The great variety of semi-natural habitat, diversity of associated species and large total area makes Yardley Chase one of the foremost sites for nature conservation in the East Midlands. Much of the site was originally a Norman Hunting Chase and is now woodland, pasture and parkland. More recently, military use over a large part has left a series of railway trackways, grassland glades and open pools. The value of these habitats, particularly for invertebrates, is enhanced by their long isolation from intensive agriculture and by their juxtapositions over a large area.

There is documentary evidence to indicate a long history of woodland on the site, although much of the former ancient semi-natural woodland has been replanted or modified. This has created a range of woodland types including plantations of oak, mixed broadleaves and conifers. The integrity of the woodland blocks as a whole is essential to their nature conservation importance, but the relatively unmodified areas are of particular significance. These are typically high forest of the ash Fraxinus excelsior-field maple Acer campestre-dog’s mercury Mercurialis perennis woodland type having an understory of relict coppice with Hawthorn Crataegus monogyna, Midland Hawthorn C. laevigata, hazel Corylus avellana, dogwood Cornus sanguinea and guelder rose Viburnum opulus. Honeysuckle Lonicera periclymenum is an abundant climber in places, and is important as the larval food plant for the uncommon butterfly white-admiral Ladoga camilla which occurs here. Field layer species include bluebell Hyacinthoides non-scripta and dog’s mercury Mercurialis perennis with a wide range of associated species such as wood-sedge Carex sylvatica, bugle Ajuga reptans, primrose Primula vulgaris and male fern Dryopteris filix-mas. Bramble Rubus spp. is locally abundant. Modified stands still retain ground flora species characteristically associated with ancient woodland such as herb Paris Paris quadrifolia. In many areas the plantations have failed and the woodland is reverting to a semi-natural mixture of native trees and shrubs. This explains the preponderance of birch species Betula pendula and B. pubescens. Natural regeneration of ash and field maple is also prolific.

The extensive system of rides in the woodland areas comprises a significant area of unimproved grassland with a varied flora, which together with the railway trackways are important for invertebrates, particularly uncommon lepidoptera such as wood-white Leptidea sinapis, purple hairstreak Quercusia quercus and black hairstreak Strymonidia pruni. Since 1977, 30 breeding species have been recorded - more than any other Northamptonshire site and including the largest known British population of wood-white.

Unimproved neutral grassland is a special feature in the northern section. Where it is extensive and includes former pasture and parkland it forms the largest known area of its type in the East Midlands. It is of the crested dog’s-tail Cynosurus cristatus-common knapweed Centaurea nigra type. Local variation in soil structure and chemistry has allowed development of an intricate patchwork of different plant associations with over 120 flowering plants having been recorded. This is an unusual feature and the best example in Northamptonshire. Other typical species include common bent-grass Agrostis capillaris, Yorkshire fog Holcus lanatus and sweet vernal-grass Anthoxanthum odoratum with locally abundant sedges such as glaucous sedge Carex flacca. Herbs present throughout are common knapweed, lady’s bedstraw Galium verum, meadow vetchling Lathyrus pratensis and common bird’s-foot-trefoil Lotus corniculatus, with those of additional note including pepper-saxifrage Silaum silaus and large numbers of adder’s tongue Ophioglossum vulgatum. In those areas which have lighter, well-drained or acid soils, plants such as heath-grass Danthonia decumbens, heath milkwort Polygala serpyllifolia, tormentil Potentilla erecta and betony Stachys officinalis are characteristic. Correspondingly, local base enrichment provides conditions for saw-wort Serratula tinctoria, dropwort Filipendula vulgaris, cowslip Primula veris and early-purple orchid Orchis mascula. The tussocky growth of tufted hair-grass Deschampsia cespitosa and small-reed Calamagrostis spp. in damper areas of grassland is an important habitat for invertebrates.

Outstanding examples of pasture-woodland, which probably formed an important element of the Hunting Chase, have also survived in the northern section and represent a valuable transitional habitat. Their large over-mature pollards and maidens of ash and pedunculate oak provide a deadwood habitat supporting rare saproxyllic* invertebrates including Procarus tibialis, a nationally vulnerable species of click beetle. These insects are regarded as relic populations whose survival has been dependent upon the continuity of suitable habitat and site management. Old individuals of hawthorn and crab apple Malus sylvestris also present are particularly valuable for the feeding adult insects. The parkland trees are additionally of value for epiphytic lichens and as roosting sites for birds of prey such as barn owl Tyto alba.

An array of biologically-rich pools, believed to be unique in the region, occur in both sections. Their base-rich waters have given rise to a diverse wetland vegetation including aquatics such as shining pondweed Potamogeton lucens, broadleaved pondweed P. natans, white water-lily Nymphaea alba and lower plants comprising the charophytes Chara globularis, C. hispida and the scarce free-floating liverwort Ricciocarpus natans. Emergent poolside vegetation contains stands of grey club-rush Schoenoplectus tabernaemontani and lesser bulrush Typha angustifolia which is a county rarity. Some pools have areas of fringing marshland where damp-loving plants including southern marsh-orchid Dactylorhiza praetermissa, Ragged-robin Lychnis flos-cuculi and skullcap Scutellaria galericulata can be found in abundance. The pools support a dragonfly population of prime importance in the county, and of 13 breeding species so far recorded, the ruddy darter Sympetrum sanguineum, of vulnerable status nationally, is of special note. Large numbers of the great crested newt Triturus cristatus, which is a protected species, breed in pools in the southern section.

The site forms part of a larger area of regional importance for the diversity of breeding birds.

*Dependent for part of their life cycle on living, dying or dead wood, associated fungi or myxomycetes.