Tansy Beetle Action Group

the species recovery trust

Tansy Beetle

Chrysolina graminis

Conservation Action Plan

2023-2027

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Species Description

Chrysolina graminis, more commonly known as the Tansy beetle, is a chrysomelid leaf-beetle that predominantly feeds on the plant Tansy *Tanacetum vulgare*, but it can also use other wetland plants. The species' world distribution ranges from south-eastern Europe through to central Asia and China. The beetle is an iridescent green and around 10 mm long, but colour variations have been recorded (Hodgson 2022). Its elytra are pitted and have a coppery tinge. Currently, the only known British populations are (a) along a 45 km stretch of the River Ouse in central Yorkshire, (b), at Woodwalton Fen, Cambridgeshire, where it was rediscovered in 2014 after a 40-year absence of records and (c) since 2018, at the Wildfowl and Wetlands Trust (WWT) reserve at Welney, west Norfolk.

Although fluctuating widely, the York population along the Ouse is by far the largest. The beetle is part of the landscape of traditionally managed floodplain grasslands (Ings) in York. Although the Tansy beetle is characteristic of the riparian margins of meadows, rather than the grasslands themselves, it is still a quintessentially 'Ings' species. It is likely that the practice of hay making, followed by aftermath grazing, favoured the survival of Tansy beetles. Removing livestock during the spring/summer aligned with the beetle's breeding and larval development period, while grazing in autumn helped suppress more competitive vegetation on the riparian fringe. This system of land use probably dates back to Roman times around York, was established extensively during the Saxon period and covered a large proportion of the Ouse floodplain until relatively recently. This historical land-use legacy is probably one of the reasons that the Ouse corridor is the Tansy beetle's remaining stronghold. Along the River Ouse the beetle is mainly found living in clumps of Tansy, which provide their staple food source.

In contrast, in the East Anglian Fens it has been recorded feeding on Water Mint *Mentha aquatica*, Gypsywort *Lycopus europaeus* Marsh Woundwort *Stachys palustris* and Hempnettles *Galeopsis,* with Tansy being completely absent (Oxford et al., 2003; Oxford, 2021). The beetles discovered most recently in Welney, west Norfolk, were also reported to eat this array of foodplants (Oxford, 2021). Due to the reduced density of beetles present at these two sites, much of the information on the biology of the species has been gleaned from the York population. However, there is evidence that beetles present in Yorkshire and East Anglia may represent different ecotypes with differing biologies (Oxford, 2021).

Life cycle

The Tansy beetle has an annual life cycle with a peak mating period during the spring and continuing into early summer. Females lay numerous batches of from three to fifteen eggs on the under surface of Tansy leaves. Each yellow, rice-grain-shaped egg is 2mm long and stands upright from the leaf's surface. In captivity, a female was reported to have laid 561 eggs over the course of 136 days, suggesting a capacity for rapid population growth. However, this figure is likely to be greatly reduced in the field, where conditions will be far from ideal (Oxford et al., 2003). High beetle density on Tansy plants induces some females to seek out other, non-food plants on which to lay their eggs. This strategy acts to decrease the chance of their eggs being cannibalised by other adults but it may, however, lead to an increase in larval mortality, while they locate Tansy to commence feeding (Chapman et al., 2006).

After hatching, the newly emerged, grey larvae pass through four instars before burrowing into the soil at the base of the Tansy clump during July. Once underground the larvae metamorphose into pale yellow pupae. Although this is certainly the case for beetles of the York population, it is likely

there is some disparity in the overwintering behaviour of fenland populations (Oxford, 2021). They too manage to survive winter flooding, perhaps by overwintering near or above ground level (Oxford, 2021). The new generation of adults emerges from the soil around a month later and begins feeding. Most of the previous generation's adults die before the new generation emerges (Oxford et al., 2003). By late September and into early October the new adult beetles return to the soil to overwinter. They do not emerge again until spring when, the cycle completed, they begin mating and egg-laying again (Oxford et al., 2003).

Knowledge gap(s) identified:

- More research into Tansy beetle ecology, specifically defining habitat requirements. Key areas for research include:
    - Soil water content during pupation and overwintering
    - Impacts of predators on eggs and larvae (ants, spiders etc.)
- Differences in ecological requirements of York and Fen populations, particularly food plants, egg laying, depth of pupation/overwintering and soil attributes of
    - Can the two populations breed to produce viable, fertile offspring?
    - Where do the Fen beetles overwinter and is their capability to withstand inundation different from populations in York?

Populations

The stronghold population of Tansy beetles along the Ouse is split into smaller sub-populations as a result of the localised distribution of their major food plant, Tansy. These sub-populations are more-or-less isolated from one another as the beetle very rarely flies. Flight has only been witnessed on one or two occasions in hot weather in August and September, most recently at Wicken Fen in 2014 (during an attempted reintroduction, see section 8) where it was recorded on film. Combined with anatomical studies, it has been found that flight is unlikely to be a significant component of dispersal (Oxford, Middleton & Sparrow 2021). Patches of Tansy along the Ouse are made more sporadic by shade from large willow trees and competition from the invasive non-native plant Himalayan balsam *Impatiens glandulifera* (Oxford and Millington, 2014). Tansy patches are further compromised by their physical removal by humans in mistake for ragwort, and by overgrazing from livestock (Oxford et al., 2003). Therefore, as beetles hardly ever fly and have been shown to walk only 150-200m between foodplant clumps, sub-populations can easily become isolated and vulnerable to local extinctions (Oxford and Millington, 2014). Large gaps in food-plant distributions threaten the long-term future of the beetles' meta-populations.

At Woodwalton Fen, unlike on the Ouse, the foodplants tend not to grow in clumps but, spatially, do vary in density. The extent and structure of the beetle population here are still to be determined.

It seems likely that the Tansy beetle populations in the Fens and on the Ouse have been separated for a very long time (Oxford, 2015) and may have evolved adaptive differences in behaviour and the ability to metabolise different food plants. For example, beetles at Woodwalton may overwinter in soil at a shallower depth compared with those along the Ouse as they are not exposed to potential soil erosion during winter flooding. Currently, a specimen of Fen and York beetles is with the Tree of Life project to undertake genetic analysis and clarify the genetics for both populations.

Likewise, feeding beetles from the Ouse population over a number of generations solely on Water Mint has been shown to severely reduce their reproductive output; similar but less extreme effects

are seen when they are fed a diet of Gypsywort (Oxford & Oxford 2022). Increased research into potential evolved behavioural and physiological differences between these beetle populations is important if we are to understand the conservation needs of the two populations. There is also a need to better understand how a mixed sward of foodplants is used by beetles in the wild.

Knowledge gap(s) identified:

- Genetic work using neutral DNA markers is required to assess how differentiated the population in York is compared with those at Woodwalton Fen
- Genetic work into the last common ancestor between the York and Fen populations
- Behaviour and ecological research to understand differences between York and Fen populations, especially with respect to survival and reproduction on different food plants and the overwintering behaviour of adults.
- Research to assess how the York and Fen populations differ from European populations

Functions and Values

The functional value of the Tansy beetle within UK ecosystems is largely unknown, especially since their single core population is geographically restricted. It is a herbivore but occurs in such small numbers that it is unlikely to make a significant impact on the ecosystem as a whole, but may affect single food-plant patches when in large numbers. However, in York it can be used as an indicator of healthy riverbank habitat as it demonstrates a higher quality, diverse ecosystem without negative impacts caused by invasive plant species and overgrazing. Because of its association with the historical management of York's Ings it is also an indirect local indicator species of the Lowland Meadows Habitat of Principal Importance (as listed in NERC Act Section 41) and the Lowland Hay Meadows Habitat of European Importance (as listed in Annex 1 of the EU Habitats Directive).

The social value of the Tansy beetle is more obvious. It is commonly known as the ''Jewel of York'', recognizing its intrinsic beauty and the fact that its stronghold occurs in York. The Tansy Beetle Action Group (TBAG) was set up in 2008 by a number of organisations to coordinate conservation efforts for the beetle and raise its public profile. Public information boards have been erected at two sites along the River Ouse where the beetle is usually found in numbers. Stalls at events such as the Insect Festival held in York, regular walks and talks and primary school visits, have all further engaged and educated the public. In 2021, Askham Bryan created 'The Jewel of York Trail' featuring giant Tansy beetle sculptures that were hidden around the city. These were later auctioned off raising funds for TBAG. Other promotional material includes handmade brooches featuring the beetle, as well as pin badges and postcards, in order to increase its public appeal. There is growing interest in captive breeding of the beetle by zoos and colleges; to use educationally as an example of invertebrate conservation in Britain, as well as potentially providing individuals for future reintroductions. Therefore, the Tansy beetle is a local icon in York but in addition raises awareness of invertebrate conservation across Britain.

Knowledge gap(s) identified:

- Research public awareness of the Tansy beetles and the education and well-being benefits the beetle provides to local residents.
- Quantify Tansy beetle's function in the riverbank ecosystem, as a food source and a herbivore, as well as defining the wider benefits to other wildlife through its conservation.

- Research the wider implications of management of the beetle, for example the ecosystem importance of Tansy as a food plant for other riparian insects such as Aculeate Hymenoptera.

Historical account

It is difficult to determine accurately the past distribution and abundance of the Tansy beetle (see below). However, in the last 50 years the distribution of Tansy beetle populations has been undoubtedly significantly reduced, with only 11 '10 km squares' verified as positive since 1970 (Oxford et al., 2003). With only two UK populations remaining the Tansy beetle was categorised as Endangered using the IUCN Red List criteria in the recent UK species status review (Hubble, 2014).

Distribution

Some historical records should be treated with caution as a number have been shown to refer to misidentified Mint beetles *Chrysolina herbacea*, which are very similar in overall appearance (Oxford et al. 2003). There are other documented cases of mislabelling and assignment to totally unrealistic locations. The past distribution of the Tansy beetle is impossible to determine accurately unless museum specimens are checked for correct identification, although errors in recorded source locations remain.

It is believed that the Tansy beetle was once relatively common and widespread in the East Anglian Fens. Up until the second half of the 1980s the beetle was regularly recorded at Wicken Fen, Cambridgeshire (Oxford and Millington, 2013) and was thought to be the last extant population in the Fens. Specimens in the Cambridge University Zoological Museum throw light on past distributions in the region. As well as Wicken Fen, Tansy beetles in the collection came from Woodwalton Fen (between 1956 and 1975), Whittlesey Mere, near Peterborough (undated) and Chatteris and Sutton Gault (both 1898) (Oxford and Millington, 2013). Therefore, until more recent recordings in 2014 at Woodwalton Fen and 2018 at the WWT reserve at Welney, the beetle had not been sighted in this region for some 30 years.

Surveying efforts have focused on the known stronghold of the Tansy beetle along the River Ouse, in Yorkshire. The first concerted attempt to assess the distribution of the beetle was by Calvert (1998), who surveyed the river from Linton Lock to Fulford Ings on the east bank, and from Nun Monkton to north of Acaster Selby on the west bank. He discovered beetles and Tansy to be distributed from about 8 km north of York city centre to 26 km south (Oxford et al., 2003; Oxford and Millington, 2013). Two postgraduate students at the University of York, Duncan Sivell (2000-2003) and Dan Chapman (2003-2006) continued this surveying work along the Ouse. Although recording valuable data at certain locations, they did not cover the entire Tansy beetle range and not all of their sites were surveyed every year. The first comprehensive survey completed along the Ouse to assess both the distribution and abundance of Tansy beetles and Tansy plants began in 2009 and has continued annually since then.

Trained volunteers survey an approximately 45 km stretch of the river (90 km of bank), which encompasses the beetle's entire distribution on the Ouse (Oxford and Millington, 2013). Surveys of the new generation of beetles each year are carried out on warm, sunny days over a four to five-week window, usually from the end of the first week in August to the end of the first week in September.

Overall, the beetles and Tansy plant range along the Ouse has remained relatively stable, although there has been some annual variation in the range of the beetle along the river, often as a result of finding, or not finding, a single individual (Oxford and Millington, 2013). However, the proportion of Tansy plants clumps occupied by beetles has varied; for example, falling from 19% to 13.2% between 2011 and 2012 (Oxford and Millington, 2013). Previously, range contraction has been particularly evident on the east bank south of York and west bank north of York. However, the 2020 survey indicated that the beetles range limits contracted on all margins excluding the east bank at the southern edge of the range, which is unsurprising given this sub-population is now confined to cattle-proof enclosures. Probable reasons for range contractions include prolonged overgrazing by sheep/cattle and regular flooding events (Oxford and Millington, 2014).

Abundance

As well as noting the presence/absence of beetles during the annual surveys, when present beetles are counted or, in some cases, numbers are estimated. Quantifying the actual beetle population size within Tansy clumps suggest that approximately half of the beetles present are visible at any one time (Oxford et al., 2003). A crude estimate of total population size is therefore made by doubling the number of beetles counted during the survey. Tables 1 and 2 are presenting total beetles recorded and population estimates annually, as well as results from a series of 'identical' stretches where the surveyors have been consistent annually. It can be seen on these stretches that prior to 2014 the beetle numbers were increasing but were low, with a population estimate of less than 5000. Since 2014, the population estimate on the identical stretches has been around or well above 10,000. 2020 was the lowest year in the last 8 years, with 8680 estimated beetles. The York population has become more robust but still fluctuating significantly.

The vagaries of beetle population changes over time are illustrated by the survey in 2011. The number of beetles north of York approximately doubled when compared to 2010 numbers whereas to the south of York they dropped to a tenth of that in the previous year. The reasons for this remain unclear but were not thought to be a result of summer flooding. In general, the factors governing population sizes and distributions of the Tansy beetle are still obscure (Oxford and Millington, 2013).

In 2012 most sites demonstrated a decrease in beetle numbers, irrespective of geography. The number of Tansy clumps also showed a marked decline of 21% (1727 clumps to 1361). The number of beetles suffered an overall decrease of 52.5% (individuals counted: 2097 down to 1101), but these figures hide marked and enigmatic variation along different parts of the Ouse (Oxford and Millington, 2013 – see below).

Flooding in the summer of 2012 was almost certainly the main reason for the marked decline observed in Tansy clumps and beetles that year, which had the wettest summer for 100 years, as cited by Oxford and Millington, 2013. Winter flooding doesn't seem to be deleterious for the Tansy beetle, but floods during their active season in the summer appear to have a significant impact. Through the spring and summer of 2012 there were at least eight major floods along the Ouse, some of which coincided with the period when the vulnerable larvae were feeding on plants (Oxford and Millington, 2013). Experiments completed to assess impacts flooding may have on Tansy beetle egg survival demonstrate that following immersion in water for just one day results in hatching success for only 50% of eggs. By four or more days of immersion, none would survive (G & R. Oxford, 2022). Unfortunately, beetles in their larval stage are even more vulnerable. Once knocked from the Tansy plant into the water they will drown (Oxford, 2021).

The number of Tansy beetles counted along the Ouse in 2015 was 15% higher than that counted in 2014 (12,139 compared with 10,557), with the largest increase in abundance (69 fold) observed

between Linton Lock and Nun Monkton (Oxford, 2015). If the doubling rule, as described by Oxford *et al*. (2003), is applied there were roughly 24,000 individual beetles in 2015, supporting an encouraging gradual upward trend in numbers. The number of Tansy clumps increased from 2014 to 2015 (2271 to 2713) but the proportion of clumps containing beetles only marginally increased (from 20.3% occupied in 2014 to 20.9% occupied in 2015) (Oxford, 2015). In 2016, the total beetle population peaked, estimated to be some 40,000 individuals, an increase on the 2015 figure of 63%. 2015 and 2016 saw two increase years in succession, this is the only occasion that this occurred in the overall 9 year survey window. Specific sites along the River Ouse in Yorkshire need to be examined to reveal finer-scale demographic trends over time and their possible causes.

The estimated beetle population size has fluctuated significantly in the years since, see table and graph 1 – pre 2014 not all stretches were surveyed. Results from the 2020 survey indicate a 49.45% reduction in the estimated beetle population size from the previous year to only 11,882. However, numbers increased in 2021 to 27,700, the second highest recorded population level. As seen in previous years, spring and summer flooding is likely to be a major contributor to this decline, however, flooding is not sole factor affecting local population sizes. For example, in 2012 a site north of Selby experienced flooding, as well as the exacerbating effects of tidal flow, but showed a dramatic increase in numbers of beetles between 2011 and 2012, bucking the general trend. Similarly, although flood events aligning with vulnerable stages in the beetle's life cycle occurred for the northern stretches of the 2020 survey, this was not reported for the south of York. Other than flooding there must be other, possibly very local, factors which influence annual variation in abundance. Other factors believed to have contributed to beetle population declines include increased grazing pressure on Tansy and competition from other plant species such as extensive willow growth and Himalayan Balsam.

Following unforeseen disruption from the COVID-19 pandemic, substantial changes were also made to the surveyor team which may have resulted in inconsistencies in survey figures since. Despite fluctuations, numbers are not dropping so dramatically and increased numbers are gradually becoming more common. This is more noticeable in table and graph 2 of numbers surveyed from identical stretches – this series of data from stretches with identical surveyors ends in 2020 due to surveyor changes. Despite fluctuations, the general trend in graph 2 shows an increase in beetle numbers, which could indicate a shift to more favourable conditions on these transects. Some of these increases can be attributed to improved land management practices resulting in a greater presence of Tansy at critical times in the beetle's life cycle.

Table and Graph 1: Total beetle numbers recorded and population estimate

	2022	2021	2020	2019	2018	2017	2016	2015	2014
Beetle numbers recorded	6579	13892	5941	12015	7724	13586	20351	12139	10557
Population estimate	13194	27700	11882	24030	15448	27172	40702	24278	21114

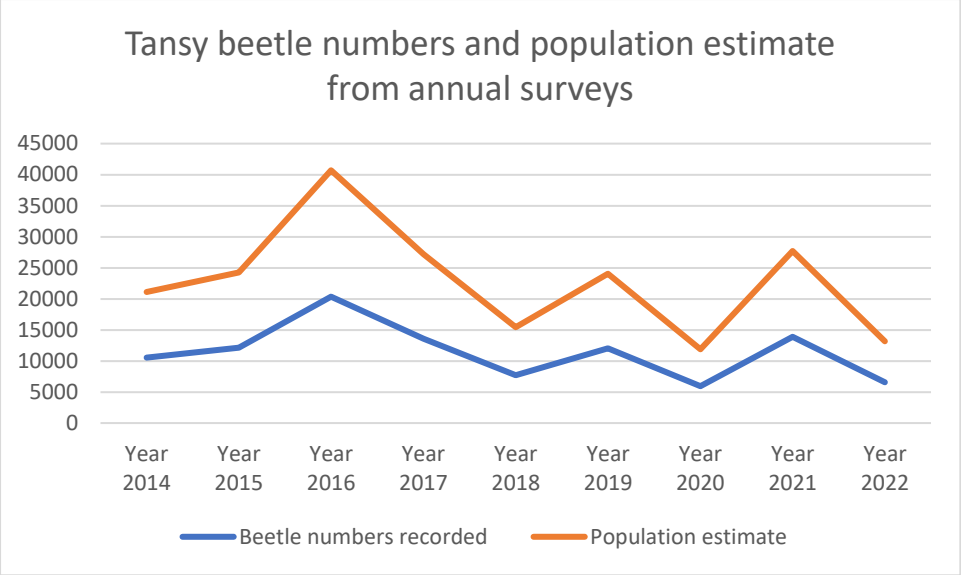
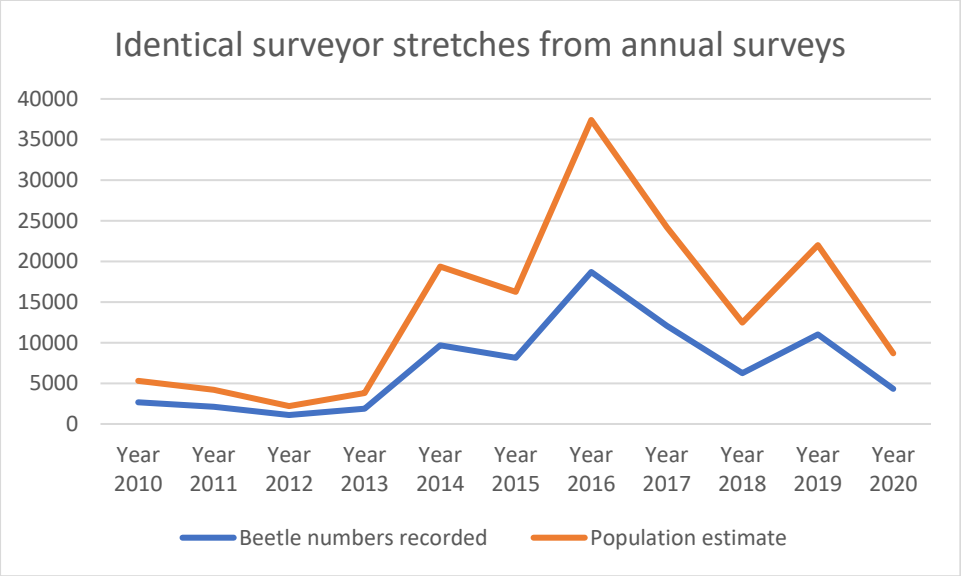


Table and Graph 2: Numbers surveyed from identical stretches (recorded)

	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010
Beetle numbers recorded	4340	11009	6243	12098	18704	8134	9687	1897	1101	2097	2650
Popln estimate	8680	22018	12486	24196	37408	16268	19374	3794	2202	4194	5300



Current distribution and demography

Since 2009, the annual surveys along the Ouse have provided insights into the current distribution and demography of both the Tansy beetle and its food plant. Surveys completed from 2014 onwards covered a 46.8 km stretch of the river, from Linton Lock in the north to Selby in the south (Oxford, 2015). In 2014, the Linton Lock to Nun Monkton west bank site, which had lost beetles in previous summer flooding, received wild-collected and captive-bred beetles which were successfully re-established. However, the population was seen to crash again in the 2020 survey.

Overall, there has been a continuing increase in the numbers of beetles, numbers of Tansy plants, and the numbers of Tansy plants occupied by beetles from 2014 to 2016. The geographical range of the beetle doesn't seem to have changed significantly in this time.

In the Fens a monitoring protocol has been established and during 2016 this has been implemented by Tom Bowers (Natural England) approximately weekly within the known beetle 'hot-spot'. A maximum of three individuals was recorded on any one occasion. A previous ad hoc survey at Woodwalton Fen recorded a maximum of nine beetles in 2014. A notice to the general public on the Fen has resulted in a small number of additional localised records. Indeed, one person reported seeing eight in the 'hot spot' during September 2016. Between 2014 and 2016 some mapping was completed but only very few individuals were seen (Oxford, 2021). In 2017, Katy Smith, John Kerr (both of Natural England) and Julian Hodgson mapped beetles along the rides recording a total of 773 adults. This population was size was much larger than was originally expected (Oxford, 2021). Additional surveying of foodplants was completed noting all species were widespread throughout the fenland and certainly were not a limiting factor in determining beetle distribution (Oxford, 2021). Unfortunately, due to COVID-19 no survey work was possible at Woodwalton Fen or at Welney Fen in 2020.

Knowledge gap(s) identified:

- Understanding seasonal and annual changes in abundance and distribution, with more intensive recording complementing the wider monitoring.
- Mapping of flood occurrence and levels (using LIDAR) relative to patches of Tansy and beetle numbers to better understand impacts and to facilitate effective management of sub-populations with reduced vulnerability
- Gather more consistent recording information for Woodwalton Fen and Welney Fen on (a) the true distribution of the population and (b) calibrate the multiplier to convert beetle counts to a true population size estimate.

Habitat and Resource Assessment

Tansy is an ephemeral plant which grows on disturbed ground, so a particular tansy patch may not be present in a habitat for very long (Oxford et al., 2003). The stronghold population of Tansy beetles along the Ouse is split into smaller sub-populations, a result of the clumped nature of their food plant. As mentioned earlier, these patches of Tansy are made more sporadic by shading from large willow trees and competition from the invasive non-native plant Himalayan balsam *Impatiens glandulifera*. More generally, Tansy occurs in damp environments such as marshland and at the margins of rivers and ponds, but also on roadside verges. It is a widespread plant in the British Isles (BSBI, 2016) but often occurs in small, isolated patches, which are unsuitable for sustaining beetle populations in the long term. The presence of the beetle on the Ouse is likely to be a result of abundant tansy, distributed along many stretches in large and adjacent clumps. It is likely that grazing is an important tool in maintaining the heterogeneous vegetation mosaics favourable to Tansy and may be a means of controlling Himalayan balsam on some sites. Fine-scale habitat preferences of the Tansy beetle are not currently fully understood (Oxford et al. 2003).

In the Fens the beetles occur on a very different vegetation type compared to the York population and at Woodwalton Fen it is found along ditch edges dominated by Common reed *Phragmites australis*. At both Fenland locations (Woodwalton and Welney), scattered food plants include Gypsywort, Marsh Woundwort, Hemp-nettle and Water Mint. With rotational management practiced on site, there is a need to maintain appropriate habitat structure and connectivity.

One obvious difference, other than food plants, between the York and Fen habitats is that the River Ouse floods every winter (Oxford et al., 2003). Tansy beetles demonstrate a high winter survival rate (Oxford et al., 2003; Oxford and Millington, 2013). It has been suggested that winter flooding may reduce the impact of predation on the beetle. For example, adults in the soil might suffer reduced mortality from moles, and in the summer larvae and eggs on plants could be exposed to reduced mortality from ants, which are less successful in damp environments (Oxford et al., 2003); however all these hypotheses need further research.

Knowledge gap(s) identified:

- Establish in more detail the ecological requirements in relation to food availability and environmental attributes of sites both in York and the Fens.
- Map and quantify the habitat being used by the beetles in Woodwalton Fen.

Threat Analysis

Historically, the Tansy beetle may have been more widespread in Britain and it is not clear what factors have led to its decline, especially in the East Anglian Fens. The beetle's food plants – Tansy, Water mint and Gypsywort – are widespread across the British Isles (Oxford et al., 2003) although, as intimated above, local quantity and distribution are both critical for the long-term survival of beetle populations. Flooding can eliminate large sub-populations; evidence suggests that summer flooding has the greatest impact. With only one known stronghold population in Britain, it would take just one year of extreme summer flooding to jeopardise the whole population along the River Ouse. During summer floods, larvae sink and drown when knocked off plants (Oxford et al., 2003; Oxford and Millington, 2013) and eggs also die after a few days inundation. Adults do not seem to suffer as much mortality, as they either float away (buoyed by air trapped under their elytra), climb to higher ground or even enter the soil by climbing down submerged stems (Chapman 2006, as cited in Oxford and Millington, 2013).

On the River Ouse a number of other threats directly impact Tansy and lead to the removal of the food plant on which the beetles rely. These include overgrazing by livestock, particularly cattle and sheep, which results in the further isolation of Tansy patches. In addition, the invasive plant species Himalayan balsam outcompetes Tansy and willows shade out clumps. It is also the case that some landowners actively remove Tansy plants, mistaking them for Ragwort or mow them out.

Eutrophication is also likely to be a significant threat. It results in Tansy decline and the replacement of heterogeneous vegetation mosaics with highly competitive nitrophilous plant communities. There is a general increase in nutrient loading in the Ouse floodplain as historic botanical data indicates the loss of many smaller, poorly competitive plants during the past 100 years. There are localised nutrient issues, for instance on the Ings Dyke and Blue Beck at Clifton where deposition of ditch dredgings along the banks has resulted in the loss of a significant Tansy beetle populations as nettle-bed vegetation has encroached. This also reflects the high nutrient inputs into these watercourses from urban surface water run-off.

Another threat is development and some land management by public authorities (Environment Agency, City of York Council, North Yorkshire County Council, district councils, Internal Drainage Boards) when exercising their duties, as well as private development (which is regulated by City of York Council). Some recent works such as regrading of the riverbank along the Esplanade in York have had a significant impact on Tansy beetle habitat and the upgrading of the Clifton Washland

defences has the potential to affect the Rawcliffe Meadows population. Tansy beetle populations need to be protected during operations and any unavoidable impacts fully mitigated.

Small Tansy patches cannot sustain beetle populations in the long term unless they form part of a landscape-scale mosaic of adjacent clumps (Chapman 2007), recent data is demonstrating a preference for Large ($2m^2$) and Very Large Clumps ($3m^2$ or more). Beetles mainly disperse by walking but clumps more than about 150 to 200 m away are not accessible. Therefore, if clumps are reduced in size or further isolated as a result of overgrazing or flooding the metapopulation structure of the beetle breaks down. Longer distance dispersal by flight is a possibility, but is thought to be relatively rare. These threats, specifically flooding and overgrazing, put the remaining patches of Tansy and beetle populations at risk. To make long term populations sustainable, there is a need to increase the connectivity between Tansy patches along certain stretches of the Ouse. Specific site impacts and threats at the Fens are still unclear.

The changing climate obviously leads to increase risks from summer flooding in York and potentially wetter conditions in the Fens, but also more extreme drier conditions in some sites affecting general environmental sites and the foodplants that grow on them. There are also increased risks of the York population relying on a single foodplant, in these very unreliable times in terms of climate.

Knowledge gap(s) identified:

- Threat analysis mapping and integration into habitat management plans
- Understand climatic changes and potential impacts on York beetles
- Ascertain the timing, frequency and duration of flight and long distance migrations (York & Fens) to understand population distributions

Conservation and Management - Status and Research

In 2008, the Tansy beetle was recognized as a BAP species and, as a consequence, the Tansy Beetle Action Group (TBAG) was formed to coordinate conservation efforts in the York area. The Tansy beetle is listed on Section 41 of the Natural Environment and Rural Communities Act 2006 and in 2014 it was classified as Endangered in the UK Red List review (Hubble 2014), establishing the beetle as a species of national conservation concern. It is worth noting that if the tiny Woodwalton population hadn't been rediscovered just prior to the publishing of the revised Red List, the designation would have been Critically Endangered since the Ouse sub-populations are effectively one population with respect to the threat of a major summer flood. Although there are still major gaps in our knowledge of what habitat factors Tansy beetles need to thrive, enough is known to inform conservation initiatives.

Conservation projects including habitat restoration

A small number of ark sites for beetles have been established to provide secure populations close to the Ouse but unaffected by summer flooding. In addition, sites have been set up specifically for educational purposes. As a result, there are small sub-populations of beetles Askham Bryan College, York (x2), on the Selby Canal (Canal and Rivers Trust) and in the York Museum Gardens (York Museums Trust). Another ark/education population was created at Stockbridge Technology Centre, Cawood, in 2017 but unfortunately the patch of foodplant was too small to sustain the population. Similarly, an ark site created at Clifton Hospital failed due to the dryness of the site, coupled with intense predation from Red Ants *Myrmica rubra.* The colony at Selby canal has continued to expand and now has beetle numbers of over 1,000, being the main insurance population (Oxford, 2021).

TBAG working with the Species Recovery Trust has in 2019-21 been working with landowners to provide advice and support to facilitate land management on the Ouse riverbanks, including holding a land manager workshop in February 2020 with 20 attendees. Other advice so far has included training to 12 EA staff supporting targeted mowing on flood banks and improvements to the enclosures, and Water Fulford and Carstairs Trust advisory visits.

TBAG, with additional funding from SITA Landfill Grant, has also built a series of 11 cattle-proof enclosures close to the riverbank near Riccall, south of York. These are spaced in walking distance for the beetle, acting as stepping-stones for beetle populations. In 2012, captive-bred beetles were introduced to a single enclosure. By 2019, only two of the enclosures remain unoccupied evidencing their ability to disperse successfully despite harsh conditions imposed by cattle between enclosures (Oxford, 2021).

This type of habitat restoration work has been continued on selective sites by the City of York Council, North Yorkshire County Council, the Carstairs Trust, Beningborough Hall (National Trust) and the Yorkshire Wildlife Trust. St Nicks has also been involved in similar habitat restoration work as part of the Green Corridors York project, which aims to reconnect and restore habitats including the riparian zones that support the Tansy beetle.

Beningbrough Hall is another site with Tansy beetle presence along the Ouse. Years ago Mark Pethullis was responsible for planting Tansy clumps in the orchard area, with visions of establishing another 'educational population'. In 2019, flooding along the river resulted in the many of the plants becoming submerged, many of which occupied by beetles. 32 individuals were rescued and transferred to Tansy in the orchard. In 2020, beetles were observed in the orchard throughout the summer. Mark intends to plant more Tansy in the area but no further beetle transfers are planned.

The Tansy Beetle Champions Project 2015-16 was set up by Buglife in conjunction with TBAG and with HLF support. This project seeks to encourage members of the public to engage with conservation efforts, support monitoring and restoration work and learn more about the beetle and how they can help in the long term. This has happened through local talks, presence at public events and promotion via media attention. The project also enabled the employment of two Tansy Beetle Conservation Officers for an 18-month period, which coordinated initiatives to remove Himalayan Balsam, plant Tansy and visit primary schools to engage the younger generation. These roles have now been taken on by volunteers.

Captive Breeding and reintroductions

The beetle has been bred by Roma Oxford for a number of years and has been found to be easy to culture. As a result of this captive-breeding work beetles have successfully been reintroduced to a number of sites along the Ouse. For example, in 2005 individuals were reintroduced on the east bank near Newton-on-Ouse, successfully re-establishing populations that had been lost around the 1960s. On the opposite bank, four sub-populations were re-established in 2014 after beetles had disappeared as a result of the 2012 summer floods. Reintroductions of populations on the Ouse lost during flooding have, with only a very few exceptions, been highly successful.

A reintroduction strategy was formulated for Wicken Fen and beetles from the captive bred population, together with some removed from large natural populations on the Ouse, were introduced into the Fen in September 2014. However, in spring and summer 2015 no beetles were found at the reintroduction site. The reason(s) for the failure of the reintroduction are not obvious but may be a result of biological differences in over-wintering behaviour between York and Fen

populations since adequate food plants were available and losses occurred outside the breeding season.

British and Irish Association of Zoos and Aquariums (BIAZA) has more recently become involved with TBAG with Dudley Zoo, Pudsey Park, the Deep and Coleg Cambria all interested in captive-breeding beetles to help raise awareness of invertebrate conservation in the UK and learn more about their autecology.

Research /knowledge gap(s) identified:

- Understanding vegetation dynamics through mapping of active management and correlating with Tansy clumps and beetle numbers in order to assess impacts along the Ouse
- How do we maintain Tansy at the inland edge of the floodplain where there are fewer opportunities for Tansy to colonise gaps?
- Need to consider ways of captive-breeding Fen material but without compromising the existing population. This could then be used to (a) expand the distribution of the beetle in the Fens, reducing its vulnerability, and (b) possibly acting as a more appropriate source of re-introduction material at Wicken Fen.

Previous plan progress review

Goal 1 – Research: Improve understanding of the beetle's ecology, population dynamics and genetics, thereby defining a viable population and optimal habitats to inform future conservation work.

Objective 1.1: Understand the biology and ecology of the Fen and Ouse populations feeding, behaviour, predators/competitors, hydrology, impact of invasive species.

There was a list of 8 research projects under this objective, but there has been limited progress on these projects. Research is a key area for establishing collaborations and resources with Colleges and Universities to facilitate more research on the beetle's biology and ecology.

Objective 1.2 Investigate the differentiation of Fen and Ouse populations against the background of European populations.

It has not been possible to do extensive investigations of the Fen population, this is partly due to the small size of the two population on the Fens, which limits the possibility of establishing a captive Fen population. DNA has been collected for the Tree of Life project from the York population and so this will be fully sequenced, it is hoped that in the near future a Fen beetle can be collected and the same can be achieved for the Fen population/s.

Objective 1.3 Establish effective monitoring of existing populations (Ouse and Fen)

The monitoring of the Ouse population has continued over the last 5 years. Although there has been a change in recorders plus the management of the monitoring scheme, data collection has still occurred annually. This scheme continues to provide invaluable information on threats and management impacts, with results summarised in an annual report and in the Knowledge Review. As part of these surveys, there is a site in Bishopthorpe being monitored over both spring and summer each year. Also, some Fen monitoring is being carried out to increase understanding of the beetle and its distribution at both Woodwalton and Welney Fen, but unfortunately this was not possible in 2020 due to COVID.

Goal 2 - Habitat Management: Strategic long-term adaptive management aiming to improve connectivity, quality/resilience and area of habitat. Habitat management plans in place and actively co-ordinated in collaboration with river catchment/wetland margin managers.

Objective 2.1 Habitat assessment to better understand current habitat use by the beetle's population

The Species Recovery Trust, working with TBAG, has been leading on habitat assessment work and applying that to management discussions and actions. More comprehensive maps are now being produced annually to show both clump sizes and beetle location, and so visually demonstrating foodplant connectivity along the river. In 2020 these maps were integrated into the annual report and are being used for management training and advice. In TBAG, there was some discussion as mapping the clump size makes the beetle locations less clear, but potentially two maps are going to be produced to resolve this issue. The Species Recovery Trust has been producing tailored management reports (to replace management plans) for the Environment Agency, York City Council, Water Fulford Hall, the Carstairs Trust and the National Trust, plus providing advisory visits and training; and ran a land manager workshop in 2020 encouraging and informing landowners. Development of an ark site strategy is outstanding. Also, there is some initial work with an agri-environment facilitation funding application to use the scheme to benefit the beetle.

Objective 2.2 Establish actions to control habitat loss in York and the Fens

The annual report has been trying to pull out land use categories and integrate this into the annual report text to highlight vulnerable areas in terms of different threats but has not been possible to integrate the flood mapping into the Tansy beetle maps - yet. There was a focused discussion on invasive species control in the 'Land manager workshop' in 2020 and this was covered in the land management advice sheet that was circulated.

Goal 3 – Outreach: To increase appreciation of Tansy beetles' and wider invertebrates' public role and importance in ecosystem function; to increase action to protect tansy beetles and UK invertebrates in general, with a particular focus on priority audiences.

Objective 3.1 Increase the number of land managers wanting to be involved in Tansy beetle conservation and taking appropriate land management actions

Through the Species Recovery Trust work there has been a steady increase in land manager engagement, with greater coverage along the Ouse. There is still slow uptake specifically for farmers, mainly as there is often management conflict with land use and conservation needs.

Objective 3.2 Increase the number of school children learning about Tansy beetle and directly involved in its conservation

An educational session was run at Crayke Primary School by Vicky Wilkins in 2019 and by Eva Freegard in 2021. In 2022, Vicky also ran a session for The Mount School in 2022 to over 100 pupils and Eva delivered sessions to Wheldrake brownies and guides groups. There was a very enthusiastic response to all of these events.

TBAG also had a stall at the 2019 Insect Festival which was another opportunity to engage with young people. Askham Bryan are planning on developing more comprehensive Educational Materials which can be shared with those delivering such sessions.

Objective 3.3 Increase awareness in the local area and directly engage people in the with conservation to secure and deliver more habitat

There is a still a need to research awareness and wellbeing benefits, as well as develop a long-term citizen science project with a surveying app and volunteers growing Tansy. Askham Bryan has continued to be an ambassador and has a Tansy beetle display in their Conservation Park, plus they organised a giant Tansy beetle trail in York this year and will be revamping their Ark site. Also, the Museum Gardens have plans for a wildlife area that will include beetles and better educational interpretation.

Goal 4 – Resourcing: To ensure the long term resourcing and sustainability of Tansy beetle conservation in York and the Fens

Objective 4.1 Secure long term partner commitments to deliver the plan

All TBAG members signed up to the Conservation Plan, the management of partners leading on actions was less coordinated and could be better managed in the future.

Objective 4.2 Maintain TBAG and deliver high quality conservation work

TBAG has continued with quarterly meetings. The coordination of plan was not fully integrated into the TBAG meetings and although the outcomes of the plan are being review here, they have not been reviewed annually; again this could be improved in the next plan.

VISION

York Tansy beetle populations and associated river corridor invertebrate species that are more resilient and widespread across suitable catchments, with functioning and robust landscape-scale habitat mosaics providing well-connected foodplant habitat; and Tansy beetle recognised as a flagship species for invertebrate and river corridor conservation.

GOALS AND OBJECTIVES

GOAL 1 - Research: An improved understanding of the beetle's threats, cultural context, ecology, population dynamics, genetics and conservation management interventions in Yorkshire to inform approaches to future conservation work.

Objectives

1.1 Understand the biology and ecology of the Ouse populations, especially feeding, behaviour, predators/competitors, weather and hydrology, impact of invasive species, vegetation and soil dynamics.

1.2 Monitor the effectiveness of specific conservation interventions to assess their success, sustainability and cost-effectiveness.

1.3 To understand wider invertebrate and plant communities that are associated with Tansy beetle habitat and how this can be optimised for biodiversity benefits in Yorkshire river corridors

1.4 Investigate the genetic differentiation of Ouse populations against the background of European populations.

1.5 To continue and improve monitoring of existing populations (Ouse and Fens).

1.6 Research exploring the broader cultural and social context of why people get involved in conservation projects.

GOAL 2 - Habitat management: Reduction in habitat loss in existing Tansy beetle river corridors via strategic adaptive management with catchment land managers, leading to an increase in connectivity, quality and area of habitat within river corridors.

Objectives

2.1 River corridor mapping that provides understanding of landscapes, habitats, beetle numbers/locations and associated threats

2.2 Evidence-based habitat management plans for each habitat type in the river corridor

2.3 Expand existing habitat along suitable river corridors and improve connectivity

2.4 Actions to control habitat loss

GOAL 3 - Public awareness: To increase public understanding of the Tansy beetle and their importance in ecosystem functioning; increasing action to protect Tansy beetles and UK invertebrates in general, with a particular focus on priority audiences.

Objectives:

3.1 Increase the number of land managers involved in Tansy beetle conservation and taking appropriate land management actions

3.2 Increase the number of school children learning about Tansy beetle and directly involved in its conservation

3.3 Increase awareness in the local area and directly engage people with its conservation to secure and create more habitat

ACTION TABLES

Action No	Actions	Who (lead in BOLD)	When	How	What resources needed	Indicator of success
Research Goal 1 - An improved understanding of the beetle's threats, cultural context, ecology, population dynamics, genetics and conservation management interventions in Yorkshire to inform approaches to future conservation work.						
1.1 Understand the biology and ecology of the Ouse populations, especially feeding, behaviour, predators/competitors, weather and hydrology, impact of invasive species, vegetation and soil dynamics.						
1.1.1	List of research topics that can be fed back to form student projects with institutes and organisations. Potential project topics, including food plant dynamics and use, soil dynamics relating to weather/hydrology, predation on larvae and eggs, egg laying behaviour, dispersal, invasive plant impacts and foodplant (growth influences, invasive competition, food plant reactions to weather/climate conditions e.g. temperature changes), knowledge on European	**TBAG Research Group** (York University, York St John, Stirling University, Species Recovery Trust, BIAZA members etc.)	By September 2023	Organisation of research group and list finalisation via Species Recovery Trust (SRT) and volunteer coordinator	Staff and volunteer time	List of research topics circulated to research institutes and research projects provide results

	Chrysolina graminis collated					
1.1.3	Continue to facilitate the PhD opportunities on the Tansy beetle	**Stirling University, other academic institutions** supported by TBAG	Ongoing	Active communication between partners	TBAG time	PhD/s active and delivering results (if funding secured)
1.1.4	Funding opportunities identified to deliver research project, for example Leverhulme, NERC, BES grants, Species Recovery Trust, Landscape funds etc.	**Species Recovery Trust** plus research institutes	By July 2023	List of funding opportunities available and develop applications	SRT time	New research projects funded
1.2 Monitor the effectiveness of specific conservation interventions to assess their success, sustainability and cost-effectiveness.						
1.2.1	Conservation inventions and practical management research feeding results back into conservation work	**TBAG research group**	Ongoing	PhD, other research project providing practical results	Projects funded	Management tweaks based on new evidence
1.3 To understand wider invertebrate and plant communities that are associated with Tansy beetle habitat and how this can be optimised for biodiversity benefits in Yorkshire river corridors						
1.3.1	Surveys on river stretches of wider invertebrates and plant communities, achieved through new projects	**St Nicks**, SRT	By 2025	Project to gather data	Project funding	Data from surveys available

1.3.2	Data analysed in relation to beetle numbers and distribution and optimised management approaches fed back to land managers	**St Nicks**, SRT	By 2025	Project to allow analysis of data	Project funding	Analysed results available
1.4 Investigate the genetic differentiation of Ouse populations against the background of Fen and European populations.						
1.4.1	Make links with DNA researchers to facilitate analysis of the sequences from Fen and Ouse beetles via Tree of Life project (once available) for genetic differences of expressed genes/mRNA e.g. digestive enzymes which may have influenced adaption	**SRT**, other research institutions	By 2025	Analysis of results facilitated	Funding to allow analysis	Genetic analysis informing conservation work
1.4.2	More specific genetic work looking into the time of the last common ancestor using SNPs and other markers. Compare relationship between the British and European populations	**Academic lead (TBC)**	By 2027	Project on wider beetle genetic, building on Tree of Life results	Funding to allow genetic work	Genetic results available and informing conservation approaches
1.5 To continue and improve monitoring of existing populations (Ouse and Fens).						
1.5.1	Continue the monitoring along the Ouse and Fens, maintaining quality of data through consistency of surveyors when possible and physical training, plus	**TBAG (SRT and Doug)**	Ongoing	Monitoring volunteers organised annually to collect data	SRT staff time and volunteer time	York survey and management reports published

	providing survey and management reports					
1.5.2	Increase the amount of spring monitoring by encouraging other people to do the same, to pick a local patch and record the number of beetles they see which could uncover more on their phenology/ weather conditions/soil moisture/temperature/pH and could be	**TBAG (SRT and Doug)**	Ongoing	Monitoring team to look at increasing volunteer engagement	Volunteer time	New data collected and available for analysis
1.5.3	Increase the data collected by the volunteers – to include Marsh woundwort distribution and Himalayan balsam quantification improvements – difficult as extensive. Define how to best record and report them	**TBAG (SRT, Doug and Geoff)**	2023	Monitoring team to work on methods	Volunteer time	New data collected and available for analysis
1.5.4	Expansion of monitoring for wider and ad hoc beetle observations, through citizen science, for example exploring other drainage ditches adjacent to the Ouse and other foodplants e.g. Marsh woundwort	**SRT, TBAG**	2024	SRT with TBAG monitoring team to work out way forward	Staff time plus, volunteer time or citizen science project	Data from ad hoc monitoring integrated into annual monitoring

1.5.5	Surveyor and land manager/owner event to encourage/enthuse people to get involved in surveying and conservation	**TBAG Coordinator**	2023 and annual or biannual	Organisation of event	Volunteer time, any costs for venue and refreshments	More volunteers and better land manager engagement
1.6 Research exploring the broader cultural and social context of why people get involved in conservation projects.						
1.6.1	Research projects on: why are people motivated to volunteer in insect conservation? Ways the beetle has been mobilised as an iconic species in York and how this has encouraged outreach? Practical conservation as an educational tool?	**York St John**, TBAG	By 2025	Student research project on topic	Lead researcher time	Research results feeding back into outreach approaches
1.6.2	Social history context of the beetle's current distribution is a function of human modifications such as flood bank changes, willows stabilising riverbank. Model what would have happened prior to modifications	**York St John**, TBAG	By 2026	Student research project on topic	Lead researcher time	Research results providing background in species knowledge review

Action No	Actions	Who	When	How	What resources needed	Indicator of success

Habitat Management Goal 2 - Reduce habitat loss in existing Tansy beetle river corridors through strategic adaptive management with catchment land managers, leading to increased connectivity, quality and area of habitat within river corridors – and manage threats.						
Objective 2.1 River corridor mapping of suitable catchments to better understand landscape, habitat, beetles and its threats						
2.1.1	Habitat suitability mapping, developing a habitat suitability index and data to identify hotspots (foodplants, habitat types, flood data, land management, climate and weather, soil type, INNS, erosion) and develop a suitability index	**York St John**, NEYEDC, Buglife, University of York sustainability hub – student volunteer projects and electives	2024	Large-funded project	Funding	Beetle maps available on suitable habitat
2.1.2	Mapping in terms of river corridor health beyond just Tansy beetle requirements and integrate any other appropriate threatened species	**York St John**, NEYEDC, Buglife, University of York sustainability hub – student volunteer projects and electives	2024	Large-funded project	Funding	River corridor maps available
2.1.3	Prioritise sites for conservation management based on mapping and decide how far to expand outside of the Ouse Corridor, in terms of creation and restoration in order to increase connectivity and resilience	**TBAG**	2025/6	TBAG meeting/workshop to assess results	Volunteer time	Prioritised maps available
Objective 2.2 Expand existing habitat along suitable river corridors and improve connectivity						
2.2.1	Delivery of prioritised sites, planting areas etc with land manager and volunteer engagement	**St Nicks**, NT, YWT etc	Ongoing and 2026 for specific project sites	Targeted planting	Funding for plants and planting	Planting gaps filled strategically

2.2.2	Sustainable sourcing of York provenance plants, developing suppliers	**St Nicks**	2024	High quality suppliers available	Staff time	High quality plants available for projects
2.2.3	Engaging volunteers, groups etc on growing and planting foodplants	**St Nicks**	2024	Beetle plant volunteer network	Staff time	Volunteers active and growing and planting
Objective 2.3 Evidence-based habitat management plans for each habitat type in the river corridor						
2.3.1	Continue with land manager reports and look at ways that the report including maps can be improved to support their work, looking at changes over time and how this influences beetle numbers	**SRT**, TBAG	2023	Feedback gathered on management report	Staff time	Management reports tweaked based on feedback
2.3.2	Based on management reports provide land manager with advice, resources and funding support when needed	**SRT**, St Nicks and TBAG	Ongoing	Advisory visits and developing small projects when needed	Staff time and funding	Evidence of habitat expansion
2.3.3	Integrations of Tansy beetle into other plans e.g. SSSI plans and schemes etc. E.g. Escrick facilitation, identify how can be integrated into ELMS	**Natural England**, SRT and land managers etc.	By 2024	Integration into wider schemes and plans	Staff time to communicate	Evidence of beetle management being delivered by other plans and schemes
2.3.4	Better understanding of what management approaches are working and what isn't – research feeding into management and landowners feeding back regarding on the ground benefits	**St Nicks**, SRT land managers and TBAG	By 2025	TBAG communication with land managers	Staff time via project funding	Management approaches tweaked
Objective 2.4 Actions to control habitat loss and threats along the Ouse						
2.4.1	Changes to upstream management to influence and reduce flooding in York (particularly summer flooding)	**EA**, IDB, Land managers, River Catchment Partnerships	By 2026	Upstream management changes	Staff time to facilitate influence	Reduced summer flooding in York
2.4.2	Control INNS in priority site for the beetle through clearance days for	**St Nicks**, EA, Land manager	By 2025	Clearance events	Staff time via project funds	Reduced recording on Himalayan

	Himalayan Balsam and through EA collaborations					Balsam along the Ouse
2.4.3	Continue to assess and manage current Ark populations for the Tansy beetle at Selby Canal and Askham Bryan. Assessing the need for new Ark sites based ongoing threat analysis	**TBAG**	Ongoing	TBAG reporting and meetings overseeing Ark sites	Volunteer time	Ark site sustained and established as needed

Action No	Actions	Who	When	How	What resources needed	Indicator of success
Public awareness Goal 3 - To increase appreciation of Tansy beetles' and wider invertebrates' public role and importance in ecosystem function; to increase action to protect tansy beetles and UK invertebrates in general, with a particular focus on priority audiences.						
Objective 3.1 Increase the number of land managers wanting to be involved in tansy beetle conservation and taking appropriate land management actions						
3.1.1	Education of landowners on existing threats to the Tansy beetle through workshops, management reports, visits and outreach materials	**SRT**, St Nicks, TBAG outreach	By 2024	Outreach events and materials	Staff time	Landowners demonstrating an increased awareness and documented change in practices
3.1.2	Creation of awareness materials that show the vulnerability of Tansy beetle with climate change, in order to demonstrate its wider value as an indicator of riverbank and ecosystem health	**Askham Bryan** the Deep, Bugtopia	By 2025	Outreach materials	Staff time	Land manager understanding climate change impacts and connections with the beetle
Objective 3.2 Increase the number of Yorkshire school children learning about Tansy beetle and directly involved in its conservation						
3.2.1	Establish a network of schools, school eco clubs, kids clubs, to provide with materials and support	**St Nicks**, BIAZA	By 2025	Network of local children focused organisations	Staff time	Network of children groups with access to

						Tansy beetle resources and opportunities
3.2.2	Create a standardised package (aligned with curriculum) which can be used by anyone for school visits etc, could include a story sack, natural history aspects of the life cycle, and an illustrated reading book	**The Deep** and Askham Bryan	By 2024	Education package and complementary materials developed	Staff time and educational expertise	Pack developed and in use
3.2.3	Tansy and other foodplants grown and planted with school kids	**St Nicks**	By 2025	Foodplant activities and materials at schools	Staff time via project	Evidence of school children growing and planting food plants
Objective 3.3 Increased awareness in Yorkshire of the Tansy beetle and directly engage people in its conservation to both secure and actively support habitat increases and improvements						
3.3.1	Increased social media on the beetle from TBAG organisations to raise awareness, coordinate outreach events, plus better online presence TBAG contact and website etc	**Askham Bryan + Buglife** and other institution marketing departments	By 2023	Social media and online materials	Staff time	More opportunities to see and engagement with online materials
3.3.2	A series of ex-situ displays with interpretative materials and events that are interactive and highlighting issues - encouraging the rethink of conservation solutions and the empowerment of visitors to make change and influence invertebrate conservation, using the Tansy beetle as an ambassador species	**Askham Bryan**, the Deep, Bugtopia, Lotherton Wildlife Park	By 2025	Interactive interpretative materials present at BIAZA sites	Staff time	More involvement in public in decision on beetle conservation
3.3.3	Dropbox of resources for Tansy beetle outreach and education events, accessible to all TBAG members	**TBAG,** Askham Bryan, the Deep, Bugtopia,	By 2024	Collated outreach resources	Volunteer time	Outreach resources available to TBAG members and

		Lotherton, St Nicks				wider stakeholders
3.3.4	Citizen science project involving Tansy beetle, gathering data on public sightings and associated foodplants	**St Nicks**, Buglife	By 2025	Public involvement project development and delivery	Project funding	Data being collected via wider public and being used to inform conservation
3.3.5	Tansy beetle week/ festival trail – across the TBAG partners – aiming to raise the profile over a bigger area, using QR codes on fence posts	**St Nicks**, Buglife	By 2025	Public involvement project development and delivery	Project funding	Trail and week active and engaging people
3.3.6	Assess the feasibility to develop a Tansy beetle educational area at the Museum Gardens	**Museum Trust,** TBAG	By 2023	Site visit to discuss suitability	Staff time	Site assessed and way forward determined

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