(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 781 674 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
24.09.2014 Bulletin 2014/39

(51) Int Cl.:
E04H 13/00 *(2006.01)*

(21) Application number: **14156262.9**

(22) Date of filing: **21.02.2014**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **18.03.2013 GB 201304932**

(71) Applicant: **Greenacres Groups Limited**
Liverpool L1 5JQ (GB)

(72) Inventor: **Paling, Andy**
Liverpool, L1 5JQ (GB)

(74) Representative: **Elkiner, Kaya et al**
Keltie LLP
Fleet Place House
2 Fleet Place
London EC4M 7ET (GB)

(54) Improved burial systems and methods

(57) A burial method for sustainably establishing graves 120 within woodland 1 is disclosed. The method comprises selecting burial trees 100 from a plurality of healthy established trees within the woodland 1 and carrying a set of steps for each burial tree 100 to establish a first set of graves 120. The method further comprises waiting a tree recovery period after which the steps are repeated to establish a further set of graves 120. The set of steps include determining the extent of a root protection zone 105 around the burial tree 100.

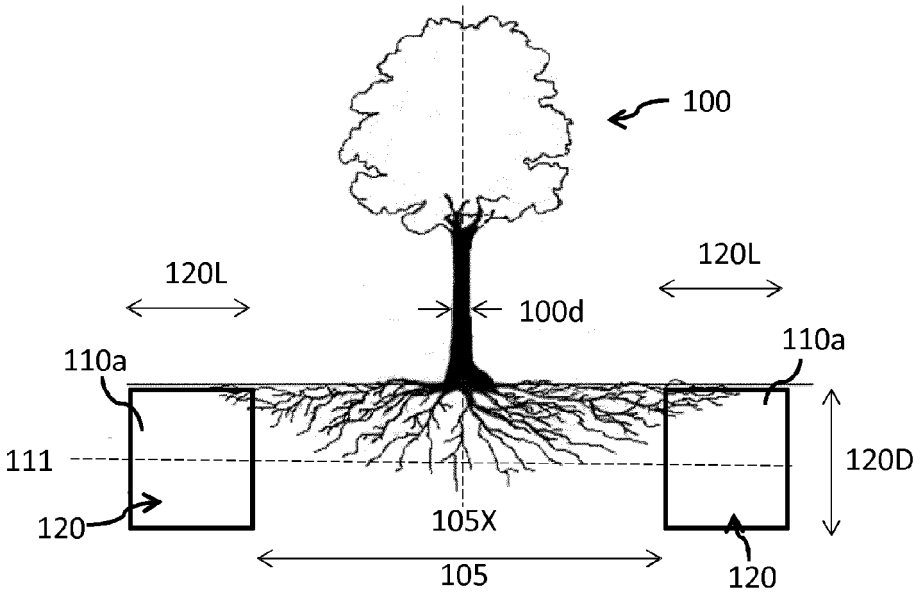


Figure 4

EP 2 781 674 A2

Description

FIELD OF THE INVENTION

[0001] The present invention relates to improved burial systems and methods. Specifically, the present invention relates to systems and methods for the ecologically sustainable burial of bodies of the deceased at burial sites within woodland or forest. The present invention also relates to burial sites and graves that are established in an ecologically sustainable way.

BACKGROUND OF THE INVENTION

[0002] There is an increasing demand on modern cemeteries, especially those in urban areas, to maximise the density of burial plots within a given area. As a result, cemeteries which are in active use tend to consist of rows of tightly-packed graves. As cemeteries become full, natural land is often reclaimed to create further burial spaces. This encroachment is ecologically unsustainable.

[0003] The graves themselves are traditionally ornamented with grave-markers such as headstones, edging, footstones, paving and the like, permanently occupying space on ground that could otherwise have ecological and environmental benefit. Furthermore, there is an environmental cost associated with fabricating and transporting such grave-markers.

[0004] A similar problem exists with the coffins within which the deceased are buried. Many coffins are made of materials that often represent a threat to the soil ecosystem and the underlying water table. This is also true of the bodies of the deceased which are frequently embalmed, and so contain contaminants such as formaldehyde which can leech into and poison the soil and groundwater. Even if such contaminants are not used, materials which are not readily biodegradable can slow the rate of decomposition of the coffin and corpse. Accordingly, this slows the rate at which the natural composition of the soil is restored.

[0005] These problems are particularly exacerbated by traditional side-by-side burials which leave very little space between graves from which any pre-existing natural life can re-establish itself back into the grave space. As the utilisation of burial plots advances, the above-mentioned problems become compounded, and so have a significant impact on the natural environment.

[0006] Some graveyards employ a system of permitting only headstones memorials. Following interment, once the back-filled soil has settled, turf is laid above the grave. However, this does not address the problems beneath the soil and cemeteries covered in grass are not rich in terms of ecological diversity. Additionally, the grass needs to be cut to maintain the appearance of the cemetery, which is labour and energy-intensive, costly, and also unsustainable in the long term.

[0007] It is an object of the present invention to ameliorate the above-mentioned problems, at least in part.

SUMMARY OF THE INVENTION

[0008] According to a first aspect of the present invention, there is provided a burial method for sustainably establishing graves within woodland. Optionally, the method comprising selecting burial trees from a plurality of healthy established trees within the woodland; and, for each burial tree, carrying out at least one of the steps of:

(i) determining the extent of a root protection zone around the burial tree;
(ii) excavating ground outside of but bordering the root protection zone to define a first set of grave pits;
(iii) interring a body of the deceased into each respective grave pit;
(iv) backfilling each respective grave pit;
thereby to establish a first set of graves; and
(v) waiting a tree recovery period after which steps (i) to (iv) are repeated to establish a further set of graves.

[0009] Advantageously, this method enables many burial plots within a woodland or forest to be established without ecologically damaging the woodland. Situating the graves at the periphery of the root protection zone, and controlling when each set of grave pits are opened allows the health of the tree to be maintained. Moreover, it enables an optimal balance to be maintained between, on the one hand, minimising the disturbance to the tree roots, and on the other hand maximising the number and distribution of graves within the woodland. Accordingly, the number of burial plots within an area of woodland can be maximised to deal with increasing demand without sacrificing the biodiversity that a woodland or forest supports. Moreover, the burial method is synergistically compatible with best forestry management techniques so that an otherwise neglected stretch of woodland can be actively managed as part of a combined natural burial and woodland management system. To this end, the selection of a suitable tree within the woodland, and the digging into the soil can be driven by good forestry management techniques - for example, those giving priority to species that are native to that woodland, and removing species that are damaging, invasive or otherwise prejudicial to the biodiversity of the woodland.

[0010] Another advantage is the effective permanency of the memorial. The longevity of tree can typically be between 80 and 150 years - potentially even longer for species such as English Oak. Thus, the tree can act as a standing memorial which effectively outlasts a headstone within a traditional cemetery. The reason for this is that graves in traditional cemeteries are not truly permanent. Rather they are placed on ground leased for a period of typically 50 to 75 years after which the cemetery has the right to reuse the grave space. This typically involves removing the headstone of the previous occupier. By contrast, the tree is never moved, even if the space

occupied by an old grave is reused.

[0011] For the avoidance of doubt, the terms "woodland" or "forest" fall under the definition of a forest as set out in the UK forestry standard - i.e. land predominantly covered in trees (defined as land under stands of trees with a canopy cover of at least 20%), whether in large tracts (generally called forests) or smaller areas known by a variety of terms (including woods, copses, spinneys or shelterbelts).

[0012] Preferably, an uppermost layer of soil is removed from each respective grave pit during the excavating step, and restored as the uppermost layer of soil after the backfilling step. Ideally, the uppermost layer is restored after a grave-settling period. Ideally, depressions in the ground caused during the grave-settling period are levelled using spoil excavated during the excavating step. Ideally, during the grave-settling period, the removed uppermost layer of soil is kept adjacent to the grave pit from which it originated.

[0013] Preferably, the burial method comprises a further step of spreading a layer of a porous substrate onto a floor of each grave pit. Optionally, the burial method further comprises laying a porous substrate onto the grave pit floor prior to the step of interring a body of the deceased. Preferably, the porous substrate is biodegradable. The porous substrate may comprise woodchip.

[0014] Advantageously, the porous substrate allows fluids to drain to the floor of the grave pit. Accordingly, during internment, the appearance of the grave is enhanced so that in the event of wet weather, or a relatively high water table, the floor of grave appears to be solid. Moreover, following internment and the backfilling of the grave, the porous substrate is important to allow any water seeping into the grave to be drained away from the body of the deceased. This is because soil lithology affects the biodegradation of the body of the deceased. Well-drained soil generally encourages aerobic biodegradation which is more efficient, rapid and environmentally friendly than anaerobic biodegradation. Poorly-drained soil, for example, peaty soil, has the reverse effect and slows decomposition.

Rapid and aerobic decomposition is preferred as this is more conducive to the reestablishment of tree roots in the vicinity of the grave. Moreover, this positive effect is self-reinforcing - i.e. the rate of decomposition will be further increased by virtue of locating the grave in close proximity to the tree. This is because water in the vicinity of the grave will be taken up by the tree as part of its natural evapotranspiration process, thereby encouraging aerobic biodegradation. This further maximises the biodiversity of the soil ecosystem. A higher rate of decomposition is also advantageous as this allows the grave space to be reused sooner without the possibility of exhuming remains identifiable as belonging to a human body.

[0015] Ideally, the burial method comprises at least one of the steps of:

laying at least one panel onto the ground adjacent to each grave pit to be excavated;

piling spoil excavated from the grave pit during the excavating step onto the at least one panel;

backfilling each respective grave pit with the spoil piled on said at least one panel; and

removing excess spoil and the at least one panel from the ground adjacent to the respective graves to restore the ground around the grave to its previous natural state.

[0016] Preferably, the burial method comprises a step of transplanting flora, such as tree saplings, rooted in ground that is to be excavated during the excavation step to another location within or around the woodland.

[0017] Preferably, the root protection zone comprises a border having sections of substantially equal length and each grave of a common set is established adjacent to a different border section. Ideally, graves of a common set are spaced at regular intervals from one another along the border of the root protection zone.

[0018] Ideally, the extent of the root protection zone is determined in dependence on a characteristic of the respective burial tree. The characteristic of the burial tree may comprise the diameter of the trunk of the burial tree. Preferably, the root protection zone is substantially circular, and has a radius calculated by multiplying the diameter of the trunk of the burial tree by a factor. Preferably, the factor is between 12 and 20. More preferably, the factor is 18.

[0019] Ideally, the diameter of the trunk of the burial tree is derived from the circumference of the trunk measured at a predetermined distance above the ground.

[0020] Ideally, the extent of the root protection zone is quantised to one of a predetermined number of discrete values.

[0021] Ideally, the root protection zone is substantially circular, and the radius is quantised by rounding up to the nearest measurement interval, the measurement interval being at least half a metre.

[0022] Ideally, each grave pit is oriented so that its length extends in a radial direction relative to the centre of the root protection zone.

[0023] Ideally, each grave pit is oriented so that its horizontal axis extends in a direction substantially transverse to a longitudinal axis of the burial tree.

[0024] Ideally, the body of the deceased is housed within a biodegradable coffin.

[0025] Preferably, the burial method further comprises at least one of the steps of:

burying at least one metallic member at a predetermined position relative to a respective grave pit; and

locating the grave using a metal detector.

[0026] Ideally, two metallic members are buried at opposite ends of the grave pit so as to aid the location of the head and foot of the grave.

[0027] Ideally, the burial trees are selected in dependence on their accessibility.

[0028] Ideally, the steps of the burial method carried out in respect of different burial trees are carried out in a sequence that, at any one time, distributes grave pit excavations evenly across the woodland.

[0029] The steps of the burial method carried out in respect of different burial trees may be carried out in a sequence that, at any one time, distributes grave pit excavations randomly across the woodland.

[0030] Ideally, the tree recovery period is determined in response to assessing the health of the burial tree.

[0031] Ideally, each set of graves comprises four graves, and the tree recovery period is approximately four years.

[0032] Ideally, the burial method further comprises labelling each burial tree with an identifier.

[0033] According to a second aspect of the present invention there is provided graves that are sustainably established in accordance with a burial method according to the first aspect of the present invention.

[0034] According to a third aspect of the present invention there is provided a burial site operating a burial method according to the first aspect of the present invention.

[0035] According to a fourth aspect of the present invention there is provided a burial site comprising a distribution of graves each established relative to a respective burial tree, each burial tree being selected from a plurality of healthy established trees native to a woodland. Ideally, each grave borders a root protection zone around a respective burial tree. Ideally, each grave belongs to one of a plurality of grave sets. Preferably, a tree recovery period separates the establishment of graves belonging to different grave sets.

[0036] Ideally, the burial site comprises constructions positioned, built and maintained to avoid harm to the burial trees. Ideally, the constructions comprise at least one of roads, car parks, staff facilities, public facilities, buildings and access routes.

[0037] Ideally, the burial site comprises equipment and machinery employed for the conversion and/or use of a woodland as a burial site, the equipment and machinery comprising at least one of: a wood-burner, felling equipment, pruning equipment, grave-shoring systems, woodchippers and work vehicles such as excavators, loaders, and general-purpose vehicles for pulling trailers and transporting loads.

[0038] Ideally, the burial site comprises access routes that are routed to ensure that at least half of the area of a woodland used for burial is within a predetermined distance of an access route. Ideally, the burial site comprises access routes that loop.

[0039] According to a fifth aspect of the present invention there is provided biodegradable products, such as coffins and monuments, used in conjunction with the burial method of the first aspect of the present invention, graves of the second aspect of the present invention and/or a burial site of the third or fourth aspects of the present invention.

[0040] According to a sixth aspect of the present invention there is provided woodland converted for use and/or maintained as a burial site according to the third or fourth aspects of the present invention.

[0041] According to a seventh aspect of the present invention there is provided a computerised record of data associated with features of the woodland of the sixth aspect of the present invention, and/or the burial site of the third or fourth aspects of the present invention. Ideally, the data is generated by carrying out a survey.

[0042] According to an eighth aspect of the present invention there is provided a map, displayed or printed from the computerised record of the seventh aspect of the present invention.

[0043] Further aspects of the present invention may reside in features of first, second, third, fourth, fifth, sixth, seventh and/or eighth aspects of the present invention.

[0044] Furthermore, it will be understood that features and/or advantages of the different aspects of the present invention may be combined and/or substituted where context allows.

BRIEF DESCRIPTION OF THE DRAWINGS

[0045] In order that the invention may be more readily understood, reference will now be made, by way of example, to the accompanying drawings in which:

Figure 1 is a schematic map of woodland to be converted into a burial site;

Figure 2 is the schematic map of same woodland of Figure 1, converted for use as a burial site according to a first embodiment of the present invention;

Figure 3 shows a plan schematic view of graves of the burial site of Figure 2 situated around a tree of the woodland of Figures 1 and 2;

Figure 4 shows a schematic sectional side view of the tree and graves of Figure 3; and

Figure 5 shows a schematic sectional front view of a grave pit excavated for the establishment of one of the graves of Figures 3 and 4.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0046] Figure 1 is a schematic map of an ancient and well-established woodland 1 typically found in the United Kingdom of Great Britain. Certain aspects of the present invention relate to the ecologically sustainable conversion and use of such a woodland 1 as a burial site. In the present embodiment, the processes described to achieve this are intended to comply with the legal requirements of United Kingdom Forestry Standard. However, it will be appreciated that in other embodiments and al-

ternatives, different forestry standards may apply, especially when the principles of the present invention are applied to woodlands outside the United Kingdom. Similarly, the present invention is intended to work in harmony with the UK Biodiversity Framework, protecting and promoting native flora and fauna in such woodland.

[0047] Initially, a surveying phase is undertaken to determine the extent to which the woodland 1 is a suitable for use as a burial site, and also how best the woodland 1 can be converted and used as a burial site in harmony with forestry standards.

[0048] The woodland 1 is surveyed to collect data which is recorded in a computerised database. It will be understood that as the state of woodland 1 shifts over time, surveys are repeated as necessary to update the data in the database.

[0049] The data includes the status and position of features in and around the woodland 1. In the present example, data associated with the position and layout of a road 2, a railway 3 and trees 10, 12 is recorded. Furthermore, the state and lay of the ground at various positions is also recorded, including areas of water 14, slopes leading to sunken ground 15 and slopes leading to elevated ground 16. Other data will also be recorded, mapped and/or assessed, for example:

- Geology: evidence of solid and drift geology.
- Ground Water Vulnerability: mapping of ground water aquifers.
- Source Protection Zones: water extraction boreholes protection zones.
- Transport and Accessibility: location in terms of primary roads and rail networks.
- Approach: aesthetic and functional assessment of route to site.
- Public Rights of Way: assessment of frequency and connectivity.
- Topography: qualitative and functional assessment relating to aesthetics and mobility.
- Water/drainage: surface water and drainage patterns and potential constraints.
- Neighbours: proximity to residential areas.
- Noise/tranquillity: aesthetic assessment.
- Woodland: qualitative, ecological and historical interest appraisal.
- Ecological: evaluation relating to designations, status and level of biodiversity.
- Utilities: proximity of likely sources of water and electricity.

[0050] Certain features of the woodland 1 may be surveyed in situ using known techniques and equipment. For example, a Topcon® GTS-220 theodolite with a tripod and a survey prism on 5m detail pole can be used to determine the relative position of woodland features, and also the woodland topography. Similarly, satellite positioning systems can also be used to obtain an absolute position of each of the features of the woodland 1. The recorded data can then be used to generate a geographically and topographically accurate map of the woodland 1.

[0051] The map shown in Figure 1 uses only two different representations for trees, categorising native broad-leaf deciduous trees 10 differently from non-native species such as certain types of conifers 12. However, it will be appreciated that the exact species of each tree will be recorded in the database, along with other details such as its maturity, size, and health, even if these are not represented on the map. To facilitate cross-referencing between the map and the database, and to maintain data integrity, each significant feature recorded by the survey is assigned a unique identifier. In particular, each mature tree 10, 12 is assigned a unique identifier.

[0052] After enough data has been obtained from the survey, it is then possible to determine and action how the woodland 1 can best be converted into an ecologically sustainable burial site.

[0053] Figure 2 is the schematic map of same woodland 1 of Figure 1, converted for use as a burial site 20 according to a first embodiment of the present invention. Figure 2 shows the same woodland 1 as Figure 1 together with additional constructions allowing the woodland 1 to be safely, conveniently and sustainably used as a burial site, offering services and amenities typically expected at most modern cemeteries. In particular, the burial site 20 comprises an access road 22, a car park 24 and buildings, including public facilities 26 for use by members of the funeral party, and staff facilities 28 for use by staff of the burial site 20. These constructions are situated at the outskirts of the woodland 1 so as to minimise the ecological disruption to the woodland 1. The burial site 20 also comprises access routes such as driveways 30 and pathways 32 that extend from the car park 24 and buildings 26, 28 into the heart of the woodland 1, allowing safe and convenient access to the woodland for users of the burial site 20.

[0054] In dense woodland, it is perhaps unavoidable that the establishing of access routes 30, 32 will require the removal of certain flora. In view of this, the access routes 30, 32 are routed in a way that prioritises native species over non-native species. In particular, the layout of the access routes 30, 32 is chosen to avoid damage to mature native trees 10, and furthermore can even be chosen intentionally to promote the removal of non-native species.

[0055] This is because certain non-native species can be invasive, spreading readily and competing with or dominating native species. What constitutes a native or invasive species varies from place-to-place. However, in England, native tree species include the Common Ash, the Silver Birch, the European Beech, the Common Hazel and the English Oak. Most conifers, apart from the Scot's pine, are considered to be non-native, and potentially invasive.

[0056] The removal of non-native species not only makes it easier to establish access into the woodland 1,

but can also help the surrounding native species to flourish. Doing this promotes the original heritage of the woodland 1 and can promote biodiversity by allowing other species to establish themselves in the woodland 1 that could otherwise not compete against the invasive species. This process can be illustrated by comparing Figure 1 against Figure 2: The access routes are established over ground previously supporting non-native trees 12. However, it will be noted that the access routes 30, 32 avoid the mature, established native trees 10.

[0057] During the actual laying of the access route 30, 32, any important native flora that is not yet properly established, and that stands in the way of a proposed access route is first transplanted elsewhere within the woodland 1. Such flora may include young native trees. In this case, these are transplanted into a tree nursery 27 at a designated area, usually at a boundary of the woodland which is sparsely populated by woodland flora. The grouping of these young trees within a tree nursery 27 and positioning them close to the staff facilities 28 makes it easier to care for them. Furthermore, the positioning of the nursery 27 on the boundary of the woodland 1 enables the woodland 1 to expand in the long term as the young trees grow.

[0058] As mentioned, the access routes are composed of driveways 30 and pathways 32. Driveways 30 are constructed to support vehicular access into woodland, and are generally created by laying a surface of gravel. Pathways 32 are narrower than driveways 30, primarily suited for access by users on foot and are created by laying woodchip to stop the ground underfoot becoming muddy and treacherous in wet conditions.

[0059] Signage may be placed within the woodland to aid navigation along the driveways 30 and pathways 32. The signage may label each area with the different name, and indicate whether the direction of a pathway 32 and/or driveway 30 is towards or away from the public facility.

[0060] As can be seen in Figure 2, the driveways 30 extend from the car-park 24 and are routed to allow vehicles to gain access to many areas of the woodland 1. Moreover, the driveways 30 are routed through the woodland 1 so that any location within the woodland 1 that is to be used for burial will be within a short distance from the driveway 30. This facilitates access for the disabled who are then able to easily gain access to the woodland via mobility vehicles. Perhaps more significantly, the driveways 30 enable a funerary vehicle such as a hearse to carry a coffin a significant distance into the woodland 1. This means that pallbearers carrying a coffin on foot through the woodland 1 do not need to carry the coffin over a long distance.

[0061] The routing is such that approximately half of the area of the woodland 1 to be used for burial is within twenty metres of a driveway 30. This provides a good balance between providing convenient vehicular access and minimising the impact that driveways have on the ecology and setting of the natural woodland 1.

[0062] As can also be seen in Figure 2, the driveways 30 are routed in loops. This also significantly facilitates access to funerary vehicle. As will be appreciated, a hearse is very long compared to its width (typically around 6 metres long) and has a significant turning circle (typically over 14 metres kerb-to-kerb). With this in mind, the routing of the driveways 30 in loops is particularly advantageous as it allows such funerary vehicles to drive into and out from the woodland without turning around. This means the driveways 30 can be narrower than if the driveways 30 were not routed in loops, further minimising their impact on the woodland 1. An average driveway width of approximately two to four metres is sufficient to allow convenient access to such funerary vehicles.

[0063] As can be also be seen, the loops join on to one another, advantageously minimising the chance that vehicles of two or more funeral parties will block or even pass one another. Pathways 32 spur from the driveways 30 and do not necessarily loop.

[0064] The woodchip that is used to define the pathways 32 has same provenance as the woodland 1. The woodchip is generated as a product of the process of removing of flora to define driveways 30 and pathways 32 and also as part of the general conversion and maintenance of the woodland 1 as will now be discussed.

[0065] It is common for previously neglected woodland to be relatively dense, and dominated by competitive species which form monocultures, preventing light and nutrients from reaching other flora. Furthermore, the canopy formed by trees can also block out light. Accordingly, it is desirable to undertake thinning of woodland to make it more accessible as a burial site 20 and also to promote the success and biodiversity of native species. For example, competitive species such as bramble and bracken are removed to make way for other less-competitive native flora such as bluebell and wood sorrel. Furthermore, non-native trees 12 such conifers are felled to open up access to the woodland and allow native trees 10 and other native flora to flourish.

[0066] As mentioned, the removed flora can be recycled as a by-product generally referred to as woodchip. As well as lining pathways 32, the woodchip can be used as a biofuel and so provide an ecologically considerate locally-sourced energy supply to the local buildings 26, 28. To this end, the staff facility 28 houses a wood-burner for supplying heat to the buildings 26, 28.

[0067] The staff facility 28 also accommodates other equipment and machinery used for the conversion and continued use of the woodland 1 as a burial site 20. For example, the facility 28 typically includes felling equipment, pruning equipment, grave-shoring systems, woodchippers as well as work vehicles such as excavators, loaders, and general-purpose vehicles for pulling trailers and transporting loads. In view of the fact that noisy work may be carried out at the staff facility 28, it is positioned away from the public facilities 26 for use by members of the funeral party.

[0068] As will be appreciated, it is not necessary to carry out conversion work on the entire area of the wood-

land 1 before it can be used as a burial site 20. The conversion is typically is a gradual and long-term process. Areas of the woodland 1 closest to the buildings 26, 28 are converted first with the driveway 30 initially consisting of only the smaller loop shown in Figure 2; the other loops may be added later. Similarly, the survey work that is carried out on the woodland 1 initially may capture only broad-level information - for example, whether the woodland is suitable as a burial site 20 and the predominant flora in each area of woodland. The more detailed information, such as the position, species and status of each tree 10, 12, may be added subsequently.

[0069] In any case, when an area of the woodland 1 has been converted sufficiently to allow convenient access into the woodland, certain trees in that area can be designated and utilised as burial trees 100 - that is, trees around which a number of graves 110 are to be established. A label is physically attached to each burial tree 100 that incorporates an identifier that matches a corresponding entry in the computerised database. Typically, the identifier includes an element that also identifies which area of woodland that burial tree is located in (e.g. A4 - Area A, Tree 4). This can also aid navigation through the woodland 1.

[0070] These burial trees 100 are specifically chosen to act as long-lasting and natural memorials to the deceased. This is instead of other unnatural memorials, such as headstones. Permanent memorials are not permitted in the woodland as they disrupt the ecology and natural composition of the woodland.

[0071] In general, native, healthy and relatively well-established trees 10 that are likely to continue to thrive for a long time (ideally greater than 30 years), are preferably designated to be burial trees 100. Some of the selection considerations are as follows:

- Tree health - when surveying a candidate tree, the following signs are representative of tree health problems, and so signs that a candidate tree should not be used as a burial tree:
    - ○ Off-colour foliage (lighter green, or yellowing leaves or needles out of season) - This can be the first sign of a problem for a tree.
    - ○ Smaller leaves - If the leaves of a tree start to become smaller than they had in the past, it is a sign that the tree is not bringing enough water and nutrients to the leaves. This is a sign that the vascular system of the plant is not working properly.
    - ○ Thinning canopy- There still may be leaves, but they are less in number than in the past.
    - ○ Deadwood - Some dead branches can be normal however an excessive number of dead branches; especially at the top of the tree is also a sign of stress. Decay can occur along the trunk of the tree identified through flaking bark or cavities in the trunk.
    - ○ Wilting leaves - Leaves are present but are limp on the branches, which could be a sign of water stress.
    - ○ Cankers - This is a general term for a wide range of plant diseases, characterised by the appearance of dead tissue that spreads over time.
    - ○ Fungal fruiting bodies - Evidence that a fungus, which predominantly lives within the tree's timber, has infected the tree. This only becomes evident when the fungus produces visible fruiting bodies, which can be seen on the trunk, branches or along the path of roots.
- Maturity - trees will naturally decline once they have reached maturity, and will become more sensitive to disturbance. The average lifespan of a tree varies depending on species but, generally, trees that are estimated to continue to live for at least thirty years, and more ideally at least fifty years make the best burial trees 100. However, at the same time it is important to select a well-established tree as a burial tree, for example, one that has been growing in the same place for at least a year - more ideally at least three years. This provides assurance that the tree is likely to continue to thrive.
- Species - Native trees are preferred as burial trees, and as mentioned, the species of a tree affects its life-span. For example, English Oak will live for hundreds of years whereas Silver Birch survives for between fifty and eighty years. Some other species are less favourable due to their inherent physical attributes - for example, larch trees are less well-rooted, and so more liable to fall over than others.
- Accessibility - if the burial tree is located in a difficult to access location this can make it less favourable as a burial tree. Some of the main accessibility considerations are as follows:
    - o Density of woodland / proximity to other trees.
    - ○ Branch structure. If the tree has low-hanging branches that cannot be removed without adversely affecting the tree, this can make access to the ground in proximity to the tree difficult, also reducing its accessibility.
    - ○ Proximity of the tree to a driveway and/or pathway. A tree situated deep in woodland away from driveways and pathway is less likely to be selected as a burial tree.
    - ○ Topography. Steep slopes 15, 16 can make it challenging to access and dig grave pits, reducing the chance that trees on sloped ground are chosen as burial trees.
    - ○ Proximity to hazards. For example, bodies of water 14, high water tables or water-logged ground can make access or grave-digging dangerous or impractical. Trees close to such hazards may therefore be inappropriate choices as

burial trees.

[0072] The above factors will be taken into consideration when determining which trees are the best candidates as burial trees 100. The trees 10 may be ranked or categorised according to suitability as a burial tree 100, and subsequently chosen according to that ranking or categorisation. Once a suitable burial tree 100 has been chosen, it is identified, ranked and/or categorised as a burial tree 100 in the computerised database for use as will be described below. Subsequent maintenance of the woodland 1 may then be carried out to give priority to the continued health of a burial tree 100. For example, the flora surrounding the burial tree may be thinned so that the burial tree 100 does not need to compete with the other flora for light and nutrients. For example, "halo-thinning" may take place wherein the woodland canopy, as formed by other trees that surround a burial tree 100, is cut back to provide the burial tree 100 with more light and space to grow.

[0073] The establishment of graves 110 around each burial tree will now be described in detail with reference to Figures 3 to 5. For the avoidance of doubt, each grave 110 is established by digging a grave pit 120, interring a body of the deceased into the grave pit 120 and then backfilling the grave pit 120.

[0074] The time at which a grave pit 120 is excavated to establish a grave 110 and the position of each grave relative to a burial tree 100 is controlled in a way that maximises the total number of graves 110 that can be accommodated by the woodland 1 without disrupting the ecology of the woodland and in particular the health of the burial tree 100.

[0075] As a broad rule of thumb, the majority of the root system of a tree is within the first third of a metre of soil. Moreover 90% of the root system is within the first metre of soil. Also, rather than extending downward, tree roots tend to extend radially-outward from the foot of the tree. These roots are important to ensure that the tree is able to remain anchored to the ground and can also pick up nutrients and water from the soil. Thus, significant disruption of the root system can severely affect the health of a tree and can also cause a tree to topple in high winds.

[0076] In view of this, it is desirable to avoid cutting into the major roots of a burial tree 100 when digging into the soil to excavate a respective grave pit 120. Thus, it is desirable that each grave 110 that is established in the woodland 1 is spaced away from a burial tree 100. However, as the spacing is increased, the woodland grave density decreases. A present invention provides a way of choosing the optimum trade-off between these two conflicts so as to maximise grave density within the woodland 1, whilst at the same time minimising the degree to which a burial tree 100 is injured as a result of disturbance to its root system.

[0077] Figure 3 shows a plan schematic view of graves of the burial site of Figure 2 situated around a burial tree 100. Moreover, the burial tree 100 has sixteen graves 110a-110d situated around it. In the present embodiment, each grave belongs to one of four sets, and each set comprises four graves. However, in alternatives, a different number of sets and graves may be utilised.

[0078] A first set of four graves is designated via reference numeral 110a, a second set of four graves is designated via reference numeral 110b, a third set of four graves is designated via reference numeral 110c and a fourth set of four graves is designated via reference numeral 110d. These graves 110a-110d are situated at a position bordering but not infringing into a broadly circular root protection zone 105 that encircles and is centred on the trunk of the burial tree 100. The graves 110a-110d are distributed in a radial arrangement around the burial tree 100. Moreover grave pits 120 that are excavated to establish the graves 110a-110d are orientated so that their length 120L extends in a radial direction relative to a central axis 105X of the root protection zone 105. Advantageously, as the roots of trees generally extend radially outward, this orientation of the graves 110a-110d reduces the damage caused by digging a grave pit 120 associated with each grave 110a-110d.

[0079] Figure 4 shows a schematic sectional side view of the burial tree, the ground in which it is rooted and the graves of Figure 3. Grave pits associated with two graves 110a belonging to the first set are also shown. As can be seen by comparing Figures 3 and 4, the grave pits 120 are generally cuboid in shape, having a length 120L, a width 120W and a depth 120D. A horizontal axis 111 extends in alignment with the length 120L of each grave pit 120 and extends in direction transverse to the longitudinal axis of the burial tree 100, which coincides with the central axis 105X of the root protection zone.

[0080] Referring back to Figure 3, the root protection zone 105 is divided into four quadrants 105A, 105B, 105C, 105D. Graves belonging to a common set are distributed around the root protection zone 105 so that only one grave from each set borders any given quadrant. In other words, the root protection zone 105 defines a border having four sections of substantially equal length and each grave belonging to a common set is established adjacent to a different border section. For the avoidance of doubt it is the head of each grave that borders the root protection zone 105.

[0081] As mentioned, the health of the burial tree 100 is also conserved by controlling the time at which each grave 110a-110d is established. All sixteen graves 110a-110d are not established at the same time. Rather, a period of recovery is allowed between establishing different graves sets.

[0082] Initially, the first set of graves 110a is established by excavating four respective grave pits 120, interring a body of the deceased into each one, and then backfilling those grave pits 120. After the final grave pit of the first set 110a is backfilled, the burial tree 100 is then left undisturbed for a period of four years. Following this recovery period, the second set of graves 110b can

established. After the final grave pit of the second set 110b has been backfilled the burial tree 100 is again left undisturbed for a period of four years, and so forth. The establishment of all sixteen graves 110a-110d around the burial tree 100 is therefore typically spread across a period of just over twelve years. Thus, the recovery periods enable roots in the vicinity of established graves to regenerate ensuring the continued health of the burial tree 100. During the recovery period, the health of the burial tree 100 can be monitored. If the health of the burial tree 100 is monitored as having been adversely affected, the recovery period can be extended.

[0083] In conjunction with controlling the time at which each grave 110a-110d is established, the particular spacing and arrangement of the graves 110a-110d, as shown in Figure 3, also promotes the well-being of the burial tree 100. Specifically, graves of the same set are radially equispaced from one another about the burial tree 100. Advantageously, this ensures that, at any one time, the burial tree 100 maintain roots that anchor it into the ground from all sides, reducing the chance of the tree blowing over in high winds. In addition to this, the spacing between sequentially established grave sets is also maximised. For example, the second set of graves 110b are radially interleaved with the first set of graves 110a at regular intervals.

[0084] The extent of the root protection zone 105 varies for different trees. However, as a general principle, the extent of the root protection zone 105 can be determined by measuring characteristics of the burial tree 100 that indicate how developed its root system is, and so the required extent and coverage of the root protection zone 105.

[0085] Referring to Figure 4, a reliable and easily-derived metric used is the diameter 100d of the trunk of the burial tree 100. This is measured at a predetermined distance of 4.5 feet above the ground - and is colloquially known in the art as the "diameter at breast height". In practice, this metric is obtained by measuring the circumference of the tree at breast height, and then dividing the circumference by pi (π). The radius of the root protection zone 105 is then calculated by multiplying that diameter at breast height 100d by a predetermined factor, typically varying between 12 and 20. The factor used in the present embodiment is 18, and this has been determined to be particularly suitable for use in conjunction with the other steps of the present embodiment, such as those concerning the number and arrangement of grave sets, and recovery periods.

[0086] Thus, by way of example, applying a multiplication factor of 18 to a tree with a breast height diameter of 300mm results in a circular root protection zone 5.4 metres in radius, and with a circular area of approximately 92 square metres.

[0087] There are other ways of calculating a suitable root protection zone, but these are not so easily determined, or are less reliable. For example, the extent of the root protection zone can be determined by following the extent of the drip line - i.e. the outermost circumference of the tree's canopy where rainwater drips from the ends of the branches onto the ground. However, this determination is more subjective, and does not result in an easily definable root protection zone.

[0088] The exact calculated radius of the root protection zone may not necessarily be used as the radius of the root protection zone 150 in practice. Rather, the calculated radius may instead be quantised to one of a number of discrete values. For example, for trees where the exact root protection zone radius is calculated to be anywhere between 4.5 metres and 5.5 metres, the upper bound of the range - 5.5 metres is chosen as the actual radius of the root protection zone. The different discrete values chosen are ideally separated by a common value, in this case a metre. Thus, grave plots within the woodland will typically be spaced from the trees at a distance of 5.5 metres or 6.5 metre or 7.5 metres (and so forth). So long as a consistent spacing model is maintained throughout the woodland, this has the particular advantage of reducing the complexity of determining where future graves are to be situated, and where established grave plots are currently situated. Moreover, this spacing model is particularly useful when attempting to locate the exact position of graves relative to a burial tree, especially when no visible permanent memorial exists to mark the head and foot of the grave and - as is desirable and encouraged - the floor of the woodland above the grave is indistinguishable from the ground around the grave.

[0089] It is appreciated that the root protection zone 150 is likely to grow over time in correspondence with the growth of the diameter of the burial tree 100. Accordingly, graves belonging to sets that are later-established will generally be spaced further away from the burial tree 100 than the earlier-established grave sets. However, for simplicity, the grave plots 110 are shown in Figure 3 to be spaced equally from the tree.

[0090] In some cases, two or more burial trees 100 may be positioned close enough together for their respective root protection zones to overlap. In this case, the root protection zones can be merged, and graves can be oriented towards the nearest burial tree 100. Alternatively, if there is significant overlap in multiple root protection zones - for example, as a result of several trees being clumped together - graves 110 can be oriented towards the centre of the merged root protection zones.

[0091] As will be appreciated, there may be many burial trees 100 distributed throughout the entire woodland 1. This provides another way to further minimise the impact of grave pit excavation on the general ecology of the woodland. In particular, the sequence in which graves are established is chosen so that, at any one time, grave pit excavations have been more-or-less evenly distributed across the entire area of the woodland 1. In other words, grave pits that are excavated contemporaneously are spaced apart from one another. Advantageously, this not only minimise the disruptive effect on individual burial trees 100, but also the areas in which they reside. Fur-

thermore, physically spacing contemporaneously excavated grave pits ensures that two or more funerals occurring on the same day do not interfere with one another. In alternatives, the choice and utilisation of burial trees and their respective graves may be carried out at random.

[0092] Figure 5 shows a schematic sectional front view of a grave pit excavated for the establishment of one of the graves of Figures 3 and 4. The manner in which the excavation and backfilling of an individual grave pit 120 is carried out also minimises the short-term and long-term effect on the ecology of the woodland 1, and also enhances the safety and appearance of the grave pit 120 for burial.

[0093] Firstly, ecologically significant ground flora in the vicinity of the grave pit to be excavated is transplanted elsewhere in the woodland 1. This helps maintain prevent decolonisation. In particular, young trees may be transplanted to the nursery 27 as mentioned previously.

[0094] A first digging operation can then take place. This removes an uppermost layer of soil 125 from the grave pit 120, known as the top soil. The footprint of the top soil removed is the same as the footprint of the final grave pit 120, as defined by the length 120L and width 120W. The depth of the top soil removed is approximately 3 to 10 cm. This top soil 125 is placed into heavy duty plastic bags to prevent desiccation and set aside. The top soil 125 is generally removed the day prior to excavating the grave proper. This allows the footprint of the grave pit to be clearly seen to aid subsequent grave pit excavation.

[0095] On the day of burial, panels in the form of wooden boards 121 are laid on the ground either side of the grave pit 120 to be excavated. A second digging operation can then take place which removes the remaining soil so as to define a suitably-sized grave pit. Generally, this is approximately 1.8 metres (six foot) in depth 120D, 0.5 to 1 metres in width 120W, and 2 to 2.5 metres in length 120L. The excavation is carried out using standard excavation machinery, for example a Kubota U20-3 excavator with an 18" square hole grave-digging bucket. The remaining soil is deposited on top of the wooden boards 121 as spoil 122. The grave pit 120 is then shored using a standing grave-shoring machinery to compact the walls of the grave pit 120 to ensure that they do not collapse.

[0096] To enhance the appearance of the grave pit and its surroundings, the spoil 122 on the boards 121 is covered to improve its appearance. Instead of green baize used in traditional burials, the coverage is provided by natural materials, such as bracken or deadwood.

[0097] Furthermore, woodchip 123 is placed onto the floor of the grave pit 120 to cover any water that may collect there. In alternatives, other porous substrates may be used.

[0098] A burial service can then take place in which a biodegradable coffin 130 containing a body 131 of the deceased is lowered into the grave pit 120. The grave pit 120 can then be backfilled with the spoil 122 and the natural materials.

[0099] The wooden boards 121 onto which the spoil 122 is deposited aid the process of backfilling, and also prevents the floor of the woodland 1 from being disrupted during backfilling. In particular, the boards prevent the backfilling machinery or tools from scraping the natural woodland floor surrounding the grave pit 120. Furthermore, the wooden boards 121 spread the load of the spoil 122 further minimising the chance that the walls of the grave pit 120 will collapse.

[0100] The act of excavating and then backfilling the grave pit 120 tills the soil, aerating it, allowing plant and animal life to more easily thrive within the soil. Furthermore, the woodchip 123 and other relatively low-density natural materials backfilled into the grave pit 120 facilitate the aeration of the soil. Also, their porosity assists in the drain-through of water. Thus, these materials can promote healthy soil composition, and facilitate rapid decomposition of the coffin 130 and body 131 via aerobic biodegradation.

[0101] Once the grave pit 120 is backfilled with the spoil 121 the wooden boards 121 are removed. The top soil 125 that was previously set aside is deposited in a mound next to the foot of the grave. Apart from this, the area around the grave pit 120 is restored to its previous natural state.

[0102] Excess spoil 122 is transported to a spoil store on the outskirts of the woodland near to the staff facility 28. The soil within the grave pit 120 is then allowed to settle. The grave-settling period typically varies between four months and a year, and is affected by factors such as the composition of the coffin 130, weather conditions and ground conditions. For example, although the coffins used in the present embodiment are biodegradable, and made of natural material to prevent the disruption of the soil ecosystem, different materials decompose and collapse at different rates: the breakdown of a cardboard coffin is a lot quicker than that of wooden coffin. Also, a prolonged period of wet weather is likely to cause the soil within a grave pit 120 to sink in more quickly than during periods of dry weather.

[0103] During this grave-settling period, the grave is monitored and routinely topped up with soil from the spoil store. This prevents the formation of a sunken grave which can pose a health and safety risk and the appearance of which may cause distress to visitors of the burial site 20. After the grave has settled, the top soil 125 arranged in a mound at the foot of the grave is drawn over the spoil filling the grave pit 120.

[0104] Advantageously, replacing the original top soil benefits the ecology of the woodland. The top soil contains the natural seed layer of the woodland floor, and so its restoration is important in ecological terms to maintain the provenance of the woodland 1. If the top soil were not restored, this would result in the decolonisation of the ground above the grave pit 120.

[0105] So that the natural composition of the woodland is maintained, no permanent memorials are permitted to

mark the position of the graves. However, in some cases, a temporarily wooden memorial 126 is placed at the head of the grave in the place of a traditional headstone. The wooden memorial 126 typically comprises a wooden post 126a driven into the ground that supports on its upper end a wooden plaque 126b laser engraved with memorial inscriptions. The maximum size of the plaque and post are limited: the plaque is typically limited to 400mm by 150mm, and the post is limited to a height above ground of 450mm. The wood is untreated to ensure that it biodegrades. Thus, over time, the ground above the grave becomes indistinguishable from its surroundings thereby ensuring that the natural environment and composition of the woodland is maintained.

[0106] In view of this, it is important to be able to find where the graves are located, especially after a long period of time. To this end, the computerised database is updated with the absolute position of each grave, as determined using a positioning system such as GPS. This information is also double-checked against other entries in the database relating to the position of the grave, such as those setting out the grave position relative to the burial tree 100. In addition to this, following burial, two metal rods, ideally made of steel are driven into the ground; one at the head of the grave pit (closest to the burial tree), and another at the foot of the grave. The metal rods are driven all the way into the ground such that they cannot pose a trip hazard, and are not visible above the ground. However, they can assist with the quick location of the actual position of the grave using a standard metal detector. This combined with the fact that grave pits 120 are oriented - from foot to head - to point towards the burial tree 100, also assists in determining the location of each grave.

[0107] The burial site 20 can also support ash urn interments. As these are significantly smaller than coffins, they can be placed within the root protection zone without harm to the burial tree 100. Moreover, the process of burying an ash urn can simply involve creating a bore hole in the ground. If a major tree root is encountered during digging it is not harmed. Instead the bore hole is refilled and another location is chosen. These urn plots employ a single steel rod for their own subsequent location with a metal detector.

[0108] As mentioned, as the state of the woodland 1 and the features of the burial site 20 shifts over time it is necessary to update the computerised database. Some of the information that is maintained in the database can be represented on a map, aiding location of existing features of the burial site and also assisting in the planning of the location of future features. Other information can be cross-referenced against the map data. The information held in the database may include:

- Locations and layout of driveways and pathways
- Area identifiers and names
- Tree identifiers and locations
- Grave plot (and urn plot) identifiers and locations
- Map data such as bearing information (e.g. direction of magnetic North)
- Grave owner and occupier (if different)
- Whether grave plots are utilised or unutilised
- Whether a grave plot has been reserved for future use ('pre-need')
- Whether a seed bank / top soil has been replaced
- The coffin type (e.g. cardboard or wood) within a utilised grave plot
- Date of interment
- Funeral director information (e.g. contact details)
- Memorial information (e.g. inscription, type and size of memorial)
- Deed information
- Lease length
- Payment information (payment plan options, interment fees etc)

[0109] As mentioned, such information may be represented diagrammatically on a map. Accordingly, a map can be printed out to assist in the practical maintenance of the woodland 1 and burial site 20.

[0110] Thus, an ecologically sustainable burial site and associated burial method has been described herein. Typically, following such a method can result in a grave density of over 400 plots per acre being achieved over a fifty year period. Furthermore, in the same area an ash urn density of over 1130 plots can also be achieved.

Claims

1. A burial method for sustainably establishing graves (120) within woodland (1), the method comprising selecting burial trees (100) from a plurality of healthy established trees within the woodland (1); and, for each burial tree (100), carrying out the steps of:

   (i) determining the extent of a root protection zone (105) around the burial tree (100);
   (ii) excavating ground outside of but bordering the root protection zone (105) to define a first set of grave pits (120);
   (iii) interring a body (131) of the deceased into each respective grave pit (120);
   (iv) backfilling each respective grave pit (120); thereby to establish a first set of graves (120); and
   (v) waiting a tree recovery period after which steps (i) to (iv) are repeated to establish a further set of graves (120).

2. The burial method of claim 1, wherein:

   an uppermost layer of soil (125) is removed from each respective grave pit (120) during the excavating step, and restored after the backfilling step and after a grave-settling period as the up-

permost layer of soil (125); and
depressions in the ground caused during the grave-settling period are levelled using spoil (122) excavated during the excavating step.

3. The burial method of claim 1 or claim 2, comprising a further step, after the excavating step, of spreading a layer of a porous substrate (123) onto a floor of each grave pit (120).

4. The burial method of any preceding claim, further comprising:

laying at least one panel (121) onto the ground adjacent to each grave pit (120) to be excavated;
piling spoil (122) excavated from the grave pit (120) during the excavating step onto the at least one panel (121);
backfilling each respective grave pit (120) with the spoil (122) piled on said at least one panel (121); and
removing excess spoil (122) and the at least one panel (121) from the ground adjacent to the respective grave (120) to restore the ground around the grave (120) to its previous natural state.

5. The burial method of any preceding claim, comprising a further step of transplanting flora, such as tree saplings, rooted in ground that is to be excavated during the excavation step to another location within or around the woodland.

6. The burial method of any preceding claim, wherein the root protection zone (105) comprises a border having sections of substantially equal length and each grave (120) of a common set is established adjacent to a different border section, ideally with graves (120) of a common set being spaced at regular intervals from one another along the border of the root protection zone (105).

7. The burial method of any preceding claim, wherein the extent of the root protection zone (105) is determined in dependence on a characteristic of the respective burial tree (100), such as the diameter (100d) of the trunk of the burial tree (100) as measured at a predetermined distance above the ground

8. The burial method of any preceding claim wherein each grave pit (120) is oriented so that its length extends in a radial direction relative to the centre of the root protection zone (105); and/or its horizontal axis extends in a direction substantially transverse to a longitudinal axis of the burial tree (100).

9. The burial method of any preceding claim, further comprising the steps of:

burying at least one metallic member at a predetermined position relative to a respective grave pit (120); and
locating the grave using a metal detector;
and if two metallic members are buried for a respective grave pit, they are ideally buried at opposite ends of the grave pit (120) so as to aid the location of the head and the foot of the grave (120).

10. The burial method of any preceding claim, wherein the steps carried out in respect of different burial trees (100) are carried out in a sequence that, at any one time, distributes grave pit excavations evenly and/or randomly across the woodland (1).

11. The burial method of any preceding claim, wherein the tree recovery period is determined in response to assessing the health of the burial tree (100).

12. Graves or grave sets (120) sustainably established in accordance with a burial method according to any one of claims 1 to 11, each grave (120) ideally comprising one or more biodegradable products, such as biodegradable coffins (130) and/or monuments (126).

13. A burial site (20), ideally converted from woodland (1), and ideally operating a burial method according to any one of claims 1 to 11, the burial site (20) comprising a distribution of graves (120) each established relative to a respective burial tree (100), each burial tree (100) being selected from a plurality of healthy established trees (10) native to a woodland (1);
each grave (120) bordering a root protection zone (105) around a respective burial tree (100);
each grave (120) belonging to one of a plurality of grave sets; and
a tree recovery period separating the establishment of graves (120) belonging to different grave sets.

14. The burial site (20) according to claim 13, comprising constructions positioned to avoid harm to the burial trees (100), the constructions comprising access routes (30, 32) that loop and that are routed to ensure that at least half of the area of a woodland (1) used for burial is within a predetermined distance of an access route (30, 32).

15. A record of data, such as a map, registering the location and/or status of features of the burial site (20) of claim 13 or claim 14.

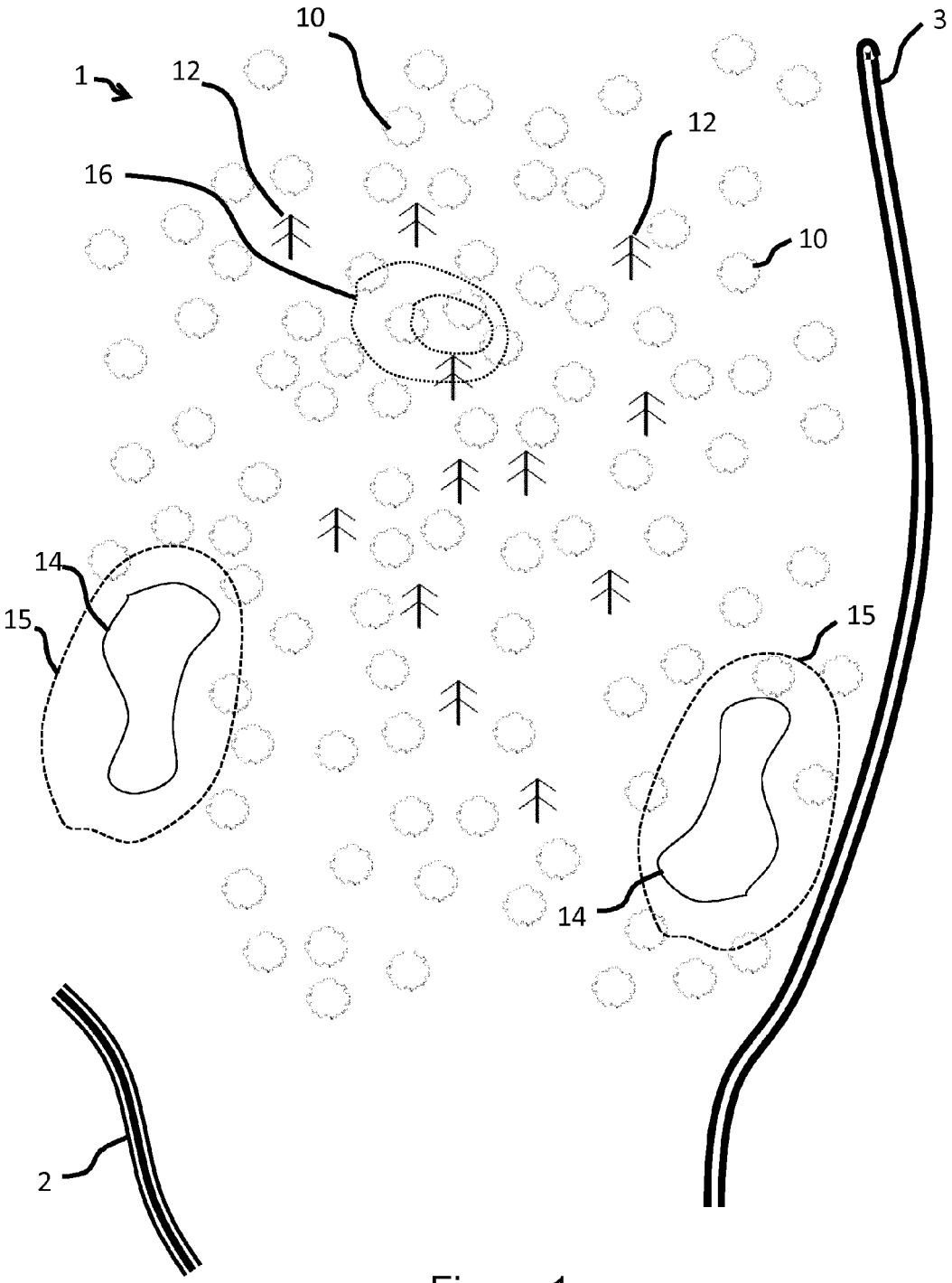


Figure 1

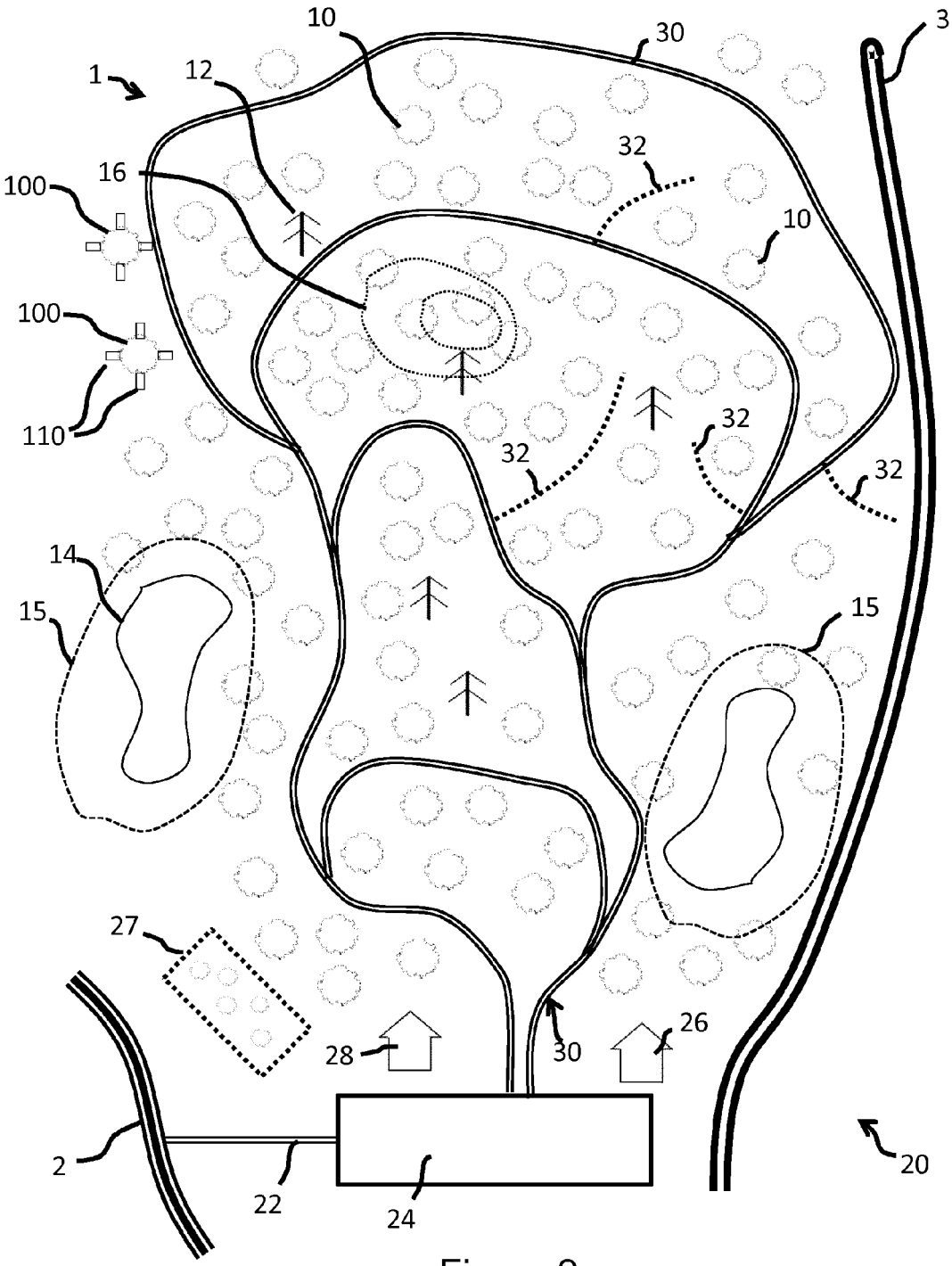

10
30
3
1
12
32
16
100
10
100
110
32
32
32
14
15
15
27
28
30
26
2
22
24
20

Figure 2

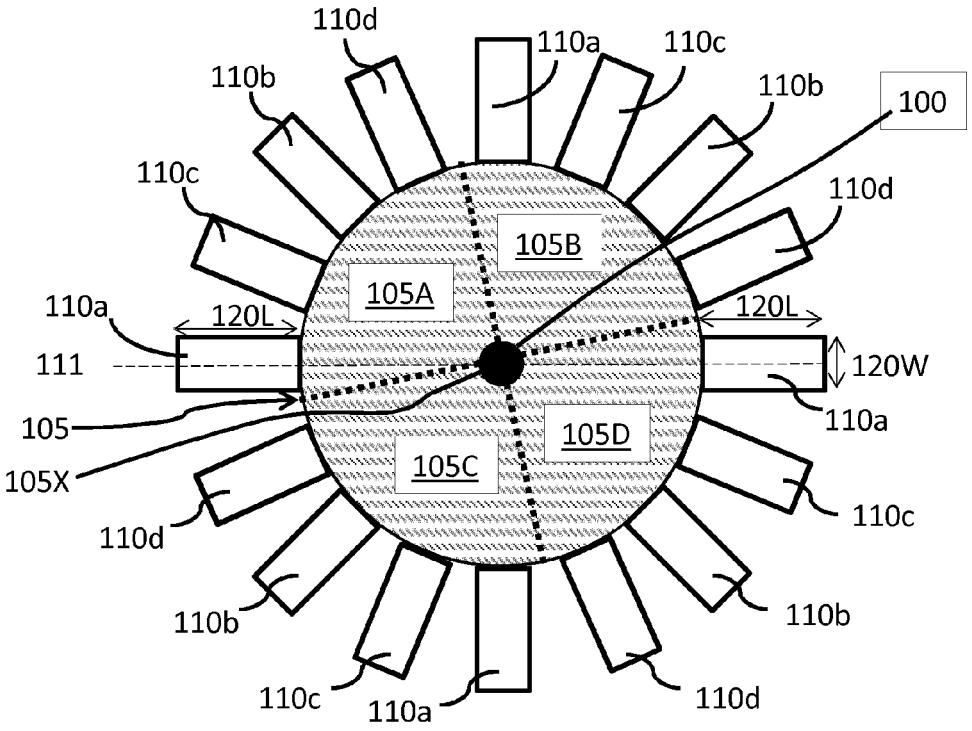


Figure 3

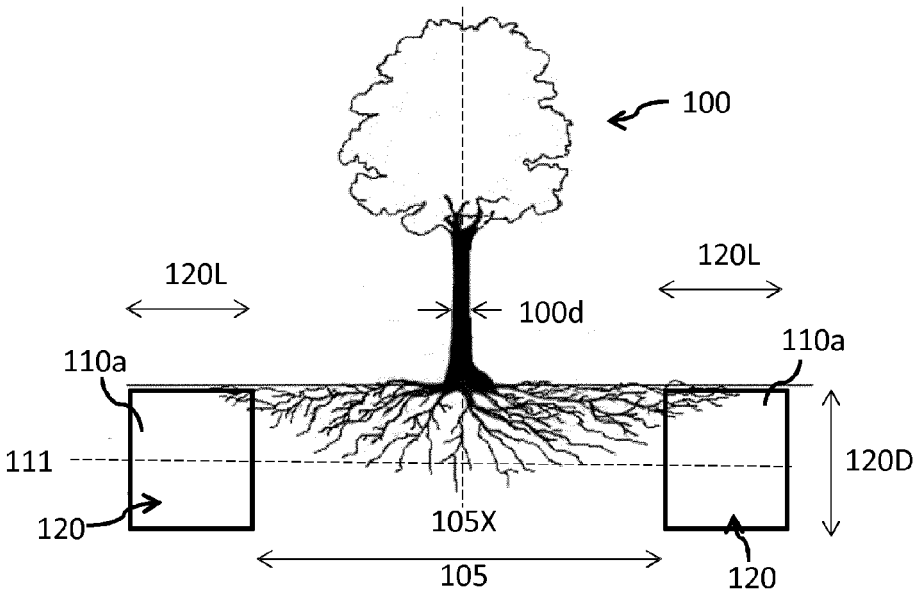


Figure 4

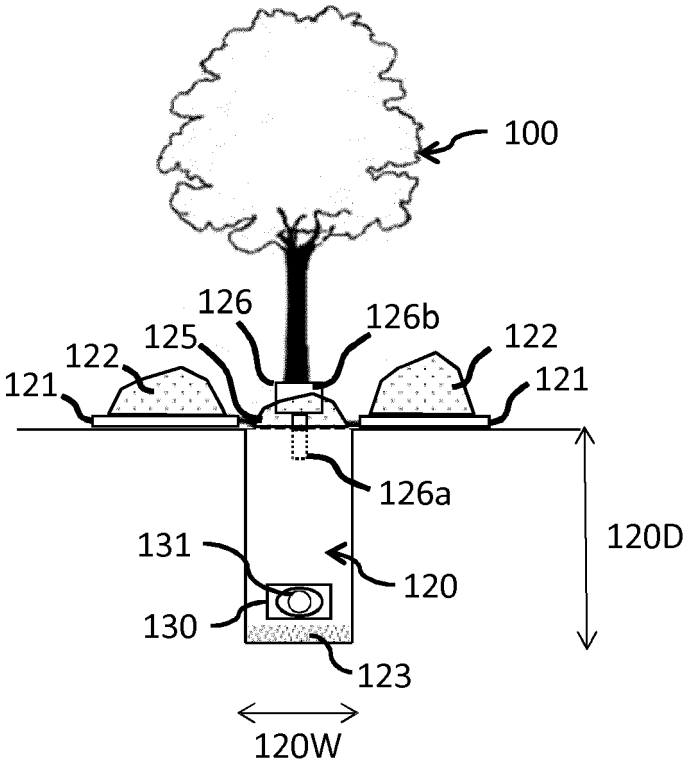


Figure 5