West Sussex County Council

Ash Dieback Survey 2021

Rural C and D Roads

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September 2021

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West Sussex County Council

Ash Dieback Survey 2021

Rural C and D Roads

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Introduction

1 Introduction

1.1 Purpose

1.1.1. The purpose of this document is to provide context and a record of the actions taken by WSP on behalf of West Sussex County Council (WSCC) in relation to ash dieback disease (ADB) present on the rural C and D category road network for which WSCC is the Highway Authority.

1.1.2. WSP was instructed to carry out a survey and produce a geospatial database to inform the quantity and quality of the ash tree population within the study area, defined as all ash visible from the relevant rural sections of the C and D category road network within falling distance.

1.1.3. In additional to the geospatial database WSCC required an estimate stem count of ash trees by 12 July 2021 to inform budget planning.

1.1.4. The survey and this report do not constitute a tree hazard assessment and should not be used as such. Where immediately dangerous trees were observed, they were reported to WSCC as a matter of good practice and professional courtesy only. Only one immediately dangerous tree was noted during the 2021 survey and this was later confirmed to be just outside West Sussex in Hampshire.

1.1.5. Due to the scale of the survey and the driven method, it was not possible to capture every ash tree within the study area. For example, some ash trees in wooded areas may not be clearly visible from the survey vehicle and therefore may not be recorded. It is therefore probable that the total number of ash trees in the survey area will be higher than WSP's estimate.

1.2 Background – ash dieback

1.2.1. First recorded in the UK in 2012, ADB is now known to be present throughout England and Wales, large areas of Scotland are also infected. The disease is caused by the fungal pathogen *Hymenoscyphus fraxineus* affecting common ash (*Fraxinus excelsior*) and other *Fraxinus* species, to find out more visit Forest Research.

1.2.2. Dependant on local conditions and genetics ADB can cause rapid physiological decline leading to mortality in all ages of ash. Mortality can be either as a direct result of ADB infection or a secondary pathogen affecting a weakened tree.

1.2.3. Ash are a common tree in highway verges and the turbulence caused by passing vehicles can spread ADB spores along the road so trees may be more readily infected along highways. Trees in close proximity to highways can also have additional stresses caused by their local environment such as impervious surfaces, seasonal drought and de-icing salts applied in winter. Such stresses can impede a tree's ability to withstand infection and increase the speed of decline.

1.2.4. Ash infected with ADB typically display crown decline resulting in deadwood. The wood in dead branches becomes increasingly weak over time and becomes unpredictably brittle. This can lead to branches snapping out from the tree which presents a hazard to people and property near the tree. There is no cure or treatment to control ADB.

1.3 Background – WSCC and ash dieback

1.3.1. WSCC has duties under both common law and statute including Highways Act 1980 as a Highways Authority. WSCC approached WSP for guidance and support in understanding the extent of the potential problem within their land holdings with the highway estate a priority.

1.3.2. WSP was instructed to survey A and B category roads for WSCC in 2019. Trunk roads within the county are the responsibility of Highways England and so were excluded from that survey. The 2019 project assisted WSCC to plan its response to ADB and helped to prioritise targeted surveys by staff generating detailed work packages.

1.3.3. A further survey to cover the rural minor C and D category roads was planned for 2020 however the Covid-19 pandemic prevented this from being completed.

1.3.4. In 2021 WSCC instructed WSP to complete the rural minor C and D category roads survey which incorporated improvements to the methods used in 2019 and 2020.

1.4 Best Practice

“Common Sense Risk Management of Trees” (2011) National Tree Safety Group (NTSG)

1.4.1. The NTSG consists of roughly 20 organisations including arboriculture and forestry industry trade organisations, organisations that represent large private landowners, and large charitable landowners. The NTSG guidance was published in 2011, is endorsed by the Health and Safety Executive and is widely accepted as ‘best practice’. NSTG guidance can be viewed on the NTSG website.

1.4.2. The NTSG believes that one fundamental concept should underlie the management of risks from trees. It is that the evaluation of what is reasonable should be based upon a balance between benefit and risk. This evaluation can be undertaken only in a local context, since trees provide many different types of benefit in a range of different circumstances.

1.4.3. The NTSG sets out a risk management process to allow a transparent and consistent approach to evaluating the benefit of trees alongside the potential risk they pose. The process consists of five steps:

- Context, how do these trees benefit their environment?;
- Risk identification, do the trees pose a threat to the safe use of that environment?;
- Risk analysis, what is the severity of the risk?;
- Risk evaluation, is this risk acceptable?; and

- Risk treatment, what remedial action is required to preserve the benefits of the trees while also reducing the risk to an acceptable level?

1.4.4. Importantly, the NTSG state that the level and extent of tree hazard management should be commensurate with the scale of organisation. That is, a homeowner with a single tree in their garden is not expected to carry out the same level and detail of inspection as large organisations which have the resources to employ specialists to manage tree hazard.

"Ash Dieback: An Action Plan Toolkit" (2019) The Tree Council

1.4.5. The Tree Council is a charitable organisation. Established in 1973 the Tree Council's intent was to be the umbrella body for UK organisations involved in the conservation, planting and care of trees. Their membership consists of a range of professional specialists, local authorities, conservation charities, non-governmental organisations and government bodies.

1.4.6. The Tree Council published their initial action plan toolkit in February 2019 which can be viewed at the Tree Council website. In a similar way to the NTSG, the Tree Council have provided a pragmatic approach to managing outcomes of ADB. Their toolkit has four parts that cover the entire management process ranging from baselining the potential scale of the problem to developing a recovery strategy post disease / remedial action. For the purposes of this report and the work completed to date, the focus is on part one, "Raising Awareness" which has three steps as follows:

- Step 1, Learning about ADB. What is the disease, how to identify it and where is it?;
- Step 2, Assessing the Impact. How many ash tree are in your area, collecting data, what are the potential costs?; and
- Step 3, Making a case for an ADB action plan. What is the extent of corporate risk, health and safety risk, economic and environmental impacts and reputational damage?

1.5 Survey Method Considerations

1.5.1. WSCC prioritised their highway estate for an ADB survey as this is the area of their land holdings that is most likely to have the highest population of ash, is more susceptible to ADB and cannot be closed from public access. A driven survey successfully photographed ash trees on A and B category roads in 2019. Covid-19 in 2020 forced a change in approach for the driven survey but use of video was not as successful.

1.5.2. In accordance with best practice, the first step for WSCC was to understand the scale of the potential problem on its highways. The task was, therefore, to locate and record ash trees within falling distance of the highway.

1.5.3. As ADB is a progressive disease, it is beneficial to obtain a visual record of the trees' canopies for cross reference in future years. A geospatial mapping system can assist in tracking and managing the effects of ADB both spatially and temporally.

1.5.4. Alternative methods for surveying to gather information about ADB were considered. The three main methods considered with some of the benefits and drawbacks were:

Walkover survey – highways walked by a surveyor on foot

- Time consuming over large areas
- Increased health and safety risk for surveyors on live roads
- Potential delay / disruption to road users where traffic management is required to ensure safety of surveyors
- Considerable additional cost for planning and installing and managing traffic management
- Greater access to locate ash trees not easily visible from the road

Digital survey – desktop assessment using high resolution aerial imagery combined with LiDAR data and National Forest Inventory (NFI)

- Eliminates health and safety risk of site surveys
- Expensive set up / data collection
- Potential data handling / storage issues
- Older data is less reliable
- Limited ability to differentiate tree species
- Would require ground truthing / calibration with walkover surveys

Driven survey – tree surveyor is driven along the highway to survey and capture data

- Due to line of sight from vehicle, not all ash trees will be visible / recorded.
- May not be as accurate as walk over survey
- Cover large areas in relatively short time
- Does not require traffic management
- Significantly reduced health and safety implications for surveyors and road users
- Vehicle mounted digital image capture device can be used enabling remote quality review

1.5.5. WSP worked with WSCC in reviewing the above options, and jointly developed a driven survey method that was cost effective, reduced risk to the survey team to an acceptable level and provided a robust data set upon which to plan future management of ADB near WSCC highways.

2

Method

2 Method

2.1 Survey Planning

2.1.1. Geographic Information System (GIS) data for 1,255km of rural C and D category roads were provided to WSP by WSCC in ESRI shapefile format. The data was uploaded to a geospatial database (GDB) to allow effective survey planning and monitoring which included:

- locating accommodation and transport bases;
- optimising survey sections to be captured while driving into and out of county from base;
- optimising survey sections into achievable, daily driven survey routes to and from bases;
- converting routes into KML format for use in Google My Maps;
- creating ESRI ArcGIS Online (AGOL) projects to enable digital mobile survey data capture;
- tracking daily and confirmation of total route completion; and
- County boundary.

2.1.2. To accurately assess the extent of ADB it is important to survey when the trees are in leaf. Spring in 2021 started later than 2019 so the survey window was approximately June to September.

2.1.3. Prior to the start of the live survey on 7 June 2021, a test route was driven on 2 June to identify any potential issues with the proposed method and equipment. No technical issues occurred. It was also established on 2 June that the ash in West Sussex were sufficiently in leaf to commence the survey.

2.2 Survey Delivery

2.2.1. The driven survey was undertaken by two teams of two over five weeks. Cars and drivers were procured from a local taxi firm. Two surveyors each week were separately driven by taxi along optimised survey routes.

2.2.2. Field work commenced on 7 June 2021 and ran continuously until the end of Week 4 on 2 July 2021. The driven survey paused at the end of Week 4, with an estimated 95% of the network covered, to enable completion of the task to produce an estimate for total number of ash stems near the rural C and D category road network.

2.2.3. Following completion of the stem count estimate in time for WSCC's deadline, a final driven survey was undertaken to complete the driven survey. Week 5 had two teams surveying on 19 and 20 July 2021, plus one team on 23 July 2021.

2.2.4. To undertake the driven survey the surveyors had two mobile devices: a WSP Android smartphone, and a WSP Android tablet.

2.2.5. Surveyors used tablets to run AGOL. This supported two tasks:

- support for navigation, showing clearly which sections of the daily route were to be captured; and
- allowed the surveyor to capture a georeferenced point (with location co-ordinates embedded) to record multiple trees as a group feature where photographing multiple stems was impractical.

2.2.6. From the passenger seat, WSP surveyors used a GoPro Hero 7 camera to photograph as many ash trees visible from a moving car as possible. On rural roads, under light daytime traffic, slow speeds were safely achieved to make this task reasonably practicable.

2.2.7. GoPro cameras are GPS enabled and captured geo-referenced images in JPG format.

2.2.8. The camera was triggered by hand, which allowed the operator to sit comfortably while taking photographs without obscuring the driver's field of view or use of mirrors.

2.2.9. While capturing survey data, the car travelled at an average of 20kph. This speed permitted accuracy of triggering the camera where ash trees were noted, allowed reasonable progress through the survey area and did not present a hazard to other road users. Over non-capture transit sections, normal driving speeds were achieved.

2.2.10. Photographs and video records of the survey were backed up from the 256GB SD memory card at the end of each survey day. Backups were held on WSP SharePoint cloud storage and on external hard drives provided to each surveyor.

2.2.11. Surveyors were requested to report any unsafe conditions to WSCC Customer Contact Centre. On the single occasion an unsafe condition was encountered, WSCC advised that the location was just beyond the border into Hampshire.

2.2.12. The project team were able to monitor survey progress closely, route tracking was available at end of each day and photographs were tallied the following morning along with AGOL tree group data which was viewable in real time. Monitoring metrics were shared with WSCC in weekly progress meetings.

2.3 Post-survey Analysis and Quality Assurance

2.3.1. Survey photographs were processed as follows:

- all images captured were geo-processed to extract GPS location co-ordinates;
- raw location data was refined to align with relevant road survey sections;
- images were then geolocated into AGOL as a point dataset, each point having a hyperlink file path to the relevant capture image;
- using an AGOL Webmap, photos were reviewed;
- photo reviewers allocated attribute data to each photo for two values: percentage of live canopy remaining, and estimated height (in five metre ranges); and
- the photo review task ran in parallel with the driven survey task, offset by one week.

2.3.2. Following the completion of photo reviewing Quality Assurance (QA) was undertaken.

2.3.3. Photo locations and group points were checked against aerial imagery to verify accuracy and also reviewed in Google StreetView to check for the presence of ash trees in historic imagery.

2.3.4. In addition to the desktop QA sample sections of the C and D category roads were revisited to establish whether the original survey data was sufficiently reliable.

2.3.5. QA consisted of assessing the following items:

- surveyors' compliance with scope;
- surveyors' handling of data and data transfer;
- surveyors' ability to capture appropriate trees;
- appropriateness of survey method;
- reviewers' ability to allocate attributes to photos; and
- in person review of areas with fewer or no trees recorded.

3

Results and Recommendations

3 Results and Recommendations

3.1 Results

3.1.1. Plans summarising the findings of the survey are presented in Appendix A. In summary these are:

- Drawing 70084936-01 is a map showing the location of groups of trees with an assessment of the percentage of canopy remaining for each group;
- Drawing 70084936-02 is a map showing the location of all photos taken with an assessment of the percentage of canopy remaining for each tree; and
- Drawing 70084936-03 which is a heatmap showing concentrations of ADB based on the number of trees in a given location and the percentage of remaining canopy.

3.1.2. The finalised geodatabase (GDB) will be delivered to WSCC digitally by email with ESRI Arc shapefiles attached for import to WSCC's own GIS systems. The GDB will also be supplied physically, copied to an external hard drive, together with the survey photos (in a logical folder structure matching the working WSP GDB), sent recorded delivery, on a date when WSCC personnel will be available to sign for receipt.

3.1.3. Key survey findings from the 2021 survey are:

- WSP estimated 17,000 ash trees were observed near to 1,255km of rural C and D category roads;
- surveyors photographed 9,206 individual ash trees and recorded 360 groups;
- 66% of ash had 75-100% live canopy;
- 20% of ash had 50-75% live canopy;
- 10% of ash had 25-50% live canopy; and
- 4% of ash had 0-25% live canopy.

3.1.4. The QA review of the survey established that errors or anomalies were relatively small, within project tolerances, and included:

- desktop QA review of group data positively matched 98% of validated photographs;
- following the photograph review, 444 photos (4.7%) have been excluded from the final analysis (originals are held on file). Of these 444 excluded photos:
  - 50 (0.5% of all photos) are geo-located but have no attribute data, since they do not show trees (for example accidental camera trigger), and
  - 394 (4.2% of all photos) show trees but cannot be located as co-ordinates are missing (probably GPS glitching, either at satellite transmitter, or GoPro device receiver). No further analysis of this data subset was undertaken as it was within the project tolerance for error and anomalies. For completeness, the raw photos are included in the final delivery dataset.

3.1.5. The findings of the 2021 survey are presented along with the 2019 results in Table 1.

Table 1 – Survey findings – proportion of live canopy from 2019 and 2021 surveys

Live Canopy (%)	2019	2021
75-100%	54	66
50-75%	28.5	20
25-50%	12.5	10
0-25%	5	4

3.1.6. The 2021 survey allocated estimated height values in five-metre bands for ash trees and this is summarised in Table 2.

Table 2 – Survey findings – estimated height of ash trees in 2021 survey

Estimated height range (m)	5-10	10-15	15-20	20-25	25-30	>30	No data
%	75.45%	20.30%	1.58%	0.29%	0.13%	0.02%	2.23%

- 95% of ash surveyed was estimated to be 15m in height or less.
- Note 1: Surveyors were instructed to ignore trees smaller than 3.0m in estimated height and therefore the 5-10m band reported may include ash slightly less than the nominal 5.0m threshold at the lower end.
- Note 2: the 'No data' category comprises photographs framed in such a way that not enough of the tree is visible in shot to enable a meaningful estimate of height. This does not necessarily mean that the photograph was invalid in terms of location or percent live canopy. The proportion of trees where height could not be estimated is within expected tolerance for the project so no further analysis was carried out.

3.1.7. It has not been possible to separate WSCC from third party trees conclusively at this stage. Therefore, the amount of effort potentially required to manage letters and notices to third parties recommending trees be managed is unknown.

3.1.8. Key QA findings are listed below:

- Daily contact with surveyors and overnight data uploads reassured the WSP project team that performance and progress was satisfactory. Ad-hoc random checks throughout the survey phase identified no significant issues.

- Post-survey feedback from survey staff was that the task was achievable: the method was held to be sound in practice, the daily coverage target both realistic and safe, the specialist survey tools fit for purpose, and the team support felt to be appropriate.
- Delivery data shared with client includes all photographs captured and have not been cleansed or edited.
- A desktop exercise audited 5% of photograph attributes (location, percent live canopy, and estimated height) as a random sample, and found data to be 95.4% accurate. In a small number of instances, the audit saw no ash in the photograph. In other instances, there was a minor difference in opinion over percent live canopy, in both directions, generally near a threshold value, but never more than +/- one category.
- A further multi-criteria desktop analysis (MCA) focused on sections of the survey network where little or no ash were recorded. Possible explanations tested included:
  - surveyor omitted survey section – not driven, possibly temporarily closed, possibly not driveable (private, unsurfaced);
  - surveyor missed ash – not captured; and
  - ash simply not present – driven, surveyed, no ash to record.
- MCA findings resulted in two further audit tasks:
  - Firstly, interpreting NFI datasets to predict where trees might be present within falling distance to the highway, 5% of survey sections were cross-checked against historic Google StreetView imagery to look for ash at 133 locations totalling 68.75Km.
  - Ash is visible in historic imagery at 1.5% of these locations.
  - Secondly, a targeted driven audit survey found inaccurate data at 8 locations.
- In summary, WSP QA indicates that survey data is accurate at over 95% in terms of location, quantity and quality.

3.2 Discussion

3.2.1. The 75-100% category represents over half of the ash tree population recorded. This may be misleading to some extent, as the category includes trees that have live canopy within expected tolerances for ash, allowing for factors such as time of year, location, weather conditions, etc., but also includes trees which could already have lost 25% of their live canopy as ADB infection progresses. Regardless, the 75-100% category trees are the lowest priority for remedial works.

3.2.2. The 25-50% and 0-25% live canopy categories make up just 14% of recorded ash. This may suggest that reactive tree works to preferentially remove diseased ash is keeping pace with ADB progression across West Sussex.

3.2.3. The 2021 data suggests broadly similar levels of significantly affected ash assessed as lower than 50% of live canopy remaining. For trees less affected by ADB there is a higher proportion with 75-100% live canopy compared to 2019. This is not likely to indicate that

ADB is becoming less damaging locally. It may indicate that owners and occupiers (including WSCC themselves) are preferentially removing high quantities of ash, retaining just those in visibly better health. This may also reflect that the environmental stresses on ash trees along C and D category roads may be less than on A and B category roads.

3.2.4. Given the scale of the estate and the range of ash tree population types (urban, rural, woodland, groups, individual) it is felt that this method for baselining the condition of ash trees is reasonable and proportionate. It provides a robust starting point on which to prioritise remedial works and follow up with detailed walkover surveys to manage the potential threat posed by ADB to the safe use of the rural C and D category roads.

3.3 Recommendations

3.3.1. Tree owners and managers have a duty of care for the safety of people or property that could be affected by their trees. This duty of care is usually discharged through tree inspections and the completion of tree work to reduce the risk of harm to an appropriate level. While this survey will have captured data on some private trees it is still the legal duty of the private landowner to continue to monitor, manage and maintain trees.

3.3.2. The data set provided should be used to prioritise walkover surveys and detailed inspection of ash trees within the 0-25% category as first priority, with 25-50% to follow as second priority.

3.3.3. Notwithstanding the programming and delivery of remedial works, subsequent walkover survey will allow a better understanding of the reason for leaf loss (ADB or another factor) and the ownership of the trees.

3.3.4. It is recommended that ecological advice is taken in advance of remedial tree work to ensure that potential impact on protected species is established and where necessary mitigated.

3.3.5. It is believed that a DEFRA Working Group continues to explore appropriate modifications to regulation and perhaps additional capital funding for ADB response works. In the meantime, current regulations (ie EPS licensing and felling licences) may apply in instances not covered by exceptions for Statutory Undertakers, and funding will have to be secured from existing budget arrangements.

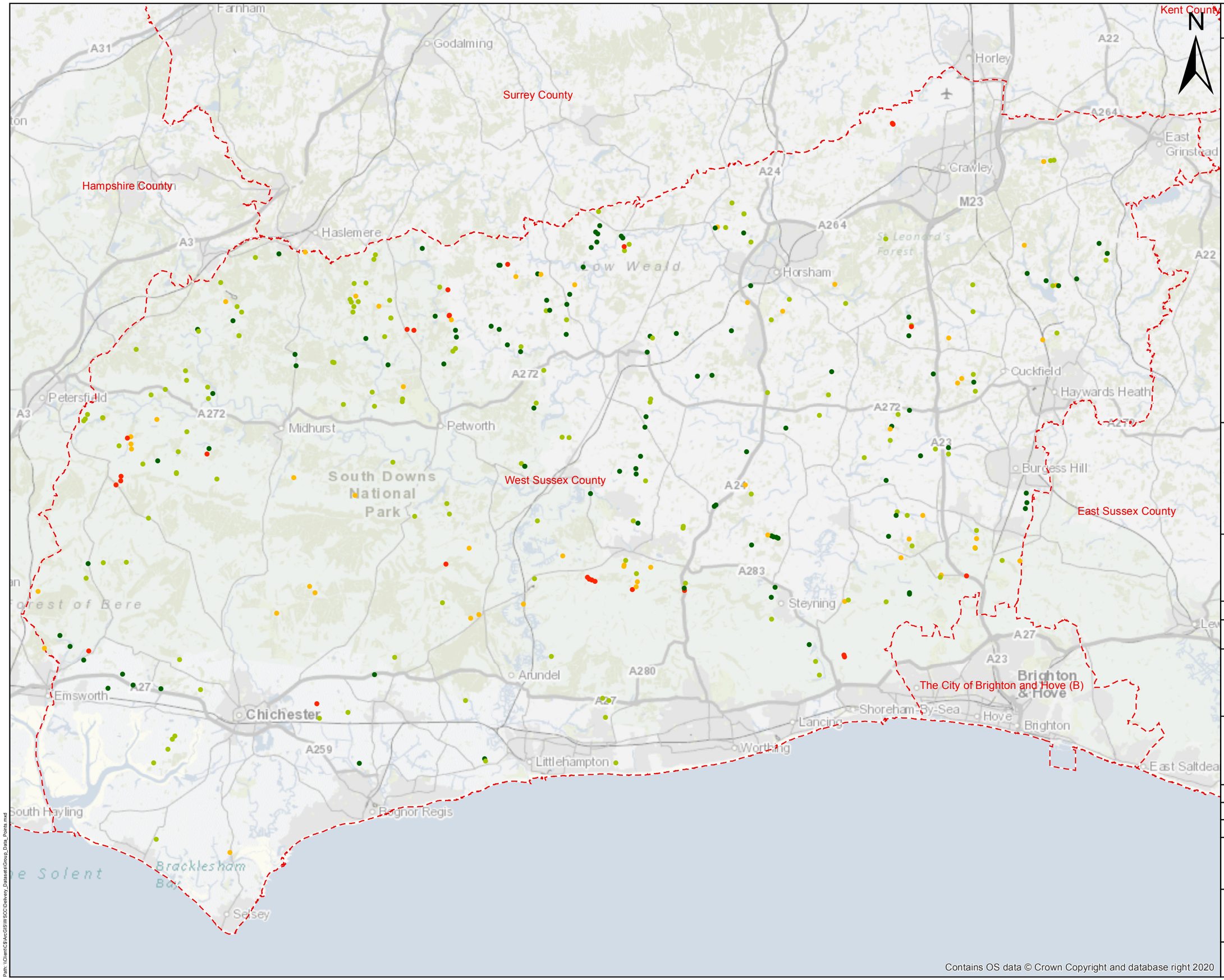
3.3.6. To ensure compliance with duty of care and the recommendations set out by the Tree Council, which can be accessed on the Tree Council's website. further pro-active checks on ash condition should be implemented as per current WSCC policy and procedure. More information can be viewed on WSCC's website.

3.3.7. Given the efforts required to collect and analyse survey data, adjustments to the driven survey method should be explored. These should focus on efficient collection of relevant data, perhaps via improvements to route optimisation, remote sensing technologies, and the application of Artificial Intelligence (machine learning) to digital photograph analysis.

3.3.8. Continued photographic and video record of the entire WSCC highways network will inform better understanding of the progression of ADB over the coming years.

Appendix A

Figures



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THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED AND ONLY WRITTEN DIMENSIONS SHALL BE USED

Notes

WSCC ADB 2021 Survey Group Points

- 0-25%
- 25-50%
- 50-75%
- 75-100%

Revision Details	By / Check	Date	Suffix

Drawing Status: FINAL

Job Title: West Sussex Rural C and D Network Ash Dieback Survey

Drawing Title: Groups of Ash Trees Data Points Overview

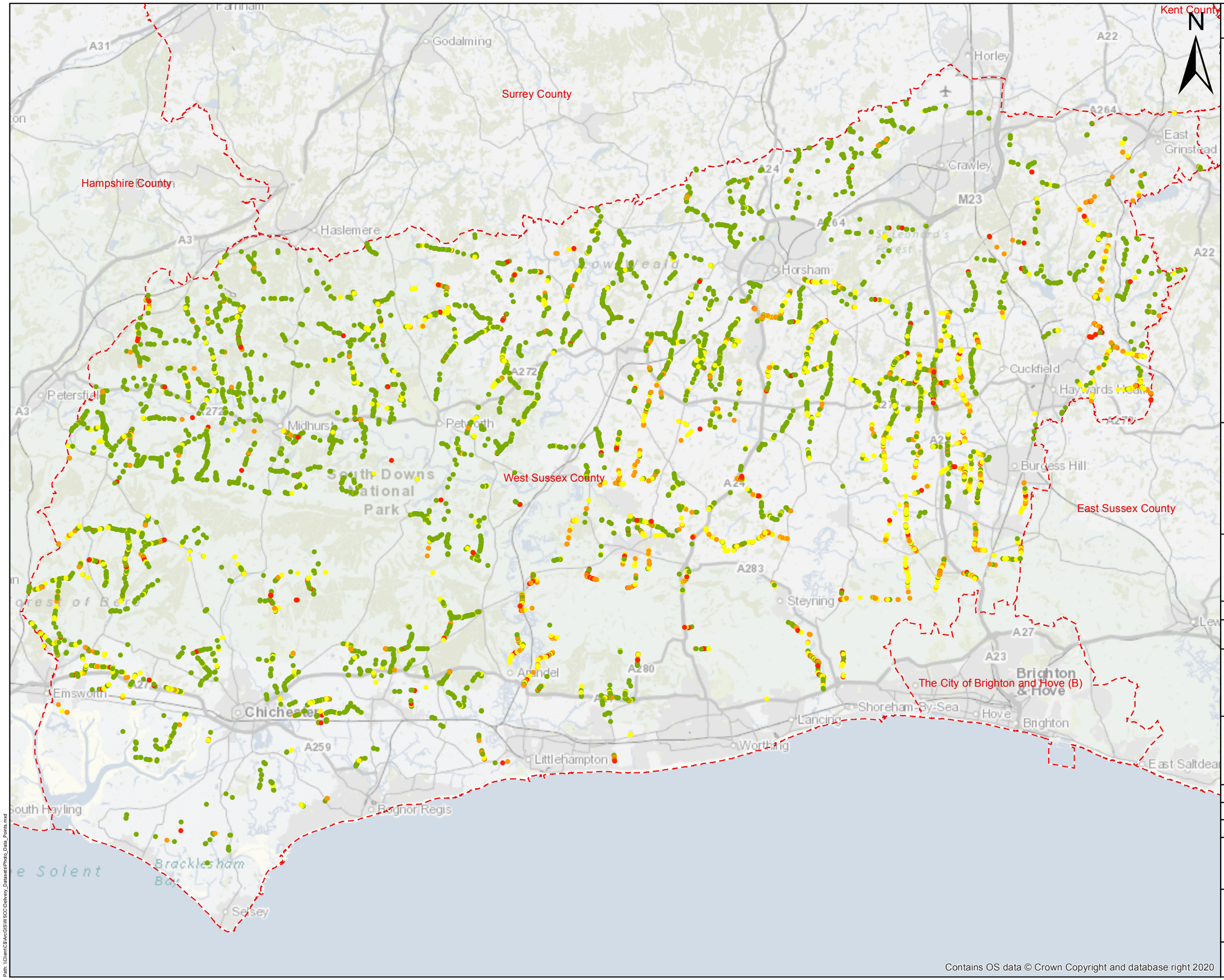
Scale at A3: 1:200,000

Drawn		
JA		
Stage 1 check: JA	Stage 2 check: CP	Originated: JA	Date: 04/10/2021

0 1 2 4 6 8
Kilometers

Kings Orchard
1 Queen Street
Bristol, BS2 0HQ
Tel: 0117 930 6200

Drawing Number	Rev
70084936 - 01	-



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Notes

2021 Survey Photo Points - Percentage Canopy Remaining

- 0% - 25%
- 25% - 50%
- 50% - 75%
- 75% - 100%

Revision Details	By / Check	Date	Suffix

Drawing Status: FINAL

Job Title: West Sussex Rural C and D Network Ash Dieback Survey

Drawing Title: Individual Ash Tree Data Points Overview

Scale at A3: 1:200,000

Drawn: JA

Stage 1 check	Stage 2 check	Originated	Date
JA	CP	JA	04/10/2021

0 1 2 4 6 8
Kilometers

wsp
London Square
2 Cross Lanes
Guildford
GU1 1UN

Drawing Number: 70084936 - 02

Rev: -

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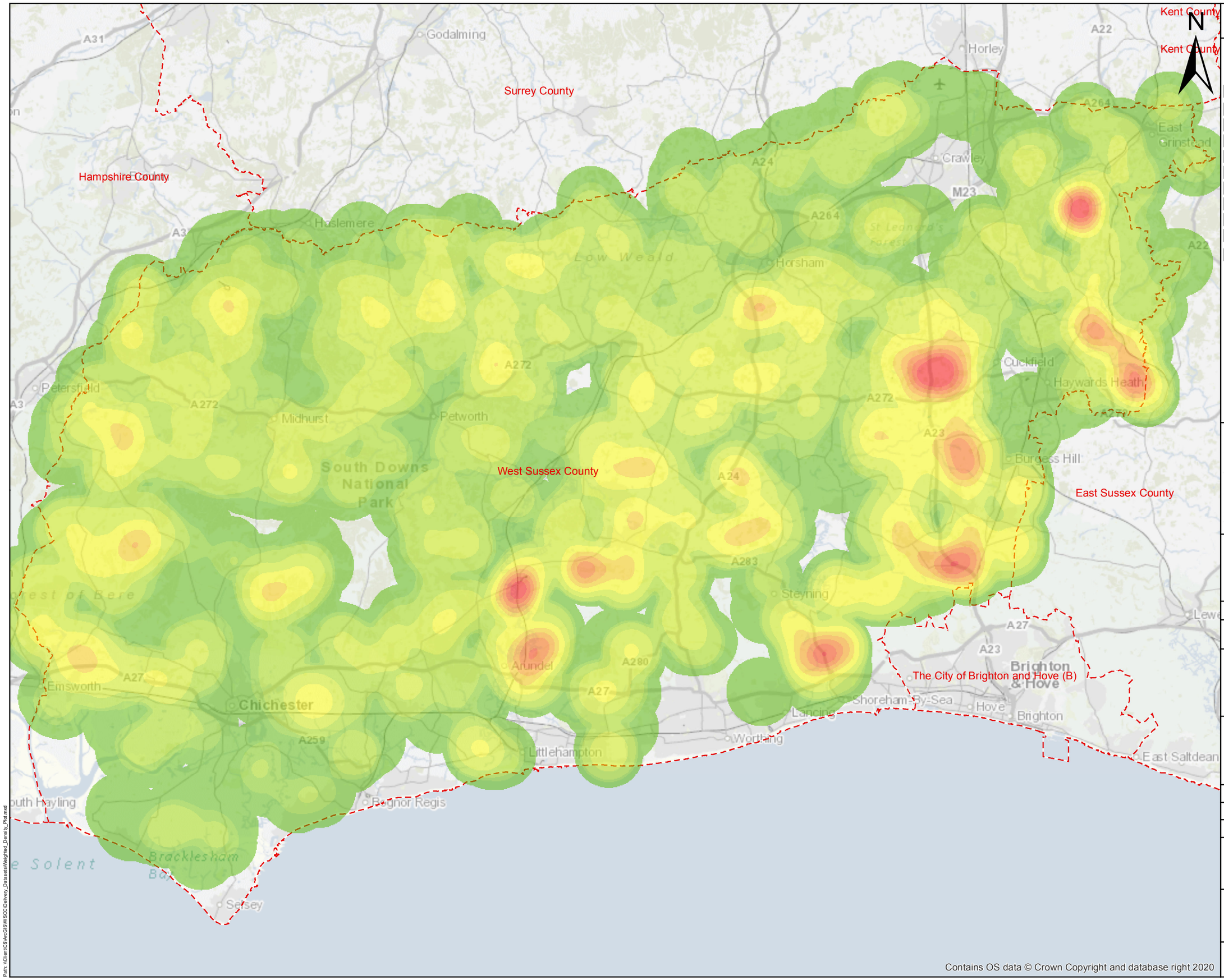

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Notes

WSCC ADB 2021 Survey Density Plot

Lowest Risk

Highest Risk

Revision Details	By / Check	Date	Suffix

Drawing Status: FINAL

Job Title: West Sussex Rural C and D Network Ash Dieback Survey

Drawing Title: Weighted Density Analysis of Ash Tree and Group Data

Scale at A3: 1:200,000

Drawn		
JA		

Stage 1 check	Stage 2 check	Originated	Date
JA	CP	JA	04/10/2021

0 1 2 4 6 8
Kilometers

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Drawing Number: 70084936 - 03

Rev: -

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