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1.0 TREES ON THE GOLF COURSE

Trees of appropriate species, planted in suitable locations, can enhance most golf courses, new or established, although they should be rarely planted on links land and only with great caution on heathland.

Trees, however, are only one of the design elements available to a golf course architect and rarely, if ever, should they be the exclusive or even the primary hazard on a golf hole, although their landscape contributions may be paramount particularly within land lacking in attractive landscape character.

Tree planting on a new course should be an integral part of the overall layout and design of each hole, not applied as an optional extra or a cosmetic application. Tree planting should have an overall structure so that it provides a co-ordinated appearance that also relates to the trees and woodlands around the course and the wider landscape character.

2.0 THE MAIN DESIGN ROLES OF TREES ON A GOLF COURSE

Trees play a number of roles on the golf course that include:

* landscape and aesthetic objectives
* creating or improving the golfing challenge
* provision of wildlife habitats
* promoting safety and providing shelter

These various roles are not performed independently, indeed they are closely interrelated and therefore tree planting should be designed and located so that it fulfils as wide a range of objectives as possible.

Further, tree planting is only one of the elements in the design of a golf hole and should not, therefore, be considered in isolation, it should be an integral part of the total design.

In addition, whilst the contribution trees make in the creation of golfing challenge, promoting safety and providing shelter, as well as improving the aesthetic appearance of a golf course, any failure to consider the landscape aspects is likely to result in an unnatural appearance of both the planting and the golf course. In the design of a new golf course careful consideration should be given to how the existing trees on the site can best be incorporated into the overall layout of individual holes to fulfil the objects and roles outlined above. Consideration also needs to be given to how and where the existing woodlands are deficient
and how they can be supplemented to fulfil these basic roles. On established golf courses a critical analysis of the existing trees and woodlands needs to be undertaken to see if all of the basic roles are met as a prerequisite of any new planting plan for the course.

3.0 TREES AS HAZARDS

Trees can be used as penal or strategic hazards or as a combination of both. Woodland on either side of the fairway is a particularly penal situation, whereas trees on one side of a hole can be used strategically. A golf hole, which has trees provocatively and strategically located on or close to the ideal line, will be both aesthetically and strategically popular with golfers. However, the three-dimensional hazard a tree presents can be both daunting and uninteresting, if used too commonly within design.

Care should, therefore, be taken when using trees strategically, there are often instances when trees are planted to tighten up a hole when in fact the correct hazard for the situation is a bunker which will afford the opportunity to recover if the hazard is found. A hazard in a strategic position should not be so penal as to put off the adventurous shot, trees unfortunately can often have this affect.

4.0 THE DETAILED ROLES OF TREE PLANTING ON THE GOLF COURSE - LANDSCAPE AND AESTHETIC OBJECTS

4.1 Screening Out Unsightly Views

Where there are unsightly elements such as industry or unattractive housing either located on the edge of the golf course or can be easily seen, consideration should be given to whether this can be screened out by appropriate tree planting. Even if it cannot be completely screened out, because of topographical reasons, any partial screen as quickly as possible, consideration should be given to the long term and landscape implications.

A planting screen should not rely on a single, especially relatively short lived, species. A most effective screen, is used in agriculture as a shelter belt, it comprises of Silver Birch, Scots Pine, and Beech. The Silver Birch is quick growing in most situations and also acts as a nurse species protecting and promoting quicker growth of the other two varieties. The Scots Pine is relatively long lived and provides the screen in winter, all are entirely natural looking species in the English countryside.

4.2 Framing Attractive Views

In producing a planting plan for a golf course, careful consideration needs to be given to whether existing attractive views should be retained and protected from being screened out as the trees mature. In some situations a particularly good viewpoint can be made more spectacular by screening out the view from the approach until you reach the specifically dramatic point that provides the visual impact. Similar principles also apply to internal views around the golf course.

Care must also be taken when managing existing woodland on a site, regeneration needs to be controlled so that such views are not lost, once a view is lost it is often lost forever as future generation will never know it existing.

The creation of woodland edges is an effective form of management in this respect and has the added benefit of creating a more diverse wildlife habitat, which will improve the ecological structure of the golf course.

4.3 Enhancing the Appearance of the Golf Course

Providing tree planting is located and designed having regard to the general character of the surrounding landscape and reflects, rather than conflicts, with the landform and providing considerable care is taken in species selection having regard to the aspects of each individual hole, then it will enhance the golf course.

4.4 Visual Characteristics of Trees

In consideration of the aesthetic contribution tree planting can make, regard needs to be given to the visual characteristics of the various species chosen. This will include the massing or outline of the mature shape (whether as an individual specimen or within a group or copse), their appearance at various times of year, their texture and colour and how this changes with the seasons.

4.5 The Relationship of Tree Species

Some varieties, possibly because they are often found together in the wild or because they are suited to the same conditions, and are therefore generally planted together, always look right, conversely some species, usually because of massing, texture, colour, or shape, never look right together. Care will therefore be taken when selecting species to be planted, in order to create a pleasing, naturalistic composition.

4.6 Visual Composition

The objective is to create composition where all elements, such as, landform, tree planting, bunkers, fairways, greens, combine to form a harmonious landscape. To this end the characteristics of different species of tree will be used to help create the composition.

4.7 Specific Visual Objectives

Trees behind a green help to provide locational emphasis and definition, particularly where it is not possible to see the putting surface. They can also assist in judging the distance. Trees either side of the fairway provide strong definition and, therefore, a visual framework. Where fairways disappear over brows and it is not possible to see the landing area, trees will be used to define the target area, particularly important if the hole doglegs, even if only slightly.

5. THE INFLUENCE OF THE AUGUSTA NATIONAL GOLF CLUB, GEORGIA, USA.

To golfers in Britain it was the classic links and heathland courses that were the subject of golfers swapping information and discussing the relative merits of golf courses. That was until the advent of televising the Masters Tournament from Georgia, USA., the Augusta National Course with its manicured turf and flowering shrubs, made British courses after a long winter, appear drab and colourless. Therefore who does not respond to the majestic images of Augusta, welcome sunshine, the vivid green grass and bright blue of the water hazards, the latter two being dyed if they fail to l9ive up to the Augusta National legend in any particular year.

Every hole has banks of flowering shrubs and is named after the particular species which is present. What many people do not realise is that the land was a nursery before the golf course was developed. The shrubs all come into flower for the Master, while there is little colour at other times of the year. In almost all situations the banks of shrubs are located under mature pine woodland which provides a broad structure to the landscape.

The layout is so specious that the banks of shrubs are not in play, an enviable situation not possible on the majority of courses. The undulating landform allows the location of the banks of shrubs on facing slopes which add to their ‘visualness’. The semi-tropical climate allows many shrubs to thrive that cannot be translated to the British climate. It should not be forgotten that the flowering shrubs exhibited at August are native to the area and are, therefore, in harmony with the surrounding landscape.

6.0 LANDSCAPE CONSIDERATIONS

6.1 Planting Proposals Influenced by Surrounding Landscape Character

Before any planting proposals are prepared, an analysis will be made of the surrounding landscape character and features, especially basic landform and existing structural planting.

Whilst it is not necessary to reprocate an identical landscape character, in general planting proposals should be in harmony and not create conflict.

6.2 Within Areas of Strong Structural Planting

Where afforested areas and areas of mature woodland are strong visual elements in the landscape and combine with the broad landform to produce a positive landscape identity, and if space within a golf course development allows, the planting proposals will similarly reflect a strong structural emphasis and where possible key into surrounding woodland areas to create a comprehensive appearance. Structural planting proposals will produce flowing, harmonious outlines related to the broad landform, creating enclosure where appropriate.

6.3 Areas of Subtle Landform

Where the landform is more intimate and small scale, or where there are existing visual features, care will be taken to avoid screening out these views, with insensitive mass planting. Copses or clumps of trees, if carefully arranged, could look like solid planting from one direction but afford views through from another.

7.0 LANDFORM AND ITS INFLUENCE ON PLANTING PATTERN

Any planting proposals should seek to reflect the landscape character of an area. Within the English landscape, either by design or accident, many woodland groups are situated on steeper slopes, on bluffs, within sleepy valleys and on the exposed higher ground. Sympathetic planting should reflect this because to ignore basic principles will result in an artificial visually discordant appearance.

8.0 TREES CREATING AND IMPROVING THE GOLFING CHALLENGE

Trees are a very strong ‘hazard’. A ball can be unplayable if caught up against the trunk and roots. A large mature tree can be up to 100 feet high and 70 feet wide and, therefore, can have a considerable impact on the playing of a hole or shot.

Woodland, alongside a hole, particularly if it is the full length, can be an extremely strong hazard. At best it may mean a hack out sideways, but can often mean a lost ball particularly if the understorey or field layer is not kept down by the leafing characteristics of the tree. However, certain varieties of shade bearing trees, can provide clear ground beneath, particularly suited to the task are Beech.

9.0 TREE PLANTING AS AN INTEGRAL PART OF THE DESIGN

On the proposed area of new development (land fill site) it would be wise to consider tree planting as a fundamental and integral part of the design and not as an optional extra being added at the end to fill in the larger spaces between holes, or even worse, as a last ditch attempt to mitigate the problems or deficiencies.

Tree planting can play a wide variety of function roles on a golf course including:

* creating or reinforcing the golfing strategy

* providing definition

* promoting safety

* providing shelter

* subdividing the land into smaller landscape compartments

* creating a positive character in an otherwise poor or bland landscape

* visually reinforcing the strategy of a hole where there may be some confusion

i.e. where the landing area is not visible from the tee, tree planting can provide the necessary definition.

10.0 TREE PLANTING AND LANDSCAPE CHARACTER

18 hole golf courses occupy between 100 and 120 acres (40-50 hectares) and are, therefore, major elements in any landscape contributing toward its character.

Tree planting should compliment and enhance the existing landscape of an area and not, as has so often happened on golf courses, conflict with its character. However, whilst the broad landscape character of an area should, in general, influence tree planting proposals on a golf course, it should not necessarily be a slavish observance, particularly if the general landscape character is somewhat bland or poor. It is worth reflecting that two of the finest inland courses in Britain, Woodhall Spa in Lincolnshire and Ganton in Yorkshire, are oases of heathland in an otherwise flat featureless agricultural landscape.

An assessment should be made of the surrounding landscape to determine its characteristics and best features that may be appropriately reprocated within the course. An assessment of an area's existing landscape character should be made as a baseline. This assessment should include:

* broad landform divisions
* skylines
* view points, areas generally overlooked
* large woodland groups and their pattern and relationship to landform and other physical elements
* small tree groups and their distribution pattern
* individual trees and their distribution pattern
* hedgerows, field sizes
* water bodies/water courses
* agricultural practices and their effect upon the landscape

Care should always be taken not to conflict with the broad landscape.

11.0 PRINCIPLES OF DESIGN

Although every golf course requires a different approach so not to lose its character or individuality there are certain principles which remain constant regardless of the situation.

The wider landscape and vistas should always be the first consideration when undertaking any planting on a golf course, a balance should be achieved between the demands of the golfer and the aesthetics of the landscape. The principles of woodland design within the landscape apply just as much to a golf course as to any other woodland development, this is summed up very eloquently in the forestry commissions guidelines.

> *"It should reflect and enhance the natural qualities of the landscape, incorporate natural features and detail, and reduce visual intrusion and eyesores as far as possible. It should assist in the development of a wide range of habitats, recreational opportunities and meet the operational needs of efficient woodland management."*
>
> Community Woodland Design Guidelines. Forestry Commission. 1991.

If the site is within an area of rolling countryside then the design should generally follow the soft flowing lines of the surrounding vista, alternatively if the situation is that of the harsh jagged peaks of Austria, then a more angular approach may be appropriate. The first priority should therefore be to identify the major landscape influences of the area, these should then be used to form the basis of any design. This should take into account the flow of the natural landform and any dominant vegetation which is present.

As the landform is the basis of all great gardens and parks, so it should be for the golf course, much can be learnt from the great English landscapes created by Brown, Kent and Repton.

Their gradual departure from the regular symmetrical patterns of the Tudor and Baroque styles, parallels in some ways the evolution of the golf course, from the early days of square bunkers and rectangular greens to the more natural rolling contours which typified the designs of Colt, Mackenzie and Hotchkin.

In the same way as the classic English landscapes used trees to frame a view or draw the eye, so too did designs on golf courses. This can be a very effective strategic weapon. For instance, a water body, may well be out of the line of play but may psychologically become a threat. Similarly trees can be used to form an avenue, up which the fairway is routed, deceiving the eye that the landing area is much narrower than it really is, and on a dog leg trees can be used to lead the eye to a bunker.

Trees may also be used to foreshorten views, a large tree adjoining a fairway confusing the player as to the distance of the green. Design of this complexity requires great skill, and should only be undertaken with professional advice.

> *"Most people appreciate and have some understanding of a lovely landscape, but not one golfer in a hundred knows a good hole when he sees it, or has any understanding of what goes to make a good hole. He may like or dislike it, but that has nothing to do with whether it is good or bad. The same applies to*

wine, or a picture gallery. It is the expert alone who is competent to say whether the wine is a great wine, or whether the pictures have anything more than decorative, wallpaper value."

Tom Simpson ~ Golf Course, Design, Construction and Upkeep. Sutton 1950.

11.1 Unity with the landscape

Unity is the most disregarded and least understood principles of design. It is perhaps easier to appreciate unity when it is lost, "It is a blot on the landscape" refers simply to the lack of unity. On the golf course this often takes the form of a large exotic tree or bed of shrubs, which mimic designs from across the ocean. It is often forgotten that the colourful, exotic trees and shrubs seen at, for instance, Augusta, are in the most part native to that area, and are therefore in unity with the surrounding landscape.

Many of the classic golf courses, exhibit perfect unity, the character of the landscape, has been complemented by the use of native vegetation such as pine, birch and heather, creating the illusion that the golf course has always been a natural part of the landscape.

In order to gain unity one often has to abandon thoughts of elaborate planting, forsaking the spectacular in order to gain compatibility, this point is emphasised by Sylvia Crowe in the publication "Garden Design", when discussing unity.

"The site its self imposes discipline. A garden whose design is based on the shape of the ground and the character of the surrounding landscape may or may not achieve the highest standards of beauty, but at least it will have a restfulness which comes from compatibility, and the more difficult and unusual the site conditions are, the stronger this virtue will be".

Sylvia Crowe. Garden Design, 1994.

Geometric planting should be avoided, as nature rarely works in such a way, such planting therefore infers that the woodland is man-made. Gentle contours harmonise with landscape and give a natural more relaxing feel to a view.

Straight parallel lines should always be avoided especially, adjoining fairways or boundary fences, as this exaggerates the symmetry.

Size, form and colour all have a part to play in unity, the unity of the golfing landscape is often broken by the planting of unsuitable ornamental trees which conflict with the rest of the vista.

Golden cypress with their bright colour and conical shape are often the culprits, both their shape and colour conflicting with the rounded shapes and pastel shades of the native trees.

11.2 Space Division

Space division is the balance between mass and open space, when associated with tree planting on the golf course, it is the visual relationship between the surrounding landscape, the trees themselves and the short mown grass of the fairways and greens, the architect can use space division in order create the impression of either closed or open space, and can therefore deceive the eye into thinking that a shot is tighter than it really is.

This illusion can be magnified by the combination of trees and water, a modern vogue to have par 3's across lakes, to a green surrounded by trees gives the impression that the hole is not only longer but also tighter than it really is.

11.3 Colour

Obviously the colour which predominates on the golf course is that of the grass, the trees planted on a golf course should therefore compliment rather than contrast this. Although contrasts are possible in design they are often the most difficult to achieve in an acceptable way. Few trees or shrubs have strong enough colour to contrast the bright green of the turf, there is however always the exception the most notable being gorse, the contrast is startling and yet unity is retained.

However when selecting trees for the golf course it is advisable to “play safe” and select those which compliment rather than contrast. By using trees native to the area nature will normally blend colour for you, pine and birch, ash and rowan, oak and bluebells and so on.

11.4 Appeal through the Seasons

Appeal through the seasons can be gained by the use of texture, colour, shape and form within the planting design.

The temperate climate and predominance of deciduous trees within the British Isles, mean that this is an area of design which deserves careful consideration if a bland winter landscape is to be avoided. The use of colour, form, shape and texture within planting design schemes can achieve spectacular autumn results, and the use of a subtle mix of conifers within the planting mix can add colour during winter months.

As with all design discretion should be used when planning such mixes as too great a contrast will look unnatural and out of place within the wider landscape.

11.5 Woodland Edges

The creation of woodland edges may be beneficial to the golf course in many ways, it can be used as a way of removing and managing regeneration that is infringing on the line of play or is blocking a desirable view. Woodland edges are aesthetically more pleasing to the eye and is therefore an important consideration when implementing new planting on a golf course.

They are valuable areas where shade intolerant species can survive, this in turn allows the woodland edge to support a large and varied animal and invertebrate life.

A woodland edge should be created in three bands, an outer band of short grass and wild flowers, an intermediate band of shrubs and small trees, and then the inner band of forest.

To maintain this, the short grass should be cut once a year in the winter, after the flowering season has finished. The centre band should be cut back every 2-3 years, but clearing the whole area at once should be avoided. Instead the area should be broken into compartments and these should be cleared on a rotational basis, so to avoid the risk of destroying any particular habitat and it will mean that there is no sudden change to the landscape, when the work is initiated.

The creation of woodland edges will benefit a golf course in a number of ways

* *Aesthetically it will be more pleasing to the eye*
* *It will control invasive regeneration*
* *It will improve the wildlife diversity of the area*
* *It will create new wildlife habitats*
* *Politically, it will be more acceptable than removing woodland that infringes on play or views.*

12.0 CONSTRAINTS ON PLANTING

12.1 Air circulation

To allow good air circulation and exposure to sunlight, dense plantations or large shade bearing trees should not be planted adjacent to greens, fairways or tees. Poor air circulation during summer increases temperatures and humidity, inhibits surface and soil drying and promotes the development of disease (such as Fusarium). During winter the shade can prolong snow and ice cover rendering the course unplayable for longer than necessary and can increase the possibility of frost damage. Where these problems exist, felling or heaving pruning are the only solutions and as both of these are unpopular and costly it is therefore advisable to avoid such problems at the establishment stage.

12.2 Leaf Litter

Care should be taken when planting trees which shed leaves which are not easily dispersed by the wind or are easily degraded (Horse Chestnut, Sweet Chestnut, Oak and Beech), the leaf fall can have a detrimental affect on the grass sward below, if the leaves are not cleared within a short period then the grass becomes stressed through lack of sunlight, rendering it prone to disease or wear.

The planting of such species as birch can not only avoid these problems but can also save man hours as leaf clearing will be unnecessary. It will also have the added bonus of increasing the speed of play as balls will not be hidden by the leaf litter.

The planting of trees near to bunkers or the sighting of bunkers near to trees can cause problems of leaf litter as the bunkers will collect leaves.

12.3 Rooting Habit

Care should be taken when planting trees near to greens, tees and fairways as the roots of trees will compete with the turf for water and nutrients. This when combined with the possible affects of shading can severely inhibit the development of a good sward.

Surface rooting trees should be avoided close to playing areas as the roots may receive damage from machinery and visa-versa. Roots are also unpopular with golfers themselves as playing a golf shot from amongst the roots of a tree is a nerve racking experience which often results in damage to expensive equipment. Trees should not be planted close to bunkers as their roots can invade the base of the bunker resulting in a severe shock for both the tree and the golfer when the hidden roots are discovered at the expense of a sand iron.

The trees themselves will suffer physical damage not only from machinery but also from the spiked shoes which are worn to play the game and the roots will become compacted from the traffic. Care must be taken when using such species as cherry and poplar as they may produce suckers from their roots and no green keeper will thank you if a mini forest appears in the middle of one of his greens.

12.4 Planting close to the Line of Play

The eventual size and form of trees must be taken into account when planting near tees, fairways or greens, as the eventual size and form of the tree may encroach on the line of play. I have often been involved in planting on a course when a member has approached me and said "Plant some over here near the fairway and tighten the hole up". The result would have been a tree extending its eventual canopy into the middle of the fairway, and I am sure that the same gentleman would, if still around in fifty years, be saying who planted this.

If planting is to occur near to any of the line of the line of play then consultation with a golf course architect is advisable as the strategy of the course or hole may be adversely affected. Discretion is often advisable when undertaking planting on a golf course and planting can often take place within the landscape of the course acting as a backdrop or framing a scenic view and have just as great an aesthetic effect without putting at risk the character or strategy of the golf course.

12.5 Shading

Tall growing and dense foliage trees will throw heavy shade (Oak, Beech, Ash, Horse Chestnut) and their roots will compete for moisture within the soil, this will stress the sward beneath predisposing it to disease. These problems are compounded if the grass is kept cut short or the area receives heavy traffic. Grass allowed to grow between 3 - 4 inches will not be as stressed and can compete better against the tree roots for moisture and nutrients, and if cut less frequently will be much less prone to disease. Dew persists longer under trees which cast heavy shade and may encourage fungal disease such as Fusarium which thrives in moist cool conditions. There are, however, grass mixtures specifically developed for such situations, which can be used.

The relationship between large shade bearing trees and areas of short cut grass should, therefore, be carefully thought out. Clearly, greens, tees, fairways should not be too closely related to such trees, although less serious if the tee, green or fairway is to the north west to north east quadrant, as the angle and direction of early morning sunlight affects the extent of drying which the grass received. The problem can be partly alleviated by pruning, the removal of lower limbs will allow more sunlight to penetrate to the ground layer and will have the benefit of permitting play from beneath the canopy, thus allowing a shot to be played without incurring damage to the tree.

12.6 Soil Types

For a tree to grow successfully and to reach maturity in a healthy condition it needs to grow in sizable soil conditions. Soil fulfils a number of functions.

Mechanical - being able to support the roots and weight of the tree in wind, to retain and supply sufficient water, nutrients, and air to the roots.

Water supply - is necessary to trees as not only is it a major component in their make up, but it is also the means by which they collect and transfer nutrients. It also is necessary in order for the biochemical reactions to take place which are a crucial part of the trees life cycle.

Soils vary in the amount of water which they hold, generally it is the clays which have the highest water holding capacity, this is due to the small particles (less than a thousandth of a millimetre) which goa to make up their structure. Sands on the other hand are composed of large particles and are therefore considered free draining.

However, clay often does not release the water easily as it adheres to the small particles within its structure, it is then up to the resilience of the tree to extract the moisture that it requires.

Loams on the other hand allow much of their water content to be extracted easily, however which ever soil type is involved the content of organic matter has an influence on this ability.

Oxygen - All plants need oxygen to respire and this takes place throughout the plant including the roots, in natural well drained soils oxygen can make up 15-20% of the total soil gases (Urban Forestry Practise 1989). However, many golf courses suffer from compaction and it may be necessary to aerate the soil in order to prevent anaerobism which can cause the death of tree roots.

Nutrients - Soils are composed of both mineral and organic materials, these are responsible for producing the essential nutrients that a tree requires and takes up through its roots.

The demand for individual nutrients varies depending on the species of tree involved.

pH - The capability of the soil to release these nutrients is greatly influenced by the pH. That is whether the soil contains free calcium carbonate (alkaline) or does not (acidic). A pH of 5 - 7 is ideal for most tree species.

The combination of these factors mean that species selection is a crucial part of tree establishment, account should be taken of surrounding vegetation as this can be an indicator to the soil type, or alternatively soil samples can be taken and analysed.

Soil types can be broken into 4 broad spectrums -

** Heavy duty clay - slow draining, easy compacted - no air, draining may be necessary*

** Very sandy - free draining, nutrients washed away out of reach of roots, similarly moisture*
may struggle to support massive tree species

** Loam's - ideal for most tree species*

** Chalk - restricts the choice of species to those tolerant (Beech, Sycamore, Norway*

Maple, etc

13.0 TREE ESTABLISHMENT

In order to successfully manage trees on a golf course a number of unique problems must be considered, compaction, close mown grass, unintentional vandalism, clubhouse politics, and a lack of continuity of management are all major influencing factors on the sustainability and establishment of woodland cover.

13.1 Compaction

Compaction is often a major problem on a golf course, this is due to a combination of the factors, soil type, the traffic created by the golfers themselves, and the constant movement of the machinery which is necessary for the intensive management that is required to maintain quality turf cover. Compaction is detrimental in many ways to tree establishment it can cause anaerobic conditions, waterlogging, physically restrict root development and cause nutrient lock up.

Cultivation may therefore be necessary before planting in order to improve the soil structure which in turn will benefit root development. The most common form of cultivation is ripping, using deep winged tines (0.5 - 0.7 in depth and 1.2m wide). The ripping should only take place during the summer months, as dry firm ground is needed to achieve the heaving and shattering effect. If the work is carried out on wet ground then little benefit will be gained. The problem faced by the arborist is in persuading the golf club that the aesthetics of ripping are worth suffering in order to achieve a successful crop. The thought of ploughing up an area of a golf course is quite naturally alien to most golf club committee's as they have striven, often for many years, to achieve a managed, manicured golf course.

13.2 Weed Control

The most competitive weed in relation to young trees is short mown grass, as mowing increases its rate of transpiration by maintaining the grass in a state of active growth, allowing it to compete more effectively and for a longer period during the growing season.

As short mown sward is the predominant vegetation on a golf course, weed control therefore becomes paramount.

Weeds reduce the survival and growth of young trees by competing for light, space, nutrients and water. Soil moisture deficits are increased under weeds due to their

ability to transpire rapidly over a long period. In comparison, bare earth will form a cap relatively quickly thus restricting further moisture loss.

Weeds around young trees can harbour mammal pests such as mice and voles, fungal pests such as mildew, and can physically damage trees especially after heavy snowfall.

It is therefore vital in order to ensure good establishment, that a programme of effective weed control is implemented. Maintaining a 1m.sq. weed free area around each tree is crucial to good tree establishment and this practice is essential for a minimum period of three years after planting. For the maximum survival and growth, newly planted trees should be weed free from the start of the first growing season as newly planted trees are sensitive to early

season growth when rood development is critical. Forestry Commission experiments have shown that the difference between trees given weed control and trees planted on a mown sward are dramatically different. In the first years growth, weed controlled trees put on growth approximately 10 times that of those without.

A range of suitable herbicides are contained in Forestry Commission Fieldbook 8.

13.3 Species Selection

Species selection is a very important decision to make and is determined by the site conditions and the objectives of the woodland in question. The trees selected must be ab le to grow on the site and if it is a difficult site such as a reclaimed land, then undemanding or pioneer species should be favoured. The surrounding landscape can be used to help in selection as this will indicate species which grow naturally in the area, and are therefore suited to the soil and the local environment. Consideration should be given to the following factors when selecting suitable species -

* *Soil moisture content and drainage*
* *Chemical reaction, pH*
* *Local climate, micro-climates*
* *Pollution*
* *Soil type, loam, clay, sand, etc.*
* *Exposure*
* *Form, size, shape and compatibility with the landscape*
* *Shade tolerance, when underplanting*
* *Wildlife, amenity and conservation value*

Where possible mixtures should be planted as groups or intimate amalgams of different species, as these are often more aesthetically pleasing and are ecologically more diverse than monocultures or rows. Diversity also increases sustainability, as monocultures can be destroyed by one disease along. i.e. Dutch Elm Disease

Within such mixes nurse crops can be introduced, the nitrogen fixing abilities of alder are useful on infertile sites. They form a symbiotic relationship with the micro-organism Frankia which forms nodules on the roots and fixes nitrogen. Nitrogen demanding species therefore benefit nutritionally by being interplanted within an alder mixture.

Care must be taken when using nurse crops on a golf course because of the constant turn over of management (if a management plan is not in place) may mean that the nurse will not be removed and may out compete the true crop causing shading, abrasion and suppression.

13.4 Stock Type and Size

The basis of a successful crop is good preparation and establishment techniques. This is particularly relevant to difficult sites where arduous climatic factors or soil structures play a major part. It is therefore very important to start with the correct species and type of stock in order to allow the crop a chance of survival.

Plant types range in size from small seedlings to heavy standards. Large plants are difficult to establish, particularly on poor sites, they are very prone to vandalism and

are very expensive. Alternatively small seedlings are susceptible to frost damage and weed competition.

Transplants, undercuts and containerised stock are consequently suitable for most soils and stand the best chance of survival and are therefore the most economical.

Transplants - are small trees under 1.2m, the preferred being 0.2 - 0.4m in height and up to 4 years of age, with a well balance root to shoot ratio. They should have been raised as seedlings for up to two years then transplanted for a further year to improve growth and rood development. They are often identified as 1 + 1, 1.5 + 1.5, 2 + 1, this refers to the amount of time first as seedlings then as transplants within the nursery.

Undercuts - are the same size as transplants but have undergone a different process within the nursery. They are precision sown seeds which have then been undercut after the first growing season (their roots severed) to improve root mass and control tree height and growth. These are commonly identifier as 5u5, 1u1, 1u1u1.

Container grown - are plants which are pot grown and benefit from minimal root disturbance. Container grown stock is therefore expensive and varies greatly in age, size and type. However smaller younger plants are generally cheaper and most suitable. Sensitive trees such as birch and Corsican pine do benefit from being containerised.

Provenance - Provenance is the geographical source from which the seeds were gathered. This can be crucial to survival, as obviously a seed source in a mild or sub tropical area will produce stock with the ability to withstand drought and high temperatures, but will be ill equipped to cope with the exposure and low temperatures. So if such stock is then located in an unsuitable area the chances of survival will be limited. It is therefore always advisable, if possible, to obtain stock of local provenance and reared in a local nursery.

13.5 Planting Near Landing Areas

Many areas of new planting have been attempted adjacent to land areas, this has resulted in the crop being devastated by the worst pest of all, THE GOLFER, not only are trees destroyed by the incoming ball from the tee shot, but a second opportunity is then afforded with the shot to the green and, if all else fails, he can tramp on the stock while searching for his ball or completely excavate the plant with the assistance of a golf club. Whichever method is chosen, the result is the same, total destruction of the plant.

The attempted establishment of trees adjacent to landing areas should be avoided due to the high fatality rate encountered from physical damage. It is also strategically more acceptable, if such planting takes place between the landing area and the target area as this allows the player the opportunity of manoeuvring his shot around the hazard.

However one method of establishing trees in situations close to the line of play is to introduce

a bunker just short of the trees, so that it catches a high percentage of the shots which arrive in that vicinity. The bunker should have a sufficiently steep face so that it demands a very lofted club to get out. This redu ces the velocity and trajectory of the shot, and consequently the damage to the trees.

13.6 Rules regarding the Protection of Planting

The location and species selection (resilience to golf ball damage) will afford some

protection to the crop once it is established, but in the juvenile stage rules will be needed to be introduced in order to protect the crop.

The only way to avoid heavy damage is to initiate a dropping zone which removes the crop from the ***line of play.*** It is often thought that the majority of damage is done by the golf club, when in fact equally as much is done by the ball striking the tree after relief has ben taken. Care has to be taken in the wording of such a rule in order to avoid the 'you can't lose a ball in Grounds Under Repair' problem. A rule is therefore needed which requires the player to find the ball in order to gain relief, once the ball is found a free drop may then be given. The dropping zone should consist of rough grass so no advantage is gained.

It is essential to implement such a rule until the trees become well established. It is always unpopular with the membership to introduce such rules, but it is the only way to safeguard young trees in high risk areas. It is also important to educate the membership as to how fragile trees are, this can be done by publishing information and having open evenings etc. This has two benefits, firstly, members then appreciate the difficulties surrounding the establishment of trees on a golf course and are therefore more considerate towards new planting. Secondly, it removes some of the pressure from the committee when implementing unpopular rules.

13.7 Formative Pruning

A golf course requires trees with clear stems and relatively high crowns in order to allow play from beneath and to facilitate easy access for grass cutting. Formative pruning is therefore crucial in order to achieve this at an early stage thus avoiding mechanical damage or the necessity to remove large limbs at a later stage, both of which are harmful to the tree and predispose it to outside agencies. Formative pruning is important to the production of a suitable crop and should therefore be included in post planting maintenance programmes. Formative pruning is a skilled job and should only be carried out by an experienced operative.

14.0 **ECOLOGICAL AND WILDLIFE VALUE OF TREES**

14.1 **Wider Ecological Issues**

It is now recognised that the destruction of large tracts of rain forests and the extensive burning of fossil fuel has increased carbon dioxide levels in the atmosphere and caused damage to the earth's ozone layer creating ecological problems that are likely to become more severe if preventative measures are not taken. It is recognised there is a need to plant trees on a massive scale in an attempt to redress the balance, therefore every reasonable opportunity should be taken.

14.2 **Wildlife Value**

Trees have considerable wildlife importance, they provide food, habitat, shelter and security to a wide variety of wildlife. Some tree varieties are, however, of much greater wildlife value than others. In general, native species are of much greater value than imported and exotics.

The English Oak plays host to more than 300 invertebrate species, near the start of the food chain, whereas many imported exotic species are host to merely 15 species. However this argument can be countered by the fact that certain non native species such as sycamore which do not have the bio-diversity of oak, but do have vast quantities of aphids at a time when other food sources are unavailable. Some tree species are favoured by particular wildlife species, for example the Scots Pine/Red Squirrel.

Golf courses are situated on many different landforms and are the home of many endangered species of flora and fauna, these include many rare reptiles and amphibians, as well as butterflies, birds and flowers. Woodlands play an obvious part in supporting wildlife, but it should not be forgotten that even bunkers are of considerable conservation value as they are used by a range of animals including foxes, badgers and hedgehogs. They also provide an ideal place for reptiles such as lizards, slow worms and snakes to bask and take up the sun.

The rough provides important habitats, housing small mammals which in turn provide an important link in the food chain by acting as a food source for birds of prey, such as barn owls and kestrels. Woodland edges act in a similar fashion but have the advantage of providing a close source of heavy cover and are therefore even richer in diversity.

> *"Woodland requires management to keep in rich in wildlife. There are all too many instances of neglected or badly managed woodlands which over a period of time becomes a dark, dense tangle of vegetation."*
>
> *"The need for effective woodland management has never been greater and clubs whose courses were damaged by the storms of recent years should rethink their management to assist the trees and the wildlife they support."*
>
> On Course Conservation, Managing golf's natural heritage. The Nature Conservancy Council 1991

Woodlands on golf courses can be important within urban localities, as they often provide the only available seclusion for certain shy species of animal, they also provide significant links

in wildlife corridors and food chains. It is therefore important to ensure that new planting should include species which are rich in wildlife value, in order to preserve a healthy, diverse culture.

15.0 **SUMMARY - GUIDELINES TO PLANTING TREES ON THE GOLF COURSE**

The modern awareness of the benefits of green vegetation within the environment has led to a vast increase in the planting of trees in the golfing landscape, but care must be taken as too many trees can restrict good air circulation and sunlight to vital areas, such as tees and greens. Furthermore, when positioned in the wrong location they can impose severe and unwarranted penalties on golfers and therefore be detrimental to the pleasure of the game.

There are a number of basic principles that should be adhered to before adding trees to golf courses in order to avoid unwanted side effects.

Before reviewing these guidelines one should realise that any one may not apply in all situations, for example, a large mature tree to the south of a green will cause more shade than a similar tree situated to the north.

1. Make sure that trees are not located where their mature canopy will infringe on the line of flight between tee and fairway as this will result in players only using a fraction of the teeing space available, making an otherwise adequately sized tee show uneven signs of wear.

2. To allow good air circulation and exposure to sunlight, dense plantations or large shade bearing trees should not be planted adjacent to greens, fairways or tees. Poor air circulation during summer increases temperature and humidity, inhibits surface and soil drying and promotes the development of disease. During winter the shade can prolong snow and ice cover rendering the course unplayable for longer than necessary and can increase the possibility of frost damage. Where these problems exist, felling or heavy pruning are the only solutions and as both of these are unpopular and costly, it is therefore advisable to avoid such problems at the establishment stage.

3. Never plant trees in straight lines as natural woodlands are never symmetrical and therefore planting of this type looks artificial. Careful placing of copses can be as effective as vast tracts of woodland, they are more natural in appearance and are more economical to produce and maintain. (Less trees, less initial expenditure in planting and less future management.) The use of copses rather than larger areas of woodland also has the benefit of not blocking attractive views which may be unintentionally lost to future generations.

1. In the case of trees which are planted for strategic reasons, great care must be taken to foresee their eventual size and form. It is also important to give consideration to the distance from the teeing ground that a tree or trees are planted. If the planting occurs too close to the landing area then the establishment of trees becomes impossible due to the physical damage inflicted on the crop by both golfers and their equipment. For strategic purposes, there should be enough space between the eventual resting place of the ball and the tree/trees to allow an adventurous shot to be attempted. This may take the form of shaping the shot around or playing over or under the tree - both options should be available to the player.

5. If trees are to be used strategically then the grass beneath should be kept in such a

manner to allow the playing of a recovery shot. It is therefore important that the tree spacing is wide enough to facilitate grass cutting without causing damage to the tree or its roots. It is therefore important in such a situation to select species of trees which are not surface rooting, as damage will be incurred from machinery to the root system. (Damage to machinery may also occur.)

6. Never plant potentially large trees close to greens and tees as, in addition to the shading, the turf and the roots will compete for water and nutrients. The roots may extend approximately one and a half times the height of the tree.

7. Flowering and ornamental trees add unmistakable beauty to parks and gardens, however care must be taken when planting exotic specimens within the golfing landscape as they can look artificial and out of place.

8. Avoid screening out scenic views such as the sea, mountains, rolling countryside, stately buildings or other beautiful scenes. A view lost that has been blocked by trees is usually forgotten and lost forever.

9. When selecting species for planting, choose those in keeping with the surrounding area and have a bias to those native to the area. Take into account the suitability of the species regarding provenance, soil type, drainage, aspect, resilience to golf ball damage, form and shape, shade, tolerance, stock type (bare root, container grown etc).

10. Limit the diversity of species, most classic courses have a continuous theme, eg Sunningdale has heather, pine and birch, Brancepeth has beech. Care must however be taken not to create a monoculture as this increases the fragility of the woodland, ie a woodland of purely elm would have been lost in recent years to Dutch elm disease.

11. Adhere to the principles laid down by the original architect as he has created the character of the course and never undertake strategic planting without the advice of a golf course architect.

12. Never plant more trees than be maintained. During the first 5 years a time consuming maintenance programme will be required.

When undertaking tree planting on a golf course one must maintain the existing character of the landscape. Trees can perform many useful roles, but when over planted or misused they can cause turf management problems and detract from the appearance and playability of the golf course.

A golf course forms a significant part of the landscape, its character should contribute to its overall quality and not conflict with or detract from it.

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