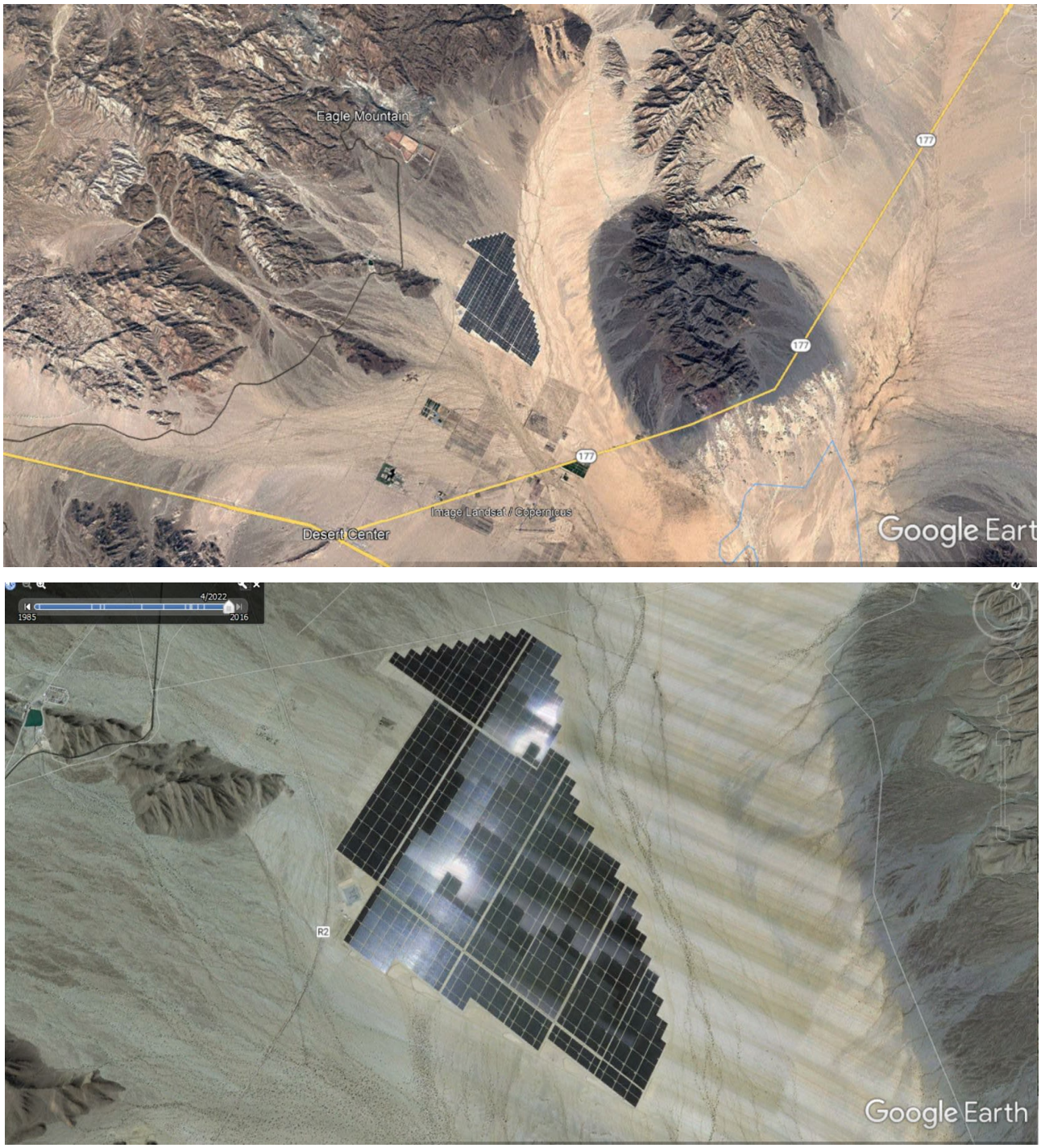


Fig. 6. The Desert Sunlight PV facility in California, USA (top overview, bottom detail showing sun-glint). Studies refer to 'ponds' near this facility but these are not obvious in these images.

Seasonal preponderance of water birds in some PV sites. Kosciuch et al (2020) separated the results of what they termed 'water associates' and 'water obligates', finding the seasonal differences across seven of their sites shown in Fig. 9. They found water associates in six of their 11 sites and water obligates in nine of them. This seems to confirm Kagan's earlier observations on the preponderance of water birds (carried out at two of Kosciuch's sites, Desert Sunlight, SMD3.1 and SMD3.2).

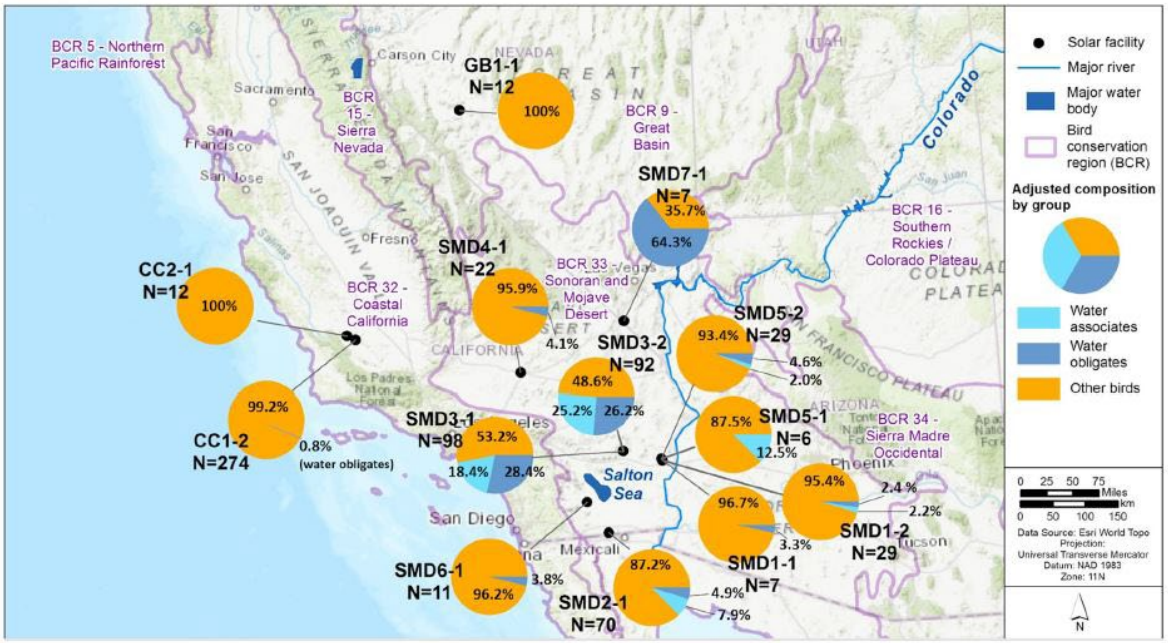


Fig 4. **Adjusted composition of water obligates, water associates, and other birds for 13 fatality monitoring site-years at photovoltaic solar facilities in California and Nevada from January 1, 2013, to September 1, 2018.** Water associates are species that rely on water for foraging, reproduction, and/or roosting; water obligates are species that cannot take flight from land; other birds are birds not falling into either of those categories. N = total number of detections for each site-year (e.g., CC2-1) represented on the map.

Fig. 7. Distribution of solar PV facility sites and relative frequency of water and other bird mortalities in SW USA. (Fig. 4 from Kosciuch et al 2020).

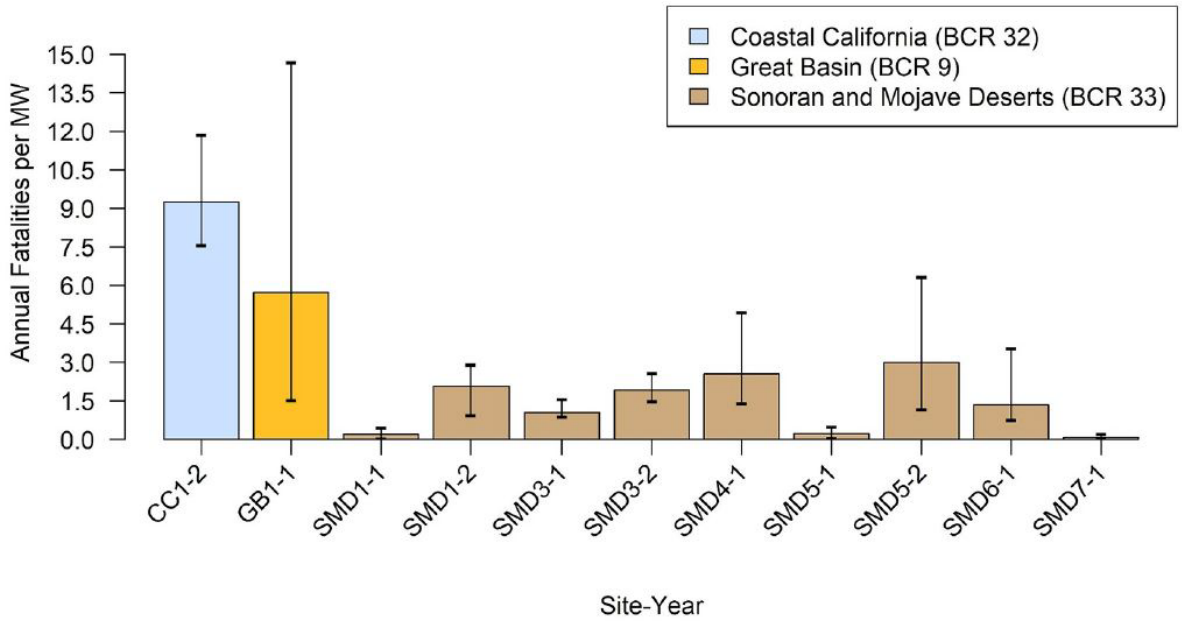


Fig 6. **Annual all bird fatality estimates, adjusted for detection probability and search effort, per megawatt (nameplate capacity) by Bird Conservation Region, from January 1, 2013, to September 1, 2018.** Vertical bars show 90% confidence interval around estimates for each study except SMD6-1, which only reported a 95% confidence interval.

Fig. 8. Annual bird fatalities per MW power at 11 Solar PV facilities in SW USA. (Fig. 6 from Kosciuch et al 2020).

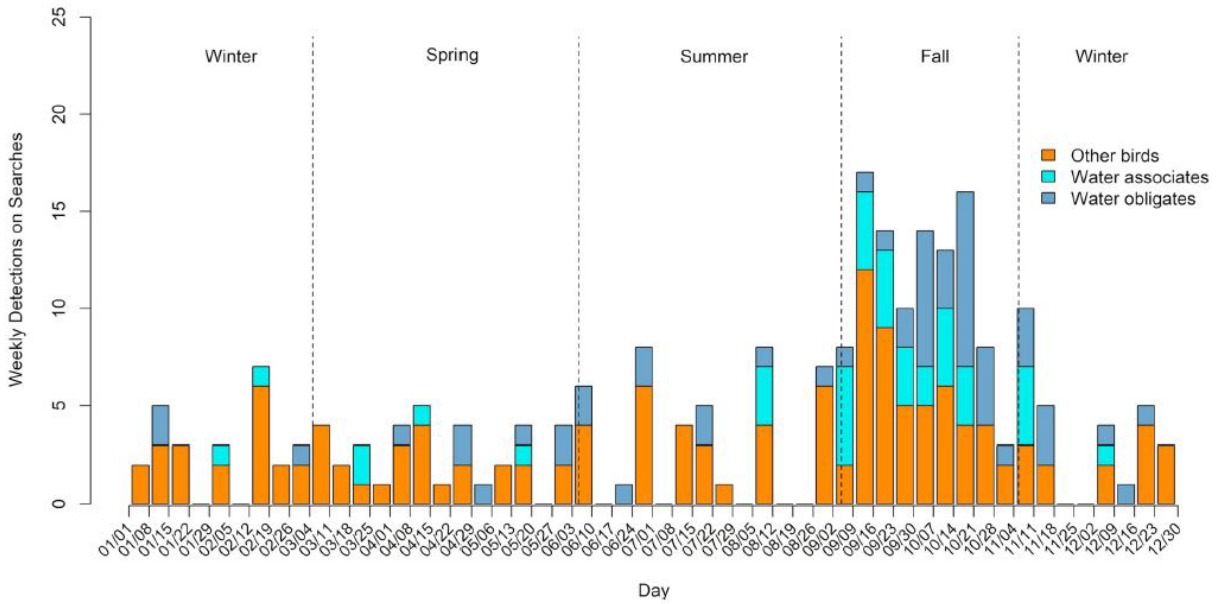


Fig 2. Phenology of avian detections found during standardized monitoring in the photovoltaic solar field at 7 sites from January 1, 2013, to September 1, 2018 in the Sonoran and Mojave Deserts and Great Basin Bird Conservation Regions. Water associates are species that rely on water for foraging, reproduction, and/or roosting; water obligates are species that cannot take flight from land; other birds are species not falling into either of those categories.

Fig. 9. Seasonal records of bird fatalities across 7 Solar PV sites in SW USA. Note the frequency of water birds in some samples (Fig. 2 from Kosciuch et al 2020).

Scaling of mortality rates with PV facility size. Most solar PV facilities in the USA are large, in Kosciuch et al's study ranging from 51ha to 1,206ha. The proposed Noke SF is below the lower figure here. There is however no evidence that bird mortality rates scale with Solar PV facility size, as shown in Fig. 10

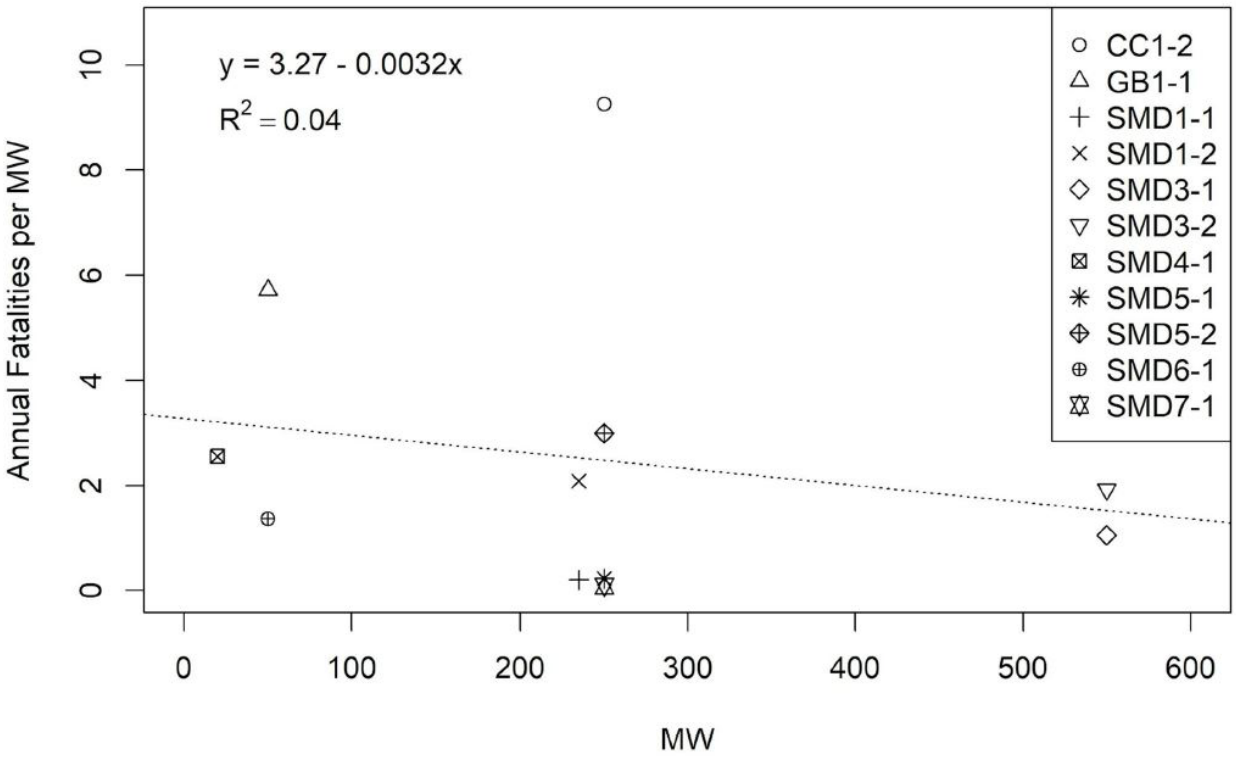


Fig 5. Annual all bird fatality estimates, adjusted for detection probability and search effort, per megawatt (MW; nameplate capacity), by nameplate capacity, from January 1, 2013, to September 1, 2018.

Fig. 10. Relationship between bird mortality rates/MW solar PV facility and the total size of the facility. Smaller facilities do not have lower mortality rates than larger ones (Fig. 5 from Kosciuch et al 2020).

Does the mortality rate depend on the surrounding vegetation? The study sites in SW USA are mostly in arid or desert regions. Visser et al's study in S. Africa looked at the differential usage by birds of a solar PV facility and surrounding vegetation. Bird species richness and density were lower in the PV facility than in the surrounding area, at least in part because of the absence of shrubland or woodland species in the PV area. Open country/grassland species were commoner within the PV facility than outside it.

The significance of polarised light. Both insects and birds can detect polarised light. Insects use it for sun-compass navigation. Birds have various navigation systems but many nocturnal migrants that start their flights at sunset or soon after apparently use polarised light to determine initial migratory direction[29]. More generally *"skylight polarization pattern near the horizon at sunrise and sunset provides birds with a seasonally and latitudinally independent compass calibration reference"* (Muheim, 2011[30]). Birds associated with water, or simply visiting it to drink, appear to use reflected polarised light as a cue. Bernath et al (2001)[31], trying to understand why so many birds and insects became trapped in a waste oil lake in Budapest, put down large sheets of shiny black or white plastic and found that birds including black kites, swallows, wagtails and storks apparently mistook them for water; for example, the swallows tried to 'drink' from the sheets and the storks moved their bills in the same way as when feeding in mud.

The 'Lake Effect' hypothesis. The above and previous findings of waterbirds in solar PV arrays led to the 'lake effect hypothesis' (LEH) that birds confuse solar PV panels with water, respond to them in the same way, and thus crash into them. This would be a particular problem for obligate waterbirds that cannot take off from land. The Lake Effect Hypothesis has been challenged by Kosciuch et al (2022)[32] although the published article (the abstract of a conference talk) does not make clear whether there were any PV facilities at the reference areas used. The authors conclude

"Thus, the idea of a "lake effect" ….. is likely a nuanced process as a PV solar facility is unlikely to provide a signal of a lake to all aquatic habitat birds at all times."

Another article in the same symposium provides more direct experimental evidence. Robertson et al 2022[33] tested whether songbirds' known sensitivity to sky polarisation patterns might be used to locate water bodies and other terrestrial sources of polarized light. Songbirds increased their visitation rate to feeders with highly polarized light cues, (independent of their color and brightness), and reduced visits in response to the addition of a depolarizing black paint. They exhibited no differential response in visitation rates to color and polarization cues associated with ground-based (i.e. non-water) test surfaces, and visited black water baths most frequently, consistent with the use of broader-spectrum sources of polarized light to locate water. The authors showed that polycrystalline and thin- film solar panels are strong sources of polarized light that mimic the polarization properties of water bodies. These results, they claim,

"provide the first evidence that birds can visualize terrestrial sources of polarized light, and use them to locate water bodies and even guide their behaviour in other contexts (e.g. feeding). These preliminary results support key assumptions of the lake-effect hypotheses and bolster the possibility that bird-solar panel collisions result from birds misidentifying solar panels as water bodies."

Do Anti-Reflective Coatings work? Anti-Reflective Coatings (ARCs) have been suggested as a way of reducing glare from PV panels, but they do not necessarily reduce polarised light from them[34]. The 'AR' in ARC refers to the reflection from the surface of the PV panel itself, not the origin and type of the light that reaches it.

Experimental studies on ARCs with insects show that some species are less attracted to ARC-coated surfaces whilst others are more attracted.

3.2 Conclusion from the above Review

From the above literature review we conclude that at least some birds use all birds' known sensitivity to polarised light in activities with survival value, such as migration, and that waterbirds may use this sensitivity to locate open water bodies – including those on migration routes. We believe there is a very strong possibility that birds confuse polarised light coming from man-made structures with polarised light from natural features such as water bodies. In responding to these man-made features, birds may crash into Solar PV panels, and some are known to be killed by them. Others may be disabled by them and will hence be prone to predation by other birds or by mammals.

We do not yet know the contribution of solar PV mortality to the overall mortality of any bird species, but we believe the closer any Solar PV facility is to a bird habitat, and the larger the number of birds in that habitat, the greater that mortality will be.

Species of conservation importance – such as the cranes on Otmoor – initially occur in very small numbers and the loss of only a few individuals could cause local population extinction. Of course, re-colonisation could occur from wherever it originally occurred, but wildlife is under threat globally and is in dire straits nationally in the UK[35].

The Solar Symposium Meeting[36] included the statement.

"There's a false dichotomy of either/or – either we address the climate problem with solar OR protect wildlife, but not both. We can do both, and these robust tools get us part of the way there."

It seems to us that the Noke SF proposals promote this false dichotomy by claiming that the climate crisis is so immediate that it justifies putting solar arrays more or less anywhere, and despite their impacts on natural landscapes, amenity value and local wildlife.

We reject this dichotomy and believe that planning decisions should aim for a better balance between what is replaceable, or movable, and what is irreplaceable or un-movable.

3.3 The Otmoor RSPB Reserve

Birds living in or migrating to the Otmoor Reserve do not stay there. On a daily basis they leave the reserve to visit foraging areas elsewhere. Towards dusk, flocks of starlings returning after foraging outside the Reserve, can be seen approaching Otmoor from more or less all points of the compass, gathering there to perform their spectacular murmurations before settling in the reed beds for the night.

Oxford's many rivers provide feeding opportunities under flood conditions. A resident of Islip has for many years seem birds from Otmoor on daily migrations to and from the Cherwell flood plain. Figure 11 shows that these birds must fly over or near any Solar Farm at Noke to reach these feeding areas.

Harrison et al's review[12] contains recommendations from two key UK eNGOs (with our emphasis):

"The RSPB have produced a policy briefing that outlines the society's position on solar PV developments (RSPB, 2014). This document highlights that the RSPB advocate solar technologies, however recommend avoiding deployment in locations close to protected areas, or close to water features (highlighting a potential negative impact upon aquatic invertebrates as a risk, both independently and as a food resource for birds)."

and

"Friends of the Earth provide uncited advice suggesting that solar farms should avoid "the best agricultural land and areas important to wildlife", with preference to brownfield and contaminated land (FOE, 2014)."

The National Audubon Society of the USA (equivalent to our RSPB) states:

"Large solar installations must be properly sited to avoid disrupting bird habitat, and to minimize the chances that birds collide with the solar panels and associated infrastructure, like transmission lines and substations."

We believe the evidence presented here strengthens the above recommendations.

In the Noke Solar Farm Site Viability Assessment[7,] the applicants' consultants, Narec Distributed Energy, explain why they rejected a site for the farm close to the railway line at which, they thought, the Rise of Earth Potential (RoEP) might pose a hazard to railway equipment. They admitted that assessment of the actual risk was 'beyond the scope of this report' and continued (p.12 of the Narec Report in Appendix A of [7]):

"However, as with anything electrical where there is any form of doubt, avoidance is always the best option"

We request refusal of the Noke SF application on similar 'precautionary principle' grounds:

"However, as with anything ecological where there is any form of doubt, avoidance is always the best option"

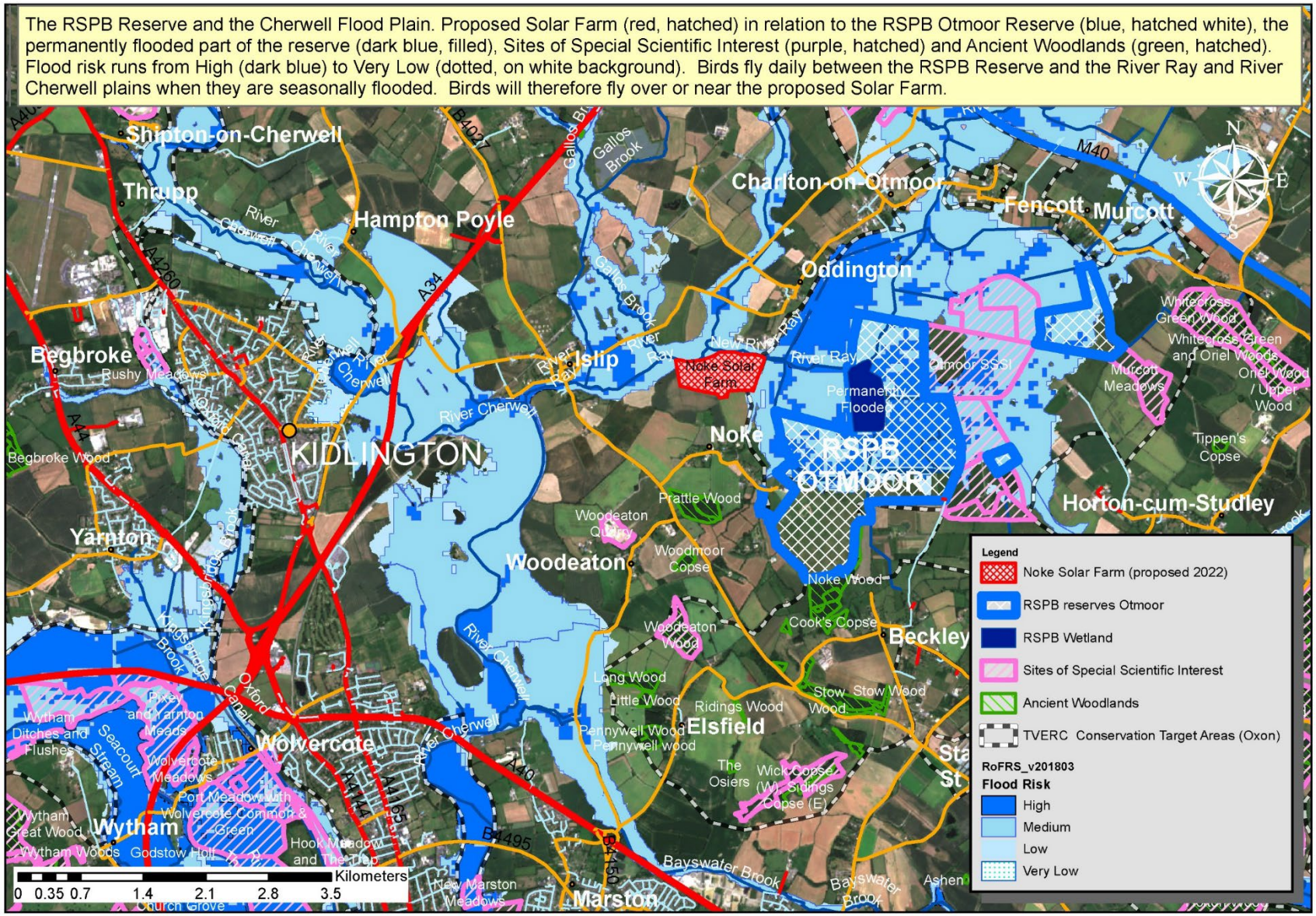


Fig 11. The proposed Noke Solar Farm (cross-hatched red) in relation to the RSPB Otmoor Reserve to the East, the Cherwell Flood Plain to the West and the River Ray flood plain to the N and NW. Flood risk areas on each river are shown in shades of blue (see Legend). Birds from Otmoor foraging in any flood plain area will pass over or near the proposed Solar Farm.

References

[1] Green Nation (2022). Letter to Noke Parish Meeting from Jonathan Thompson, dated 11/7/22 following the public meeting in Noke Church on 7th July 2022.

[2] As reported here: https://www.switch-plan.co.uk/energy/consumption/

[3] As reported here: https://www.switch-plan.co.uk/energy/consumption/

[4] https://www.e-education.psu.edu/eme812/node/738

[5] From https://insight.oxfordshire.gov.uk/cms/census-2021-results-highlight-oxfordshire%E2%80%99s-growing-population

[6] https://www.nationalgrid.com/electricity-transmission/network-and-infrastructure/network-route-maps

[7] Green Nation (2022). Site Viability Assessment. Noke Solar Farm – land off B4027, Manor Farm, Noke, Oxford, OX3 9TU. Rev.08 Redacted. 16pp, from: Planning application: 22/01682/F - Planning register | Planning register | Cherwell District Council

[8] The National Grid (2020). Future Energy Scenarios, 124pp, available at https://www.nationalgrideso.com/document/173821/download

[9] Pegasus Group (2022). Planning Application for Development of Solar Park and Associated Infrastructure. Consultation Statement. Land at Manor Farm, Noke, Oxfordshire, OX3 9TU. On behalf of Oxford New Energy. 34pp, from: Planning application: 22/01682/F - Planning register | Planning register | Cherwell District Council

[10] https://data.southoxon.gov.uk/ccm/support/Main.jsp?MODULE=ApplicationDetails&REF=P15/S2202/FUL#exactline

[11] The Delegated Report is available at the SODC Planning portal of Ref. 9, above.

[12] Harrison C, Lloyd H & Field C. (2017). Evidence review of the impact of solar farms on birds, bats and general ecology. Natural England Technical Report. [Online] DOI:10.13140/RG.2.2.24726.963 and http://publications.naturalengland.org.uk/publication/6384664523046912

[13] Fiona Reynolds (2018). Otmoor, the majestic Oxfordshire landscape that inspired Lewis Carroll, under threat once more. **Country Life**, December 2018., available at Otmoor, the majestic Oxfordshire landscape that inspired Lewis Carroll, under threat once more - Country Life

[14] Land Research Associates (2020). Agricultural Quality of Land at Manor Farm Noke. Report 1468/1, January 2020. 15pp, from SODC Planning portal of Ref. 9, above.

[15] Pegasus Group (2022). Planning Applicatio0n for Development of a Ground Mounted Solar Farm and Associated Infrastructure. Land at Manor Farm, Noke, Oxfordshire, OX3 9TU. Planning, Design 7 Access Statement. On behalf of Oxford New Energy. 62pp, from SODC Planning portal of Ref. 9, above.

[16] Solar Power Portal (2022). Eustice says local authorities disregarding guidance around solar development on agricultural land, available at https://www.solarpowerportal.co.uk/news/eustice_says_local_authorities_disregarding_guidance_around_solar_developme?fbclid=IwAR2v5-Ky6zBsV_ZYq08eDQKvOarGXDkfo6TTedATYvCnA0T9esxkquORPr4

[17] Environmental Audit Committee, 29th June 2022. A recording of this session is available at https://www.parliamentlive.tv/Event/Index/aaf848f6-7cb7-4c58-98bf-76abb69ede44
Start at time marker 14:29:21 for the Q&A about grade 3B land.

[18] https://www.cpre.org.uk/news/we-call-for-land-strategy-and-new-planning-rules-to-guard-food-security/?utm_medium=email&utm_source=engagingnetworks&utm_campaign=2022_bmv_email_general&utm_content=2022+BMV+email+general+version+A

[19] UK.GOV. Environmental Impact Assessment Guidance (2020). https://www.gov.uk/guidance/environmental-impact-assessment

[20] BSG Ecology (2022). Manor Farm, Noke. Ecological Appraisal, 41pp, from SODC Planning portal of Ref. 9, above.

[21] Montag H., Parker G. & Clarkson T. (2016). The effects of solar farms on local biodiversity: a comparative study. Clarkson and Woods and Wychwood Biodiversity, available at https://www.farminguk.com/content/knowledge/Effects-of-Solar-Farms-on-Local-Biodiversity(4654-8780-3868-4254).pdf

[22] BSG Ecology (2019). Potential ecological impacts of ground-mounted photovoltaic solar panels: an introduction and literature review, 19pp, available at https://www.bsg-ecology.com/wp-content/uploads/2019/04/Solar-Panels-and-Wildlife-Review-2019.pdf

[23]SEIA Solar Industry Research Data, available at https://www.seia.org/solar-industry-research-data

[24] McCrary MD, McKernan PAF, Schreiber RW, Wagner WD & Sciarrotta TC. (1986). Avian mortality at a solar energy power plant. Journal of Field Ornithology, 57(2): 135-141.

[25] Kagan RA, Viner TC, Trail PW & Espinoza EO. (2014). Avian mortality at solar energy facilities in southern California: a preliminary analysis, 28pp, available at https://www.ourenergypolicy.org/wp-con, tent/uploads/2014/04/avian-mortality.pdf

[26] Walston LJ, Rollins KE, LaGory KE, Smith KP & Meyers SA. (2016). A preliminary assessment of avian mortality at utility-scale solar energy facilities in the United States. Renewable Energy, 92:

405-414, available at https://www.sciencedirect.com/science/article/pii/S0960148116301422

[27] Kosciuch K, Riser-Espinoza D, Gerringer M, Erickson W(2020) A summary of bird mortality at photovoltaic utility scale solar facilities in the Southwestern U.S.. PLoS ONE 15(4), available at https://doi.org/10.1371/journal.pone.0232034

[28] Visser E, Perold V, Ralston-Paton S, Cardenal AC & Ryan PG. (2019). Assessing the impacts of a utility-scale photovoltaic solar energy facility on birds in the Northern Cape, South Africa. Renewable Energy, 133: 1285-1294, available at https://www.sciencedirect.com/science/article/pii/S0960148118310565

[29] The Cornell Lab (2008). The Basics: How Birds Navigate When They Migrate https://www.allaboutbirds.org/news/the-basics-migration-navigation/

[30] Muheim R. Behavioural and physiological mechanisms of polarized light sensitivity in birds. Philos Trans R Soc Lond B Biol Sci. 2011 Mar 12;366(1565):763-71. doi: 10.1098/rstb.2010.0196. PMID: 21282180; PMCID: PMC3049006, or at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3049006/#:~:text=Many%20organisms%20use%20the%20skylight%20polarization%20pattern%20as,polarization%20pattern%20in%20sun-compass%20orientation%20is%20very%20weak.

[31]Bernath, B., Szedenics, G., Molnar, G., Kriska, G., & Horvath, G. (2001). Visual ecological impact of a peculiar waste oil lake on the avifauna: Dual-choice field experiments with water-seeking birds using huge shiny black and white plastic sheets. Archives of Nature Conservation & Landscape Research, 40, 1-28,available at https://arago.elte.hu/sites/default/files/PakuraBirds_ANCLR.pdf

[32]Kosciuch, K., Riser-Espinoza, D. Moqtaderi, C. & Erickson, W. Aquatic habitat bird occurrences at photovoltaic energy development in Southern California, Abstract of a talk given to Solar Power and Wildlife/Natural Resources. Symposium Proceedings presented by REWI (formerly AWWI) in 2021. Meeting Proceedings published March 2022, available at https://rewi.org/wp-content/uploads/2022/03/Solar-Symposium_Proceedings.pdf

[33] Robertson, B, Rothburg, O., Heitman, J.B. & Fraleigh, D. (2022). Testing the 'Lake Effect' hypothesis for avian attraction to solar panels. P. 50. Abstract of a talk given to Solar Power and Wildlife/Natural Resources. Symposium Proceedings presented by REWI (formerly AWWI) in 2021. Meeting Proceedings published March 2022, available at https://rewi.org/wp-content/uploads/2022/03/Solar-Symposium_Proceedings.pdf

[34] https://www.axonoptics.com/polarization-vs-anti-glare-coatings/

[35] Environment Agency (2022). Working with Nature. Chief Scientist's Group Report, July, 2022, available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1088383/Working_with_nature_-_report.pdf

[36] https://rewi.org/wp-content/uploads/2022/03/Solar-Symposium_Proceedings.pdf