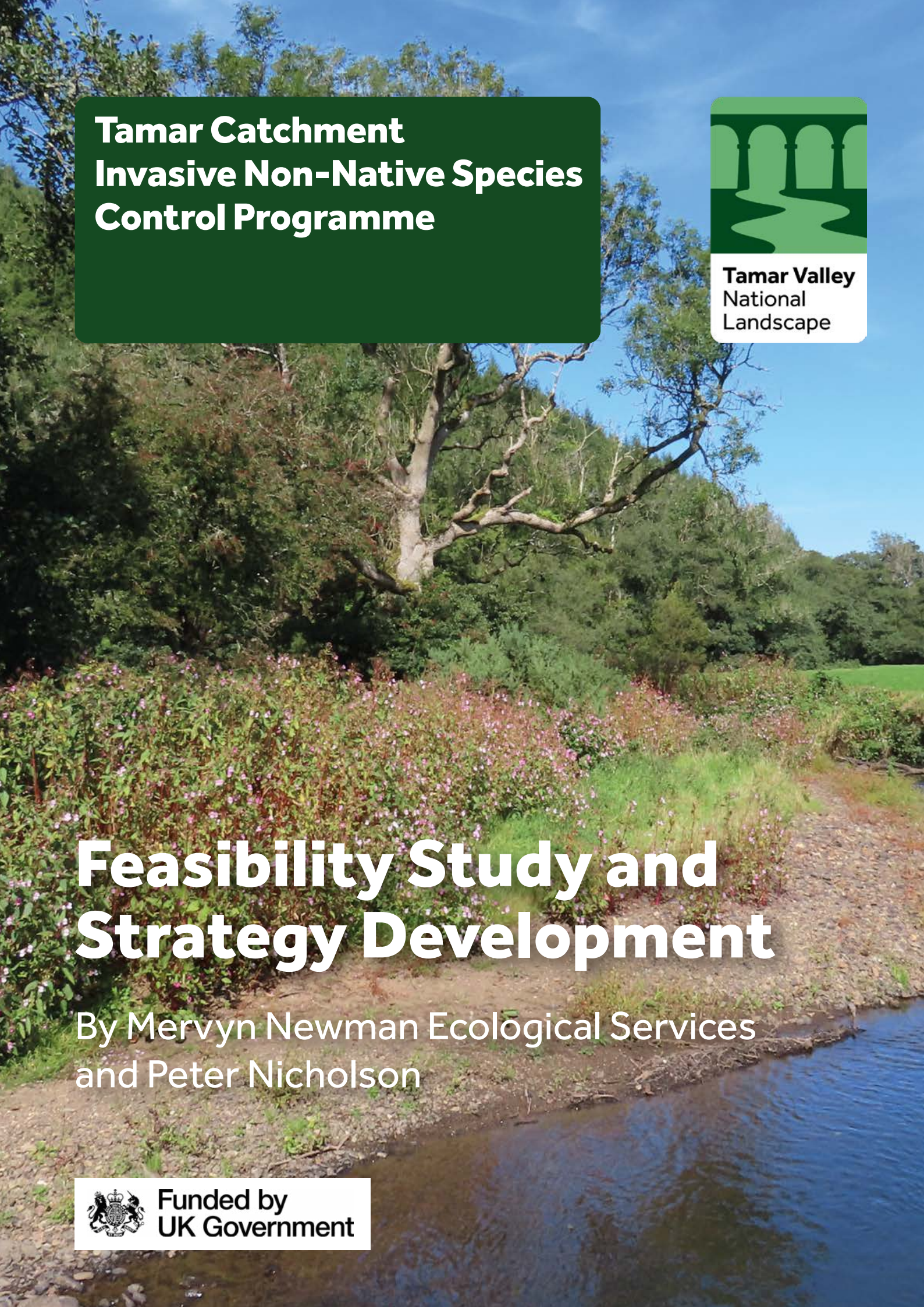

Tamar Catchment Invasive Non-Native Species Control Programme

Tamar Valley National Landscape

Feasibility Study and Strategy Development

By Mervyn Newman Ecological Services and Peter Nicholson

Funded by UK Government

Contents

Abbreviations

APHA	Animal and Plant Health agency
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
ENNIS	Exmoor Non-Native Invasive Species project
ENPA	Exmoor National Park Authority
EU	European Union
FiPL	Farming in Protected Landscapes scheme
GH	Giant hogweed
HB	Himalayan balsam
INNS	Invasive Non-Native Species
JK	Japanese knotweed
MPA	Marine Protected Area
NNSS	Non-Native Species Secretariat
PPE	Personal Protective Equipment
RIMP	Regional Invasive Species Management Plan
SAC	Special Area of Conservation
SC	American skunk cabbage
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
TCP	Tamar Catchment Partnership
TECF	Tamar Estuaries Consultative Forum
TVNL	Tamar Valley National Landscape
WRT	Westcountry Rivers Trust

Foreword

Tamar Valley National Landscape, designated an Area of Outstanding Natural Beauty in 1995, encompasses 75 km² at the heart of Devon and Cornwall and sits within the Tamar catchment, which covers an area of 1,750 km². Protected for its rare valley and water landscape, its landscape of high visual quality, an area offering unique wildlife resource and a remarkable heritage, whilst being a landscape of artistic and public appeal, Tamar Valley National Landscape is a special place, of national and international importance.

The area faces significant challenges from the spread of invasive non-native species (INNS), particularly in plant life, with a noticeable increase in large INNS plants within our riverbanks and floodplains. This report, commissioned by the Tamar Valley National Landscape Partnership, aims to address critical questions: How widespread are these species across the entire Tamar catchment? Is control feasible? What strategic approach to management should be taken and over what period of time? Regarding Himalayan balsam and Japanese knotweed specifically, "Surely, that horse has bolted?"

In response to these questions, it's important to recognise that INNS have significant negative environmental and economic impacts. This report highlights that the situation could worsen in the Tamar Valley National Landscape. It compiles survey data showing that to tackle this problem, work should be conducted from the top of the catchment downstream. While the spread of some species presents a huge challenge, our success in controlling giant hogweed over the last 20 years, along with INNS programs elsewhere in the UK, demonstrates that effective management is possible and worthwhile.

The Tamar Valley National Landscape Management Plan 2025-2030, a plan for the place and delivered by multiple partners and agencies, intends to prioritise the management of INNS. However, to be truly successful, work at catchment scale is required. A coordinated approach and catchment-wide consensus involving many partners and stakeholders is clearly necessary. As always, the extent of control will depend on funding and goodwill.

We hope this work will contribute meaningfully to addressing the spread of INNS across the catchment and look forward to the collaborations to tackle this growing challenge.

Sarah Gibson
Tamar Valley National Landscape Manager

Tamar Invasives Group

Tamar Valley National Landscape
NATURAL ENGLAND
Environment Agency
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CORNWALL COUNCIL

Executive summary

This report deals with four very different invasive non-native species (INNS): giant hogweed, Japanese knotweed, Himalayan balsam and American skunk cabbage within the catchment of the River Tamar. It suggests how best to deal with them given the collective experience of similar control here and elsewhere. How much work can be done on controlling them will depend on the level of both funding and goodwill available. Clearly, with over 20 years work and effort on giant hogweed already invested, it must make sense to complete the work on this species through to eradication. This could be within five years, although keeping a level of awareness for its presence after that could be done alongside the work on other species.

The other three species could be controlled but at very different costs. If the seemingly limited abundance of American skunk cabbage noted from this survey is proved to be truly representative, this could be eradicated with a combination of herbicide spray and digging out plants depending on their whereabouts and accessibility. The seed bank for this species is thought to be some seven to eight years, so even if the mature plants are removed, there would need to be follow-up monitoring for that time. Even the downstream site believed to have several thousand plants could be controlled in that timescale.

Japanese knotweed can only be effectively tackled at the moment using a glyphosate-based herbicide as that is transferred to the deep rhizomes created by this tall and unwelcome perennial. If it is possible for one licence for the whole catchment to be negotiated, as has been done for the giant hogweed and Japanese knotweed control on the River Tweed, this would be a great help. It is likely that at least five to six years of once-a-year spray control of the Japanese knotweed stands, preferably by contractors but possibly by trained volunteers or a mix of the two would reduce down all the stands, at least in the majority, non-tidal sections of the catchment, to a level that would stop them competing with the native vegetation.

With the Himalayan balsam, several of the Tamar tributaries start from statutorily-designated areas such as Bodmin Moor and Dartmoor, and so there is likely to be wider support for tackling these rivers, at the very least. It will be worth trying to get landowner-led local volunteer groups running on as many of the rivers as possible, as realistically only they can provide the long-term input that can help to clear a river in the first instance and then ensure that there is sufficient follow-up to keep it clear. Raising and running volunteers however, is not free and a Tamar catchment-wide consensus is likely to be needed to give the best chance of supporting the numerous groups that might be able to help with balsam-related work over such a large area and timescale.

Grant funding should be pursued from likely sources to support such INNS work directly, but it would be helpful in the long term if many more of the stakeholders in the catchment include an element of INNS work in all appropriate grant applications. Agri-environment scheme funding may also help as has been shown with the recent Farming in Protected Landscapes (FiPL) grants when pooled and then distributed locally. Individual farm grants from national schemes may also provide a local contribution to the overall effort required on any one river. In the long run though, funding partnerships with companies or corporate bodies or harnessing the potential of biodiversity net gain or corporate social responsibility may yet prove the way forward.

Introduction

The four plant species: giant hogweed (GH) *Heracleum mantegazzianum*, the Japanese knotweed clone *Reynoutria japonica* var. *japonica*, (subsequently referred to in this document as 'Japanese knotweed' (JK), Himalayan balsam (HB) *Impatiens glandulifera*, and American 'skunk cabbage' (SC) *Lysichiton americanus* with which this report is concerned have been in the UK long enough for it to be clear what is needed to remedy them. Even though all four of these species have been in the Tamar catchment for some decades, it cannot be wrong to try to do something about them now. However, this would carry the responsibility of ensuring that the best use of the resources is made and that the control work is effective. This would mean confirming that the funds are applied consistently and that improvements are seen either through eradication or prevention of invasives or minimisation of the problems associated with them.

A great start has been made with the work already done on giant hogweed in the Tamar catchment which has, by 2024, reduced the number to some 300, mostly non-flowering, plants. The majority of these are on the tidal section of the river which is not easy to work in, with tricky access and visibility in silty scrub. For the first few years of the control work, there was so much giant hogweed that it was being treated on an 'area basis' rather than the plants being counted. So, it wasn't until 2009 that a realistic estimate of the numbers of plants (>4,000) then present could be made. As the contractors were likely to be halving the area needing to be dealt with each year, the start point is likely to have been in tens of thousands of plants present. The overall area being dealt with was said to be 167 ha (Rule 2022).

Below: Giant hogweed and Himalayan balsam among native vegetation by the tidal Tamar 8/5/2024

The Tamar catchment

In 936 AD King Athelstan decreed that the boundary of Cornwall was at the Devon bank of the Tamar, meaning that the river itself is in Cornwall. For the majority of its length, although with one or two anomalies, the river has remained the boundary between the two counties ever since. However, for the work on invasive non-native species (INNS) to be successful, this river catchment needs to bring the two counties together to act as one.

Waterbodies

- The main River Tamar runs approximately north-south for 98 km across the SW Peninsula (Fig. 1), forming the boundary between Devon and Cornwall barring 6 km to the north coast. It is tidal from the south coast for 22 km up to Gunnislake.
- It rises in Culm grasslands on Woolley Moor, flowing south to Plymouth Sound. Several of its tributaries emanate from the peat moorland of Dartmoor to the east and Bodmin Moor to the west.
- The Tamar catchment is approximately 1,750 km², not including the Yealm catchment which is an additional 119km².
- It has around 2750 km of Water Environment Regulations (2017) designated water bodies (for protection and management) including freshwater, estuarine and coastal waters.
- The Tamar catchment contains four significant lakes: Upper Tamar Lake (38 ha), Lower Tamar Lake (15 ha), Burrator Reservoir (52 ha) and Roadford Lake (266 ha) (Fig. 1).
- For management purposes, the Tamar catchment includes seven Environment Agency operational catchments, specific areas used to manage and assess water bodies in England, which may not strictly follow natural hydrological boundaries (Fig. 2).
  https://environment.data.gov.uk/catchment-planning/ManagementCatchment/3089.

A carved slate marks the source of the River Tamar on Woolley Moor

Landscape and land use

- The Tamar catchment contains multiple landscape and ecological designations (Fig. 3).
- It is a predominantly rural catchment with a few major settlements upstream (Holsworthy, Launceston, Tavistock, Callington), whilst the largest urban areas (Plymouth and Saltash) flank the river to the south.
- The catchment is largely agricultural, mainly grassland managed for livestock.
- The Culm area to the north consists mostly of improved pasture and now arable land.
- Further south, there is also arable and improved grassland but with some residual horticultural interests.
- A number of commercial forests line the river in the middle and lower sections.
- The Tamar rivers are a key part of the region's water supply network, supplying the reservoirs from upstream and downstream sources.

Recreation

- Tourism and recreation have developed as significant industries in recent decades, including water sports and long-distance hiking.
- The Tamara Coast to Coast Way shadows the River Tamar from source to sea.
- Fishing is a popular pastime, with long reaches of bank being leased out to angling clubs, including high-end hotels and a fish pass scheme across the West Country, where pre-paid access is brokered to privately owned rivers for angling (Westcountry Rivers Trust).

Fig.1 Tamar catchment rivers and tributaries

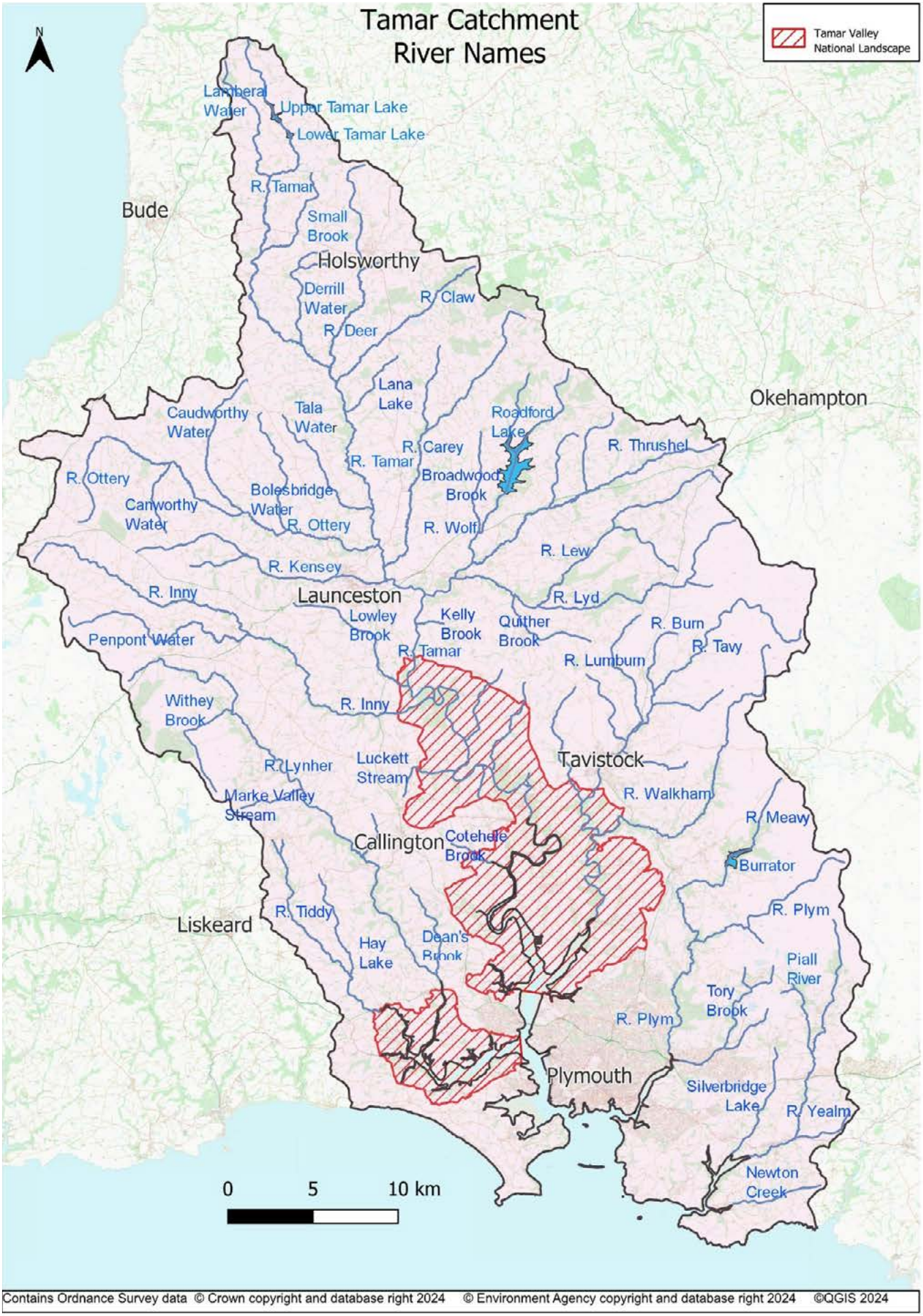
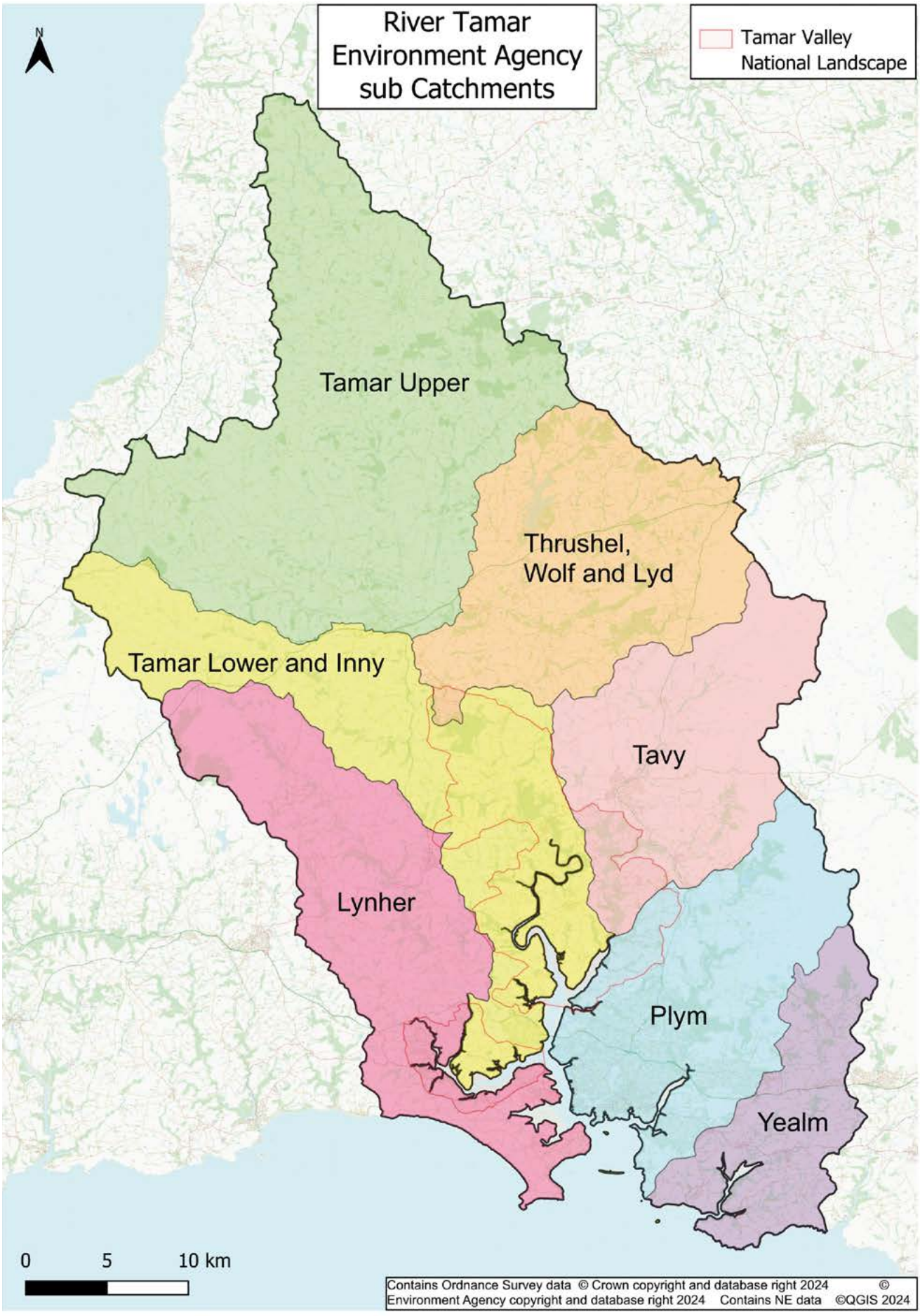


Fig. 2 Tamar operational catchments



Statutory designations

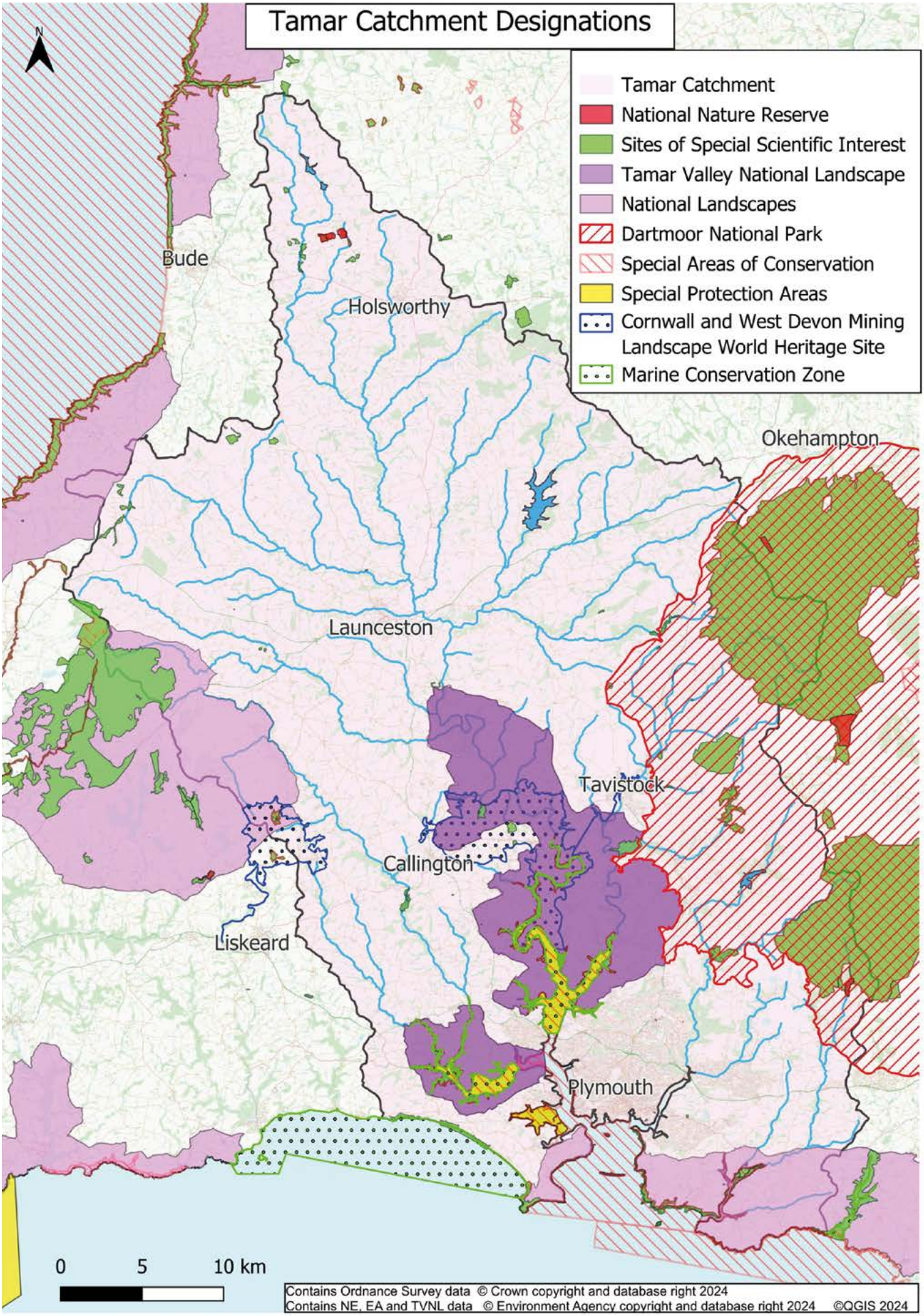
These designations (Fig. 3) include:

- Dunsdon National Nature Reserve
- Dartmoor National Park
- 3 National Landscapes (Cornwall, South Devon, Tamar Valley)
- 61 Sites of Special Scientific Interest (from Woolley Moor to Rame Head SSSI)
- 5 Special Areas of Conservation (Blackstone Point, Culm Grassland, Dartmoor, Phoenix United Mine and Crow's Nest, Plymouth Sound and Estuaries)
- The Tamar Estuaries Complex Special Protection Area
- The Tamar Estuary Marine Conservation Zone
- Cornwall and West Devon Mining Landscape UNESCO World Heritage Site (Area 10)

These multiple designations serve as a reminder that there are many reasons, ecological and otherwise, to try to control and eliminate invasive non-native species throughout the overall catchment before they are brought downstream with the river's flow to colonise the estuarine stretches.

Marsh fritillary at Dunsdon NNR 2/6/2024

Fig. 3 Tamar catchment statutory designations



National legislation

A longer list of national and international INNS legislation and regulations is provided in Appendix 1.

The relevant part of our national legislation when dealing with INNS in England is the Wildlife and Countryside Act 1981, which in Section 14, Introduction of new species etc. states: (2) Subject to the provisions of this Part, if any person plants or otherwise causes to grow in the wild any plant which is included in Part II of Schedule 9, he shall be guilty of an offence. Giant hogweed, Japanese knotweed, Himalayan balsam and American skunk cabbage are all included in Part II of Schedule 9.

However, there are ambiguities enough in the phrase: 'or otherwise causes to grow in the wild' which have tended to preclude its practical use in relation, for example, to the presence of Himalayan balsam on someone's land. Very few people will have planted the balsam on their land and it is clearly an arguable point as to whether leaving a plant to seed equates to 'causing it to grow' and what is 'in the wild' anyway? Defra's advice note, dated 26 May 2011, on section 14 suggests that this would have to be established on a case-by-case basis, but at that point (2011) it was clear that it had never been tested in the intervening 30 years.

Nationally, choosing not to clarify such wording may be a part of why invasives such as Himalayan balsam are becoming ubiquitous. It will be interesting to see whether the clarification (section 14ZC) made in Scotland in 2011 came too late to make a difference:
For Scotland, section14ZC of the Wildlife and Countryside Act 1981 'Prohibition on keeping etc. of invasive animals or plants' includes:
(1) Subject to the provisions of this Part, any person who keeps, has in the person's possession, or has under the person's control-
(a) Any invasive animal of a type which the Scottish Ministers, by order, specify; or
(b) Any invasive plant of a type so specified, **is guilty of an offence**.

Ultimately though such legislation really only works if it has everyone's understanding and co-operation to make it work. A case in point is the presence of ragwort that is now proliferating both in fields, abandoned or otherwise but particularly on road verges. This plant and four others, two docks and two thistles, are covered by the Weeds Act 1959 which, where the 'Minister of Agriculture, Fisheries and Food is satisfied that there are injurious weeds to which this Act applies growing upon any land, he may serve upon the occupier of the land a notice in writing requiring him, within the time specified in the notice, to take such action as may be necessary to prevent the weeds from spreading.'

This Act applies to the following injurious weeds:

- **spear thistle** (*Cirsium vulgare*), **creeping or field thistle** (*Cirsium arvense*), **curled dock** (*Rumex crispus*), **broad-leaved dock** (*Rumex obtusifolius*) and **ragwort** (*Senecio jacobaea*).

Helpfully it was clarified that in this Act, 'occupier' means 'in the case of any public road, the authority by whom the road is being maintained'. Therefore, it could hardly be clearer whose responsibility it is when on a road verge.

Again, more should be made of section 25 of Defra's 2011 advice note, on section 14 of the Wildlife and Countryside Act 1981, 'negligent or reckless behaviour, such as inappropriate disposal of garden waste, where this results in a Schedule 9 species becoming established in the wild would constitute an offence.'
https://www.gov.uk/government/publications/preventing-the-release-into-the-wild-of-certain-plants-and-animals-guidance/guidance-on-section-14-of-the-wildlife-and-countryside-act

It was clear on this survey that many of the problem plants found in the river corridors have come from riverside garden escapes and often where cuttings and other garden waste are just tipped down the river bank for the next flood to take them away. This practice could and should be both highlighted and stopped. It is the less obvious but even more antisocial equivalent of tipping your garden waste over the neighbouring fence or hedge. But with a river, the detriment is to the river and its wildlife and potentially to all of the land downstream from that moment onwards. [A potential remedy could be found under the Environmental Protection Act 1990 section 3].

On a more practical level, Scotland has led the way with **The Wildlife and Natural Environment (Scotland) Act 2011** which introduced **species control orders**. In England, this was picked up by the Law Commissioners engaged by Defra to recommend revision of Wildlife Law in England and confirmed by the House of Commons Environmental Audit Committee. This resulted in the inclusion of the same for England via the **Infrastructure Act 2015**.

This is best explained in the 'Invasive Species Theme Plan' covering 'Strategic principles for the management of invasive species on Natura 2000' sites where on page 22, it states:
'Section 23 of the Infrastructure Act 2015 which received Royal Assent on 12 February 2015, amends the Wildlife and Countryside Act 1981 by inserting a new Schedule 9A to introduce a new statutory regime of **species control agreements and orders** to ensure that landowners take action on invasive non-native species or permit others to enter the land and carry out those operations.

The powers enable the Secretary of State or one of the named environmental authorities (Natural England, Environment Agency, Forestry Commission) to set up species control agreements with landowners on whose land invasive species are found, or species control orders where: owners fail to comply with a species control agreement they have entered into; owners refuse to enter an agreement that has been offered; in cases of urgent necessity; and where no landowner can be identified. If the agreements fail to bring about a successful control a species control order can then be served which enables access to the land to undertake the control. Failure to comply with a species control order, without reasonable excuse, constitutes an offence.
https://www.legislation.gov.uk/ukpga/2015/7/section/23

It is clear that, if used properly, species control agreements and species control orders could play a key part in ensuring that a river or catchment level programme of INNS control is not able to be derailed by the non co-operation of one landowner.

Below: Offers of help to deal with the Himalayan balsam in this field have been declined 25/8/2021

Survey methodology

The survey element was split into four parts. Firstly, a desktop survey was undertaken. Existing records of the four target species were gleaned from both Cornwall and Devon Biological Records Centres and from other partner organisations willing to share their records. These included the Environment Agency, South West Water, South West Lakes Trust and the Botanical Society of the British Isles (BSBI).

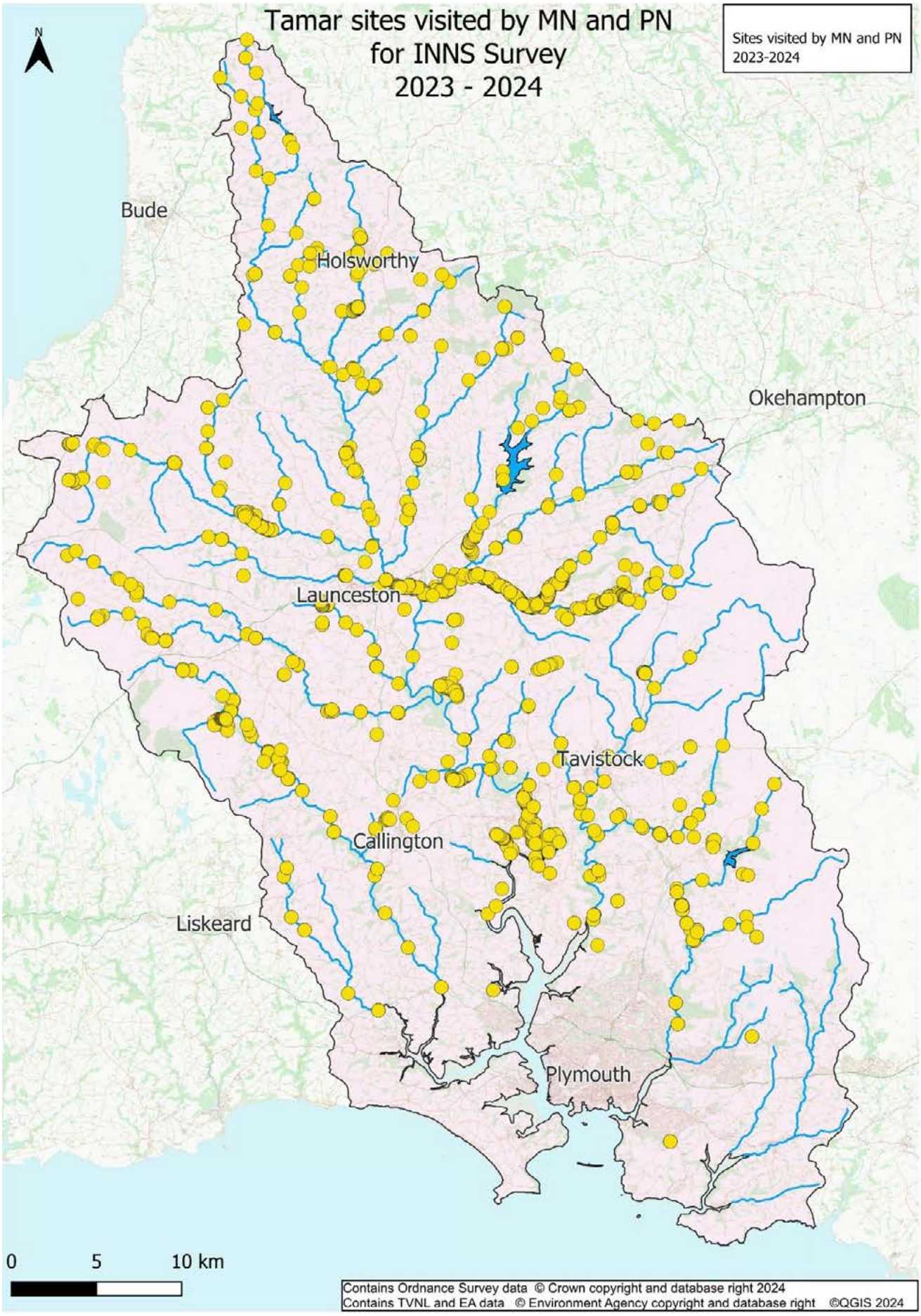
Secondly, from these records, the highest upstream recorded INNS presence was taken as the starting point and then sites visited upstream approximately every 4 km. Without access to the riparian ownership details, a bridge survey was carried out using binoculars looking at both banks, 50 metres upstream and downstream where possible. Publicly accessible sections of the rivers were walked and again the four target species were looked for and any other INNS noted as well. Abundance was also noted on a scale of 1s, 10s, 100s, 1000s of plants/stems (JK) as was absence of Himalayan balsam. Subsequently, downstream sites were also surveyed to help show the overall position. The sites visited by Mervyn Newman and/or Peter Nicholson are shown in Fig. 4.

Thirdly, a parish questionnaire survey was sent out by e-mail to around 100 parishes within the Tamar catchment with a roughly equal 50:50 Cornwall and Devon split.

Lastly, an online survey 'Invasive species in River Tamar catchment area' was organised by the Tamar Valley National Landscape, set up through Cornwall Council's 'Let's Talk Cornwall' in August 2024. An interactive satellite map allowed the general public to report sightings of the four species (location, approximate numbers, management information and photographs).

Below: Himalayan balsam (100s) by River Tamar 27/7/2024

Fig. 4 Sites visited by Mervyn Newman or Peter Nicholson for INNS survey 2023 to 2024



Survey results

The desktop survey produced 3,037 records of the four target species (1,528 Japanese knotweed, 762 giant hogweed, 740 Himalayan balsam, 7 American skunk cabbage), but a certain amount of weeding was needed and records with two-figure grid references or pre-2000 were not included in the maps shown in the sections on each species.

The bridge and riverbank survey (MN and PN) produced 1,295 records of the four target species and 1,032 records of non-target INNS. The giant hogweed contractor, Adam Phillips, surveyed the lower and mid sections of the River Tamar in the spring of 2024 for giant hogweed (16 records, 270 plants) and American skunk cabbage (15 records, 6,000+ plants). His records have also been included in the maps shown for each species.

The non-target INNS noted were also mapped (see Appendix 2).

Parish questionnaire survey

There were 17 returns from:

Marhamchurch PC
Plasterdown Grouped PC
St Giles in the Heath PC
Broadwoodwidger PC
Pillaton PC
North Petherwin PC
St Dominic PC
Bradworthy PC
Pancrasweek PC
Gulworthy PC
Calstock PC
Virginstow Parish Meeting
Linkinhorne PC
Trewen Parish Meeting
Lifton PC
Milton Abbot Grouped PC

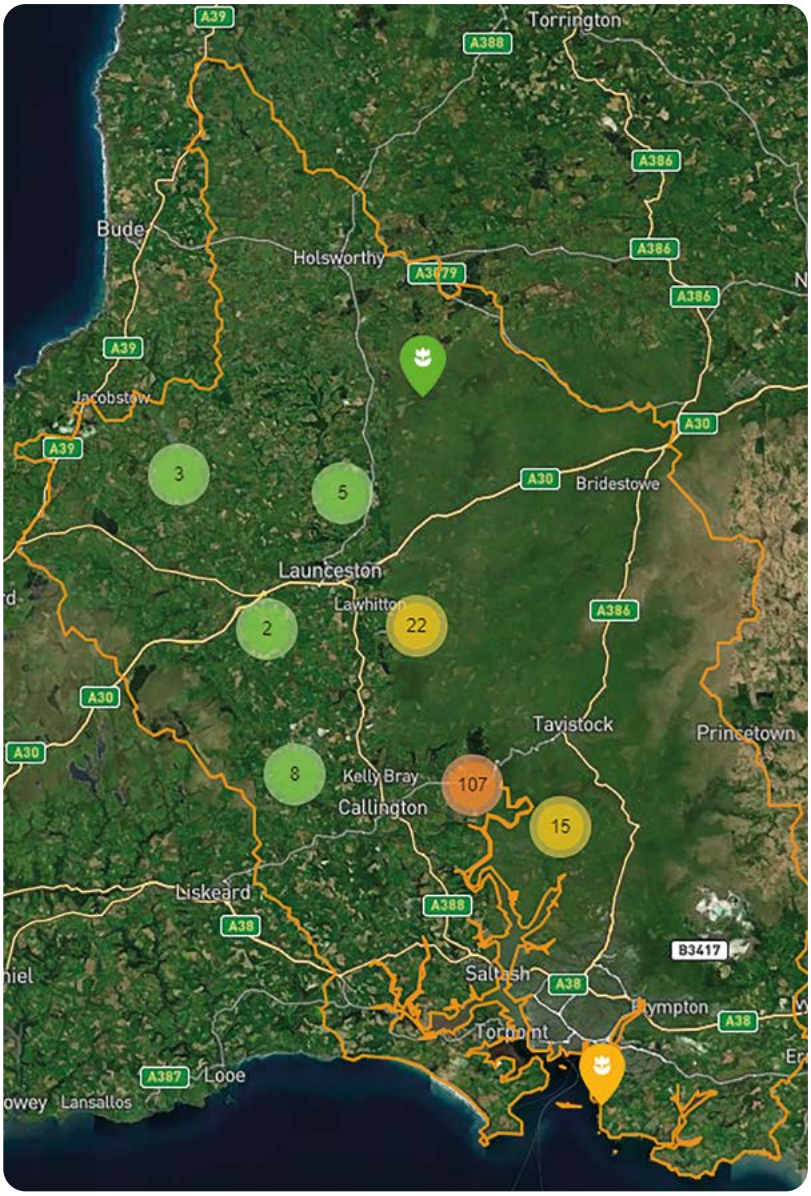
Two parishes mentioned giant hogweed and both of these reports have been checked out. One was outside of the catchment and was followed up by the Environment Agency with no obvious giant hogweed plants found, and the other turned out to be hemlock water dropwort. Five mentioned Japanese knotweed but with no grid references: 'present in the road verges' or locations were described but with local landmarks as the reference. These would also need to be visited before the information could be usefully used. Himalayan balsam was reported by 10 parishes. One gave a grid reference, whilst most described it as 'all along the riverbank', 'present in the verges' or similar. One stated that it was: 'Environment Agency responsibility as it is on the river bank' *. One mentioned American skunk cabbage as being present on the river but downstream of their parish.
*[In fact this is the landowner's responsibility.]

Whilst reporting invasives may not yet be a strong point, parishes may well have a part to play in the control of invasives as they may know riverbank ownerships and all are likely to have a regular newsletter. Elsewhere in Devon, some parishes (Kilmington, East Devon) have hosted 'Invasives Wardens' in much the same way as Tree Wardens are now a regular thing. Although a more inviting title might be 'River Warden' (KS), 'River Keeper' (PRK, 2024) or Wildlife Warden (WDBC and MDDC). Each river should have a series of River Wardens, able to walk a section on a periodic basis looking for issues such as pollution incidents or invasive plants. They could then inform the relevant people and help the groups responding to these problems with their local knowledge.

Online survey

The online survey had 545 visits, with 36 respondents reporting 113 Himalayan balsam, 48 Japanese knotweed, 1 (historical) giant hogweed and 0 American skunk cabbage locations. Most sightings were from the River Tamar (particularly the tidal section) and River Tavy (Fig. 5). These returns were included in the mapped records.

Fig. 5 Online survey records totals map



This map was produced from the Let's Talk Cornwall site: https://letstalk.cornwall.gov.uk/invasive-species-tamar/maps/invasive-species-in-the-tamarcatchment-area. Encircled numbers include combined records from that area.

Present recorded INNS position in the Tamar catchment

The latest position on the four target INNS: giant hogweed (GH), Japanese knotweed (JK), Himalayan balsam (HB) and American skunk-cabbage (SC) is shown below (Table 1) for the different rivers and tributaries making up the Tamar catchment (Fig. 1).

Table 1 Tamar Catchment rivers with tributaries and water bodies

River or Section*	EA Operational Catchment	GH	JK	HB	SC
Deer	Tamar Upper		√	√	
Claw	Tamar Upper		√	√	
Carey	Tamar Upper		√	√	√
Ottery	Tamar Upper		√	√	
Canworthy Water	Tamar Upper		√		
Caudworthy Water	Tamar Upper		√	√	
Bolesbridge Water	Tamar Upper		√		
Kensey	Tamar Upper		√	√	
Upper Tamar (above A30)	Tamar Upper		√	√	√
Upper Tamar Lake	Tamar Upper			√	
Lower Tamar Lake	Tamar Upper			√	
Lamberal Water	Tamar Upper	√	√	√	
Tala Water	Tamar Upper		√	√	
Derrill Water	Tamar Upper		√		
Small Brook	Tamar Upper		√		
Wolf	Thrushel, Wolf & Lyd		√	√	
Roadford Lake	Thrushel, Wolf & Lyd				
Thrushel	Thrushel, Wolf & Lyd		√	√	√
Lyd	Thrushel, Wolf & Lyd		√	√	√
Quither Brook	Thrushel, Wolf & Lyd				
Lew	Thrushel, Wolf & Lyd		√	√	
Broadwood Brook	Thrushel, Wolf & Lyd				
Inny	Tamar Lower & Inny		√	√	
Penpont Water	Tamar Lower & Inny		√	√	
Lower Tamar (below A30)	Tamar Lower & Inny	√	√	√	√
Lowley Brook	Tamar Lower & Inny	√	√	√	
Luckett stream	Tamar Lower & Inny	√	√	√	
Cotehele Stream	Tamar Lower & Inny		√	√	
Tavy	Tavy		√	√	
Burn	Tavy		√	√	
Lumburn	Tavy		√	√	
Walkham	Tavy		√	√	
Lynher	Lynher		√	√	
Tiddy	Lynher		√	√	
Kelly Brook	Lynher		√	√	
Meavy	Plym		√	√	√
Burrator Reservoir	Plym			√	
Plym	Plym		√	√	
Tory Brook	Plym				
Yealm	Yealm		√	√	
Newton Stream	Yealm		√		
Piall	Yealm		√		
Silverbridge Lake	Yealm		√		

***The EA-defined Tamar catchment includes the rivers: Meavy, Plym, Yealm, Lynher and Tiddy**

Impacts

The potential ecological, environmental, economic and human costs caused by the unchecked spread of giant hogweed (GH), Japanese knotweed (JK), Himalayan balsam (HB) and American skunk cabbage (SC) are summarised in Table 2.

Table 2 Negative impacts of these four INNS

Impact	GH	JK	HB*	SC
Biodiversity loss - Dense monocultures outcompete and shade native vegetation, with potential loss of native species (terrestrial and aquatic flora and fauna), degradation of natural habitats e.g. rivers and wetlands, disruption of ecosystems and making habitat restoration challenging. HB is likely to impact on the health and behaviour of bees and other pollinators.	√	√	√	√
Reduced soil health - GH, HB and JK can alter soil chemistry, making it less hospitable for native plants.	√	√	√	
Reduced water quality - Winter dieback of riverbank monocultures expose bare soil leading to increased erosion and sedimentation. Degradation of the plant material in the water will contribute to deoxygenating the watercourse.	√		√	
Increased flood risk - Dense monocultures can block drains and ditches and take up space in both the river channel and flood plain, increasing the risk of flooding.	√	√	√	√
Landscape impact - Aesthetic impact on landscapes can be significant, especially in Protected Landscapes, including visual disruption to the natural beauty of these designated areas and undermining of the cultural and historical significance associated with native habitats.	√	√	√	√
Infrastructure deterioration - Damage to built environment (JK), blockage of drainage systems etc. JK rhizomes can grow through small cracks in concrete, tarmac, and brickwork, leading to structural damage in buildings, roads, and pavements.	√	√	√	√
Access difficulties - Riverside, path and woodland access all potentially impeded, impacting on maintenance/habitat management, recreation and local tourism.	√	√	√	
Human health risk - GH contains chemicals that can cause skin, eye and respiratory damage.	√			
Economic costs - Mitigating impacts of all the above, plus management costs to control (especially when population allowed to spread over large areas) require significant resources. Controlled waste disposal also causes delays and additional costs. JK can reduce real estate values and has significant legal implications when selling a property in the UK.	√	√	√	√

***Further detailed impacts of Himalayan balsam – see pages 52 - 54**

Giant hogweed

Giant hogweed
Heracleum mantegazzianum

Giant hogweed *(Heracleum mantegazzianum)* in the UK is usually a monocarpic (flowers once and dies) herbaceous perennial plant of the carrot (Apiaceae) family. Every umbel has many small, unspecialised flowers, making each insect visitor a probable pollinator. The species is considered to be self-compatible although it has the temporal separation of male and female flowering phases that is common in umbellifers. However, the ability to self-fertilise if necessary is important as that can result in the successful seeding from even an isolated plant. With usually windblown seeds this is likely to happen at some point.

If the plants have good growing conditions, they can reach 4 or 5 metres in height, having deeply cut leaves a metre across and apical umbels of 50 cm or more in diameter. Although in a dry year, the flower spike might only be 2 metres tall, making it less conspicuous from a distance.

Each plant can produce many tens of thousands of seeds so the 'seed rain' will be many thousands per square metre. Most of the surviving seeds will germinate the following year. In its native region of the Caucasus mountains in Armenia, Azerbaijan, Georgia and Russia, the plant may be living at 2,000 metres or more above sea level. Consequently, it will experience a much greater temperature range and poorer soils (unless on previously managed or disturbed ground), leading to it needing five years or more of growing before a flower spike is thrown and the plant dies. With a more benign climate in the UK and fertile silts or soils, the plants here can flower within three or four years and possibly even two years which is likely to have contributed to its invasiveness (Phillips, 2024).

There should be no mistaking Giant hogweed in flower

Most of its relatively light seed falls near the parent plant but can be windblown some distance. The seeds can float for a few days and certainly long enough for a flood to deposit them downstream at new sites. Animals can move seeds by fur, foot, flight and eating them. One of the reasons the plant was liked here was as a copious seed source for birds. Several websites report it being spread by birds. People too can move them intentionally or otherwise such as in the mud on feet or vehicles. For all these reasons, the plant can appear in improbable places and at some distance from its source stand. This needs to be borne in mind when seeking to control its spread.

The leaves and stems of this plant have fine hairs that can inject a passer-by with a furanocoumarin which damages the skin's pigment cells without which the skin blisters when exposed or re-exposed to sunlight. This can be semi-permanent damage and take years to stabilise.

Giant hogweed on bare riverbank

TVNL's giant hogweed contractor, Adam Phillips, found 270 giant hogweed plants in 2024 in the middle and lower Tamar compared to 282 in 2023 (Figs. 6 and 7). The outlying site to the north of the catchment, noticed by TVNL staff in 2023 near Kilkhampton, had 20 to 30 plants in 2024 in awkward blackthorn and willow scrub.

Giant hogweed - Records

Fig. 6 Giant hogweed records - Tamar catchment 2023 to 2024

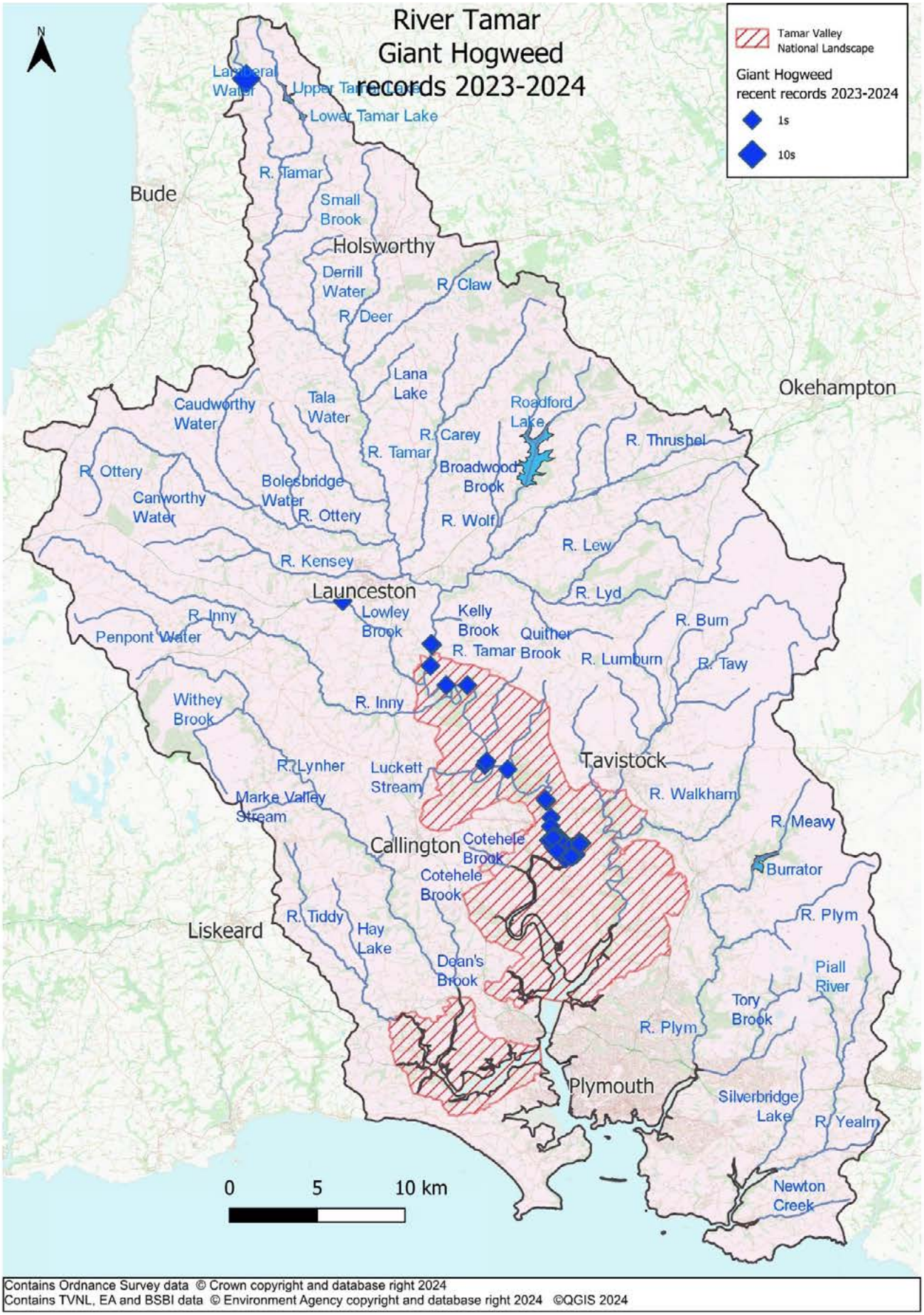


Fig. 7 Giant hogweed records - Lower Tamar 2023 to 2024

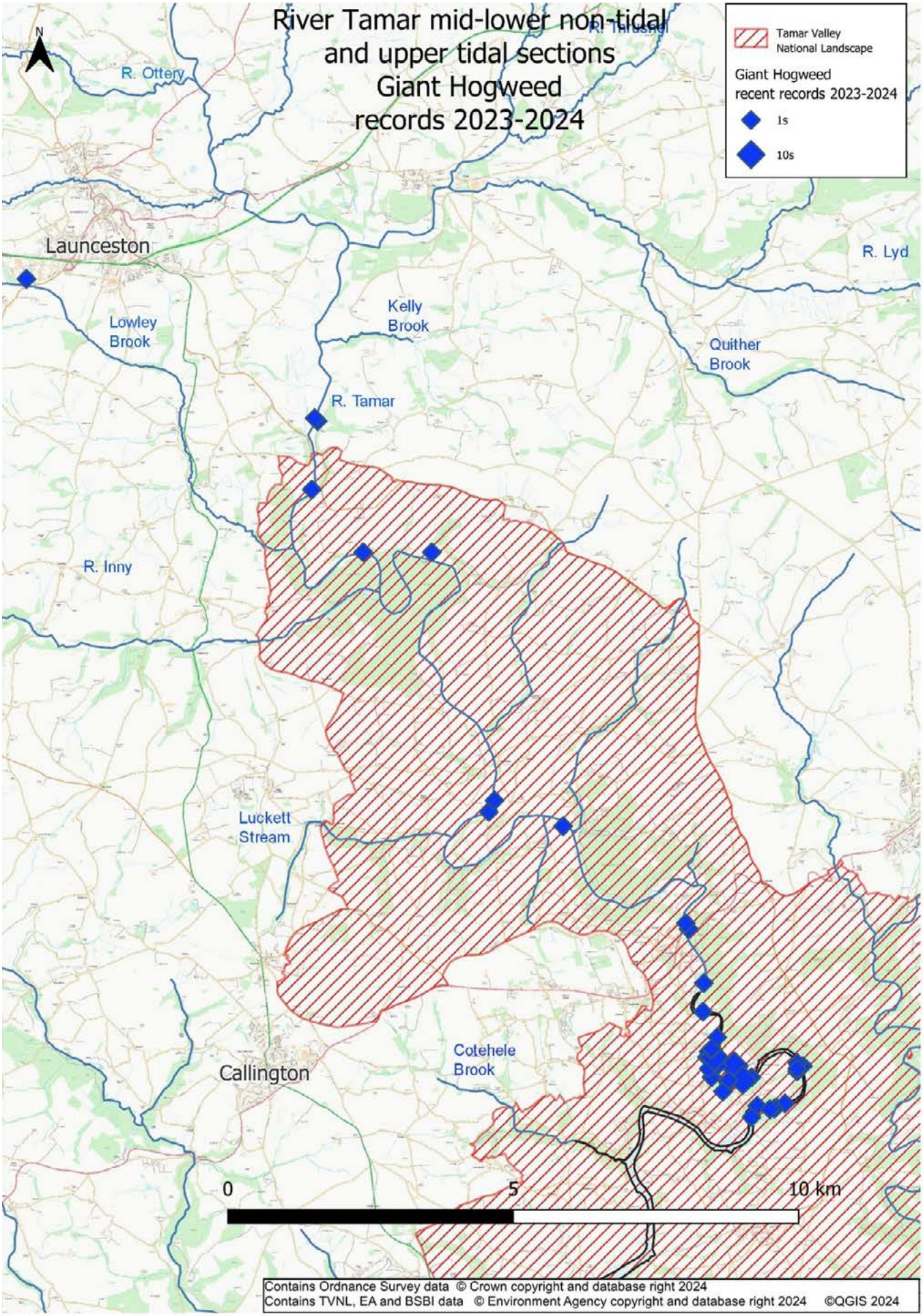
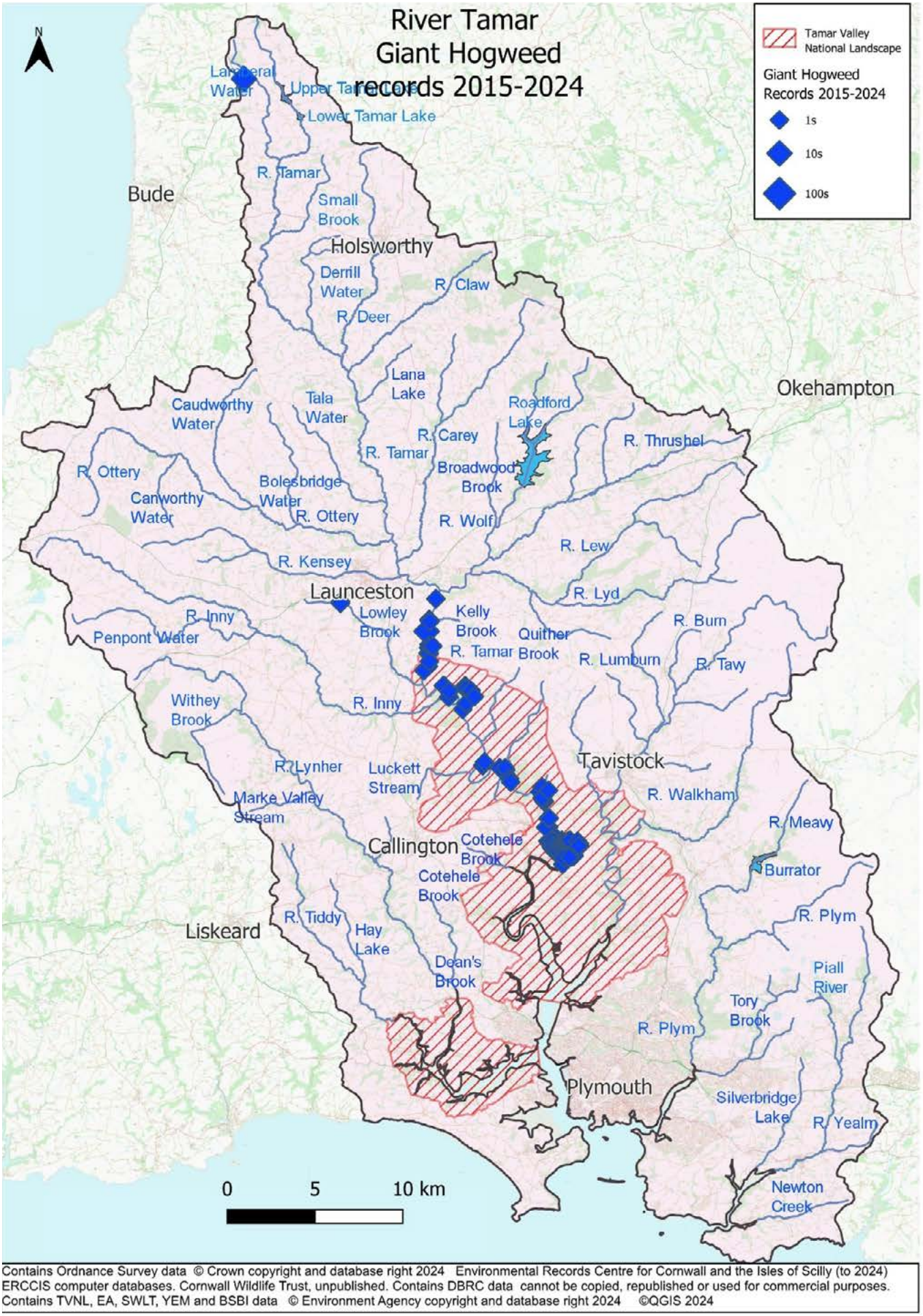


Fig. 8 Giant hogweed records - Tamar catchment 2015 to 2024



Giant hogweed - Methods of control

Lots of control methods have been tried in dealing with giant hogweed, from sheep grazing the new growth to spraying, cutting and digging out the whole plant. Flower heads have been cut off and seeds bagged and burnt. In the Tamar Valley, both herbicidal and mechanical control have been used over the past 20 years of dealing with the giant hogweed. However, once reduced down to mainly pre-flowering plants and seedlings, as is believed to be the current position in the Tamar catchment (Figs. 6 and 7), digging out the plants carefully so as not to leave any root in the ground and cutting them up (at least removing the root from the stem) and allowing the parts to desiccate is likely to be the most effective form of control. Using a fork first to loosen the soil is much more likely to release the entire root system whereas a spade will cut through roots, leaving some behind.

This presupposes that you know where they all are and finding them will be time-consuming as it means checking everywhere they have been, certainly in the recent past and checking all reports of new plants. The last few remaining ones are likely to be hard to find as first or second year plants and without flower stalks to flag their presence. This is where prior knowledge of where they have been or where they are likely to be becomes crucial (Fig. 8).

Once they have all gone, how long do you have to keep looking? Normally, one would look to see how long the seeds are viable for the 'seed bank'. However, not many studies have been done on this subject for giant hogweed and so most reports of seed longevity are anecdotal. For example, 10 websites from internet searching produced the following range of years for the viability of giant hogweed seeds: 2, 4, 3 to 5, 3 to 7, 5 to 7, 7 to 15, 10, 12, 15, 20. A telling comment came from the 'Giant Alien' project manual: "Published information on how long seeds survive in the soil seed bank varies and is to a large extent unreliable as it was only inferred from indirect evidence. This can be reliably assessed only experimentally, by burying seeds and following their fate over time" (Neilson, C. *et al.*, 2005). Ironically of course, it was a proper experimental trial that came up with the figure of two years which is probably the least accurate in describing what happens in the wild even though that was the result recorded from that trial. What happens outside of controlled trial conditions with planted seeds is clearly much more varied and if viable seed does not meet the plant's requirements for breaking dormancy, then a reducing number may remain viable for years.

Another way of looking at it is that most of the above year figures and ranges for giant hogweed seed longevity may be correct, in their experience at those sites. Indeed, given the wealth of practical experience from those actually dealing with giant hogweed as a problem, it would seem foolish to exclude completely their 'anecdotal' observations. For example, a recent experience was reported from a site in Scotland where they were still getting giant hogweed seedlings seven years after the last flowering plant was present and control was started (SISI, 2021).

Usually, it is a prolonged period of cold temperature (4°C or less) (how cold and for how long is also a matter of debate) that is required to ensure that the seeds don't start to germinate before the winter and then a period of wet and warmer weather after the cold spell to start the seed growing. However, it has also been established (using Arabidopsis as a model) that as well as the seed cells' ability to sense a long period of cold, they can also sense the absence of high temperature spikes (above 15°C) and both are required to keep the seed dormant *(*Hepworth, J. *et al.*, 2018). If there is an equivalent effect on giant hogweed and it must presumably have something similar, both of these condition requirements might be affected by the climatic changes that we are undergoing and, therefore, the seed dormancy period might well be altered as a consequence of its vernalisation requirements not being met.

So, whilst after 20 years of active management of the plant on the Tamar the inclination may be to reduce down the effort. In practice and to make sure of its permanent departure, surveys for it ought to continue for several more years in all the previously known locations (Figs. 6,7 and 8) and provision be made for a prompt response if further plants are found in these or any other locations. Furthermore, it is sensible for, at the very least, a second person to accompany the present contractor, so that the priceless site knowledge of how best to access sites, of where plants have been or are likely to be, built up over many years, is not all with one person. A second person could be recording the number and location of plants and taking record photographs of the sites and perhaps assessing and recording the Japanese knotweed, Himalayan balsam and any other INNS present. In fact, with the much-reduced number of plants, there is an argument for even more people (perhaps volunteers) to be present at each site, lending more pairs of eyes to search for the last few giant hogweed plants.

After five years with no giant hogweed at all being found, the responsibility of checking for it at all sites could then perhaps pass to those dealing with the Japanese knotweed (early season survey) and Himalayan balsam (May/ June visits).

The parish questionnaire survey carried out as part of this report produced one further potential site from the neighbouring River Strat towards Bude. The area was checked by Environment Agency staff, with no giant hogweed seen. A new site was also noticed by a member of Tamar Valley National Landscape staff in the summer of 2023 in the Lamberal Water catchment, and a continuing cluster at Morwellham, along with other 'single figure sites', all suggest that there is more work to be done before this plant can be considered finally dealt with in the overall catchment. There are still some potentially key sites that decline the offers of help and it would be important to ensure that this plant really is being dealt with on those sites by ensuring that the surveyor is allowed access annually either by agreement with the owner/s or by the route outlined in section 23 of the Infrastructure Act 2015.

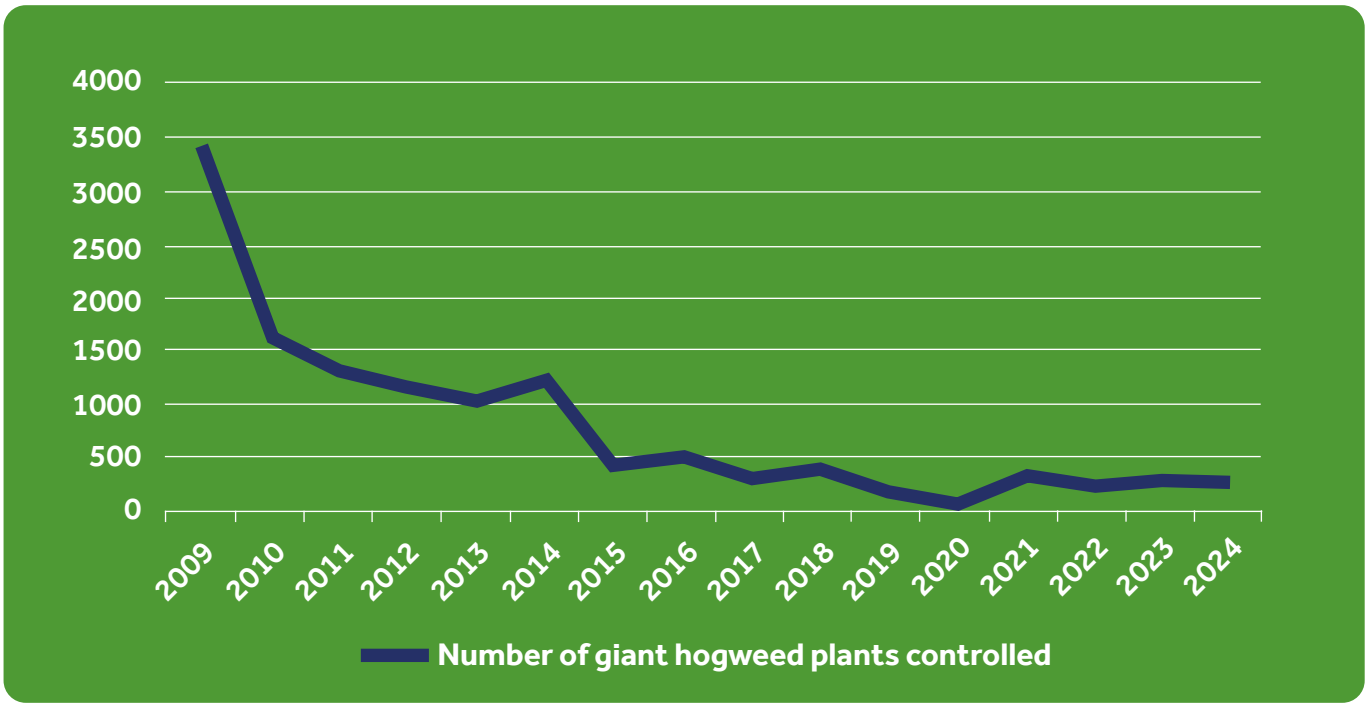
The timing of checks is important as visits in March, April and May are more likely to allow giant hogweed plants to be seen before other tall plants quickly obscure the view. Without the flowering stems as an obvious beacon, and with fewer plants in among background vegetation, it will be more and more difficult to see the seedling leaves or basal rosettes or stems of young plants.

Giant hogweed seedling among native plants in late May 23/5/2023

To check for any new sites and sites away from the river, regular visits should be made to the various reporting websites that are now available such as INNS Mapper, to ensure that any new reports of giant hogweed are followed up promptly. However, whichever reporting route is advocated, it should be remembered that this is only a step towards the control of that species as the reported plant/s still need to be confirmed and dealt with.

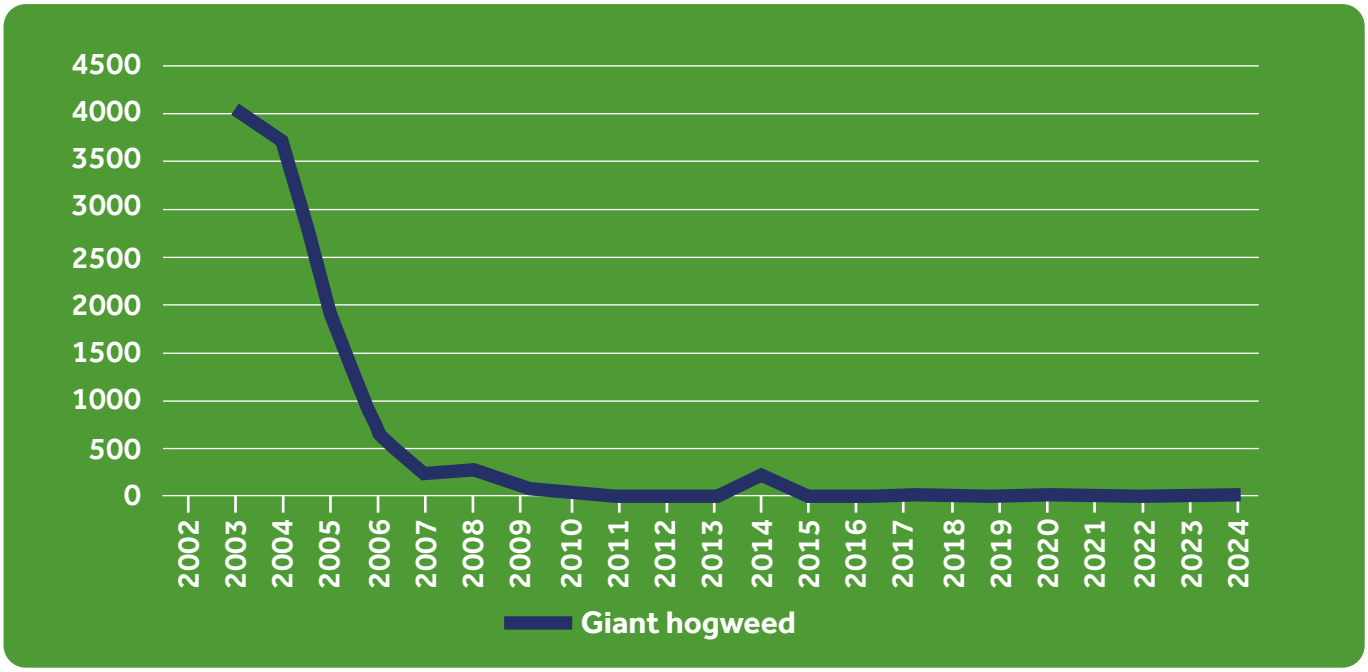
Realistically, it has been a fantastic achievement to have got the giant hogweed down to the present level of low hundreds of non-flowering plants (Fig. 9) within the last 2 decades and with the resources available. By contrast, the Tweed Invasives Project, in its 21st year of operation (2023) still had to deal with 14,295 giant hogweed plants (down from the 17,673 plants in 2022). However, it would be good to complete this task which must have seemed impossible in the early days.

Fig. 9 Main Rivers Tamar and Lyd - Giant hogweed plants controlled 2009 to 2024



In 1996, a landowner at Harewood, Calstock started to control giant hogweed on over 10 acres of riverbank and floodplain habitat, but began recording his efforts only from 2001 (Fig. 10) (after several thousand plants had been cut or dug out in the intervening period). Each of the 15,162 giant hogweed plants since has been cut down or dug out.

Fig. 10 Main River Tamar, Calstock - Giant hogweed plants removed on an organic site 2002 to 2024



In the same period, he also dug out over 2,000 American skunk cabbage and controlled both Himalayan balsam and Japanese knotweed without the use of herbicide. This has been a phenomenal undertaking over an extensive period and one wonders whether anyone could begin to match the single-minded time and effort expended to defend this riverside land from the unwanted legacy of careless gardening upstream. https://calstock.org.uk/elfarc/invasive/giant_hogweed/.

Tamar riverside at Harewood, Calstock, INNS controlled by landowner since 1996 27/6/2024

Giant hogweed - Next steps

1. The letting of a long-term contract has been a sensible choice which must give a better chance of retaining the same contractor/s through that period.
2. Try to stay with the same contractor throughout if they are keen to continue. Their familiarity with sites, site access and the local owners will all contribute to a more effective result. The owners too are likely to be happier dealing with someone they know.
3. Keep the landowner database up to date. Send pictures and details of the plant as there will be new owners who may not be familiar with it.
4. Revisit all the known sites each year and log with grid references from GPS where remaining plants are being found.
5. Continue boat survey for giant hogweed on the tidal section from Gunnislake weir downstream to supplement any landward surveys. Boat landings will be necessary in some places to ensure that tidal reach inlets and the landward side of the flood banks are also checked.
6. Include boat survey upstream of Greystone Bridge (steep banks - difficult access).
7. Encourage one or more local volunteers to accompany contractor on the spring survey visits to get them familiar with each site and help spot any seedlings.
8. With a smaller number of non-flowering plants now, the remaining plants should be dug out, using a fork to loosen the ground and give the best chance of removing the entire root system, cut up (i.e. stem from root) and allowed to desiccate on site but out of any potential flood or tide reach.
9. Spraying may not guarantee that the plant is killed and would require revisits in the same year to ensure that it has been effective for that year but also in subsequent years to make sure that there are no further plants growing from a part of the rhizome perhaps not reached by the herbicide.
10. Early in the year (March/April) raise awareness of giant hogweed alongside work on Japanese knotweed, Himalayan balsam and American skunk cabbage.
11. Encourage volunteers to help survey local rivers sections. Ask anglers and boat users on the tidal section to look out for giant hogweed.
12. Liaise with estate managers and gardeners of the large well-established gardens on giant hogweed and INNS generally in case they can help or know of other sites.

13. Keep in contact with the privately managed sites such as Harewood, to encourage reporting of the control work there and to provide support, if needed.
14. Check out the other recently reported sites such as: Pennygillam Industrial Estate Quarry, Launceston (Environment Agency and Botanical Society of Britain and Ireland (BSBI), 2023) pond and verge near Rowden farm, Kilkhampton (TVNL, 2023).
15. There needs to be a standing fund available so that any new sites are able to be dealt with immediately (dug out) without wrangling with owners as to who is paying.
16. Encourage reporting of INNS directly to the Tamar Invasives Group or future catchment INNS programme, with photos to help correctly identify the plants.
17. Encourage further reports through The Environmental Records Centre for Cornwall and the Isles of Scilly (ERCCIS) and Devon Biodiversity Records Centre (DBRC), together with phone app reporting (see page 74). These will all need checking periodically and in time to take action that year.
18. Each year, count and map the plants found and update TVNL's INNS project web pages regularly. Note whether any flower spike is present.
19. Produce updated Giant hogweed information for website.

Fine hairs on a characteristically blotchy branch of giant hogweed

Flowering giant hogweed, Harewood July 2024 (Photo: P. Thompson)

Japanese knotweed

Japanese knotweed
Reynoutria japonica var. *japonica*

Description

The Japanese knotweed clone *Reynoutria japonica* var. *japonica* is a thicket-forming male-sterile herbaceous and rhizomatous perennial plant. The original species *Reynoutria japonica* is at home on volcanic slopes in Japan but struggles to outcompete other native plants there like taller grasses in a closed sward which can keep it in check. However, in the UK, *Reynoutria japonica* var. *japonica* thrives with little fungal, insect or mammal predation that might otherwise set it back. In the South West, it may find things even more to its liking with the present warmer and wetter winters exerting little climatic control. It appears to have an advantage in soft or worked ground such as silt, dumped soil, landfill areas and particularly mine spoil heaps where it probably has little competition from native plants and less competition from the allelopathy of any existing plants or mycorrhizal networks. Other recent specific names were *Fallopia japonica* and *Polygonum cuspidatum*.

The spoil heaps from extensive mine workings may well be a factor in why there is so much Japanese knotweed in this area, both along and away from the river as this plant may be better able to tolerate the presence of a greater range of metals and minerals than our native flora. Historically, knotweed-contaminated soil being dumped on receptive ground such as mine spoil, road verges and waste ground will have started the problem. Then either careless or no management of the plant has facilitated its spread. Cornwall County Council through its subsidiary Cormac is actively dealing with 2,500 stands throughout the county.

Even small (5 mm) sections of the plant have the potential to re-root when displaced. This vegetative spread can be by the river action or by the movement of knotweed-contaminated soil by vehicles or from people dumping garden waste containing it. Japanese knotweed can regenerate from small pieces in grass cuttings dumped in or over the hedge or spread from the segments left by mechanical hedge trimmers or mowers cutting road verges. So, no flail, brush-cutter, strimmer, swipe, mower or chipper should be used on Japanese knotweed or its stems as this can exacerbate the problem. Surface water draining from roads anywhere in the catchment will

Path made through the middle of Japanese knotweed stand on mine spoil in the Tavy Valley 1/7/2019

very quickly carry these cut pieces to the nearest stream or river where they have a chance of regrowing into yet another stand of unwanted Japanese knotweed.

The thickets formed by this plant then dominate the native plants competing so effectively for light and space. Although Japanese knotweed dies back in winter there is still some structure left in the dead stems, but its suppression of indigenous plants and its potential economic devaluation of land mean that it should be treated both as quickly as possible and over as many years as is necessary to remove this plant.

Whilst it is assumed that our Japanese knotweed is all the clone *Reynoutria japonica* var. *japonica*, it is possible that some of the stands are *Reynoutria x bohemica* which is a cross between the existing female clone and another species sometimes present, giant knotweed *Reynoutria sachalinensis*. The significance of this is that *Reynoutria x bohemica* would then be able to backcross with either parent and, therefore, has the potential to replace the missing male *Reynoutria japonica* and provide the ability to reproduce by seed as well as vegetatively. By the same process the hybrid is generating the genetic diversity lacking in *R. japonica*. To understand the population structure, it may be necessary to be able to identify hybrids and putative back-crosses (Bailey *et al*., 2008).

Three-winged seed of Japanese knotweed at the Kelly Bray site 31/1/2024

It is also known that Russian vine *Fallopia baldschuanica* can also replace the missing male and produce a fertile cross known as railway-yard knotweed *Reynoutria x conollyana*. These seemingly academic considerations might become much more relevant if subsequent variations in the offspring prove even more suitable to the situation and climate in which they find themselves and can reproduce by seed. Japanese knotweed can have up to 190,000 flowers per stem (Bailey, 2013) and many stands have more than 100 stems. So potentially that could be 19 million seeds from a small clump of Japanese knotweed. Within the catchment there is already one stand of Japanese knotweed over 3.5 hectares in extent at Kelly Bray.

Below: Japanese knotweed flowering by the River Lyd 19/8/2024

Extensive Japanese knotweed stand on past landfill site at Kelly Bray 8/6/2024

Japanese knotweed - Records

The Japanese knotweed recorded from this survey (2023-24) are mapped (Fig.11) but this reflects what was found on the small proportion of the river able to be looked at from bridges or accessible land. The collected records from all sources are shown in the catchment map (Fig.12). However, this represents records from 2010 to 2024 and in Cornwall particularly, many of these Japanese knotweed sites have been or are being dealt with and so the apparent preponderance of Japanese knotweed on the Cornish side of the river may be a record of past presence. Conversely, on the Devon side, the records are lighter than they should be, with less recording and survey effort and many of the sites shown may not have been dealt with. In which case the earlier records (2000-24) may show a more realistic map (Fig. 13).

Within the Tamar catchment, this report was able to combine 1,528 previous records of Japanese knotweed with 66 records from 2021 (TVNL - A. Phillips 2021) and 156 more from the 2023-24 survey (Figs. 12 and 13). Many of the Records Centres' records are likely to be the stands visible from the roads and publicly accessible areas and it is hoped that most of these (on the Cornwall side at least) will have been treated. Earlier this year (25/4/24) one road journey along the Tamar's eastern watershed between Sourton Down and Holsworthy, Devon revealed 12 stands of Japanese knotweed of varying sizes in the road verges, 8 of which were on the Tamar side of the watershed. Without a roadside Japanese knotweed control policy in place in Devon, it is likely that all of these stands will get cut with the verges, hedges or both, making many more knotweed pieces available to start a new stand nearby or wherever the nearest drain, ditch or watercourse takes them. That does need to change.

There will be many more Japanese knotweed stands along the watercourses that are not in the public eye and the overall figure will not be known until fuller surveys are carried out along all the watercourses. Also, the records from the desk-based survey mostly indicated only presence with no scale of abundance and these have been mapped as 1s which is likely to be underestimating the size of stands that have not been treated.

Fig. 11 Japanese knotweed records - Tamar catchment 2023 to 2024

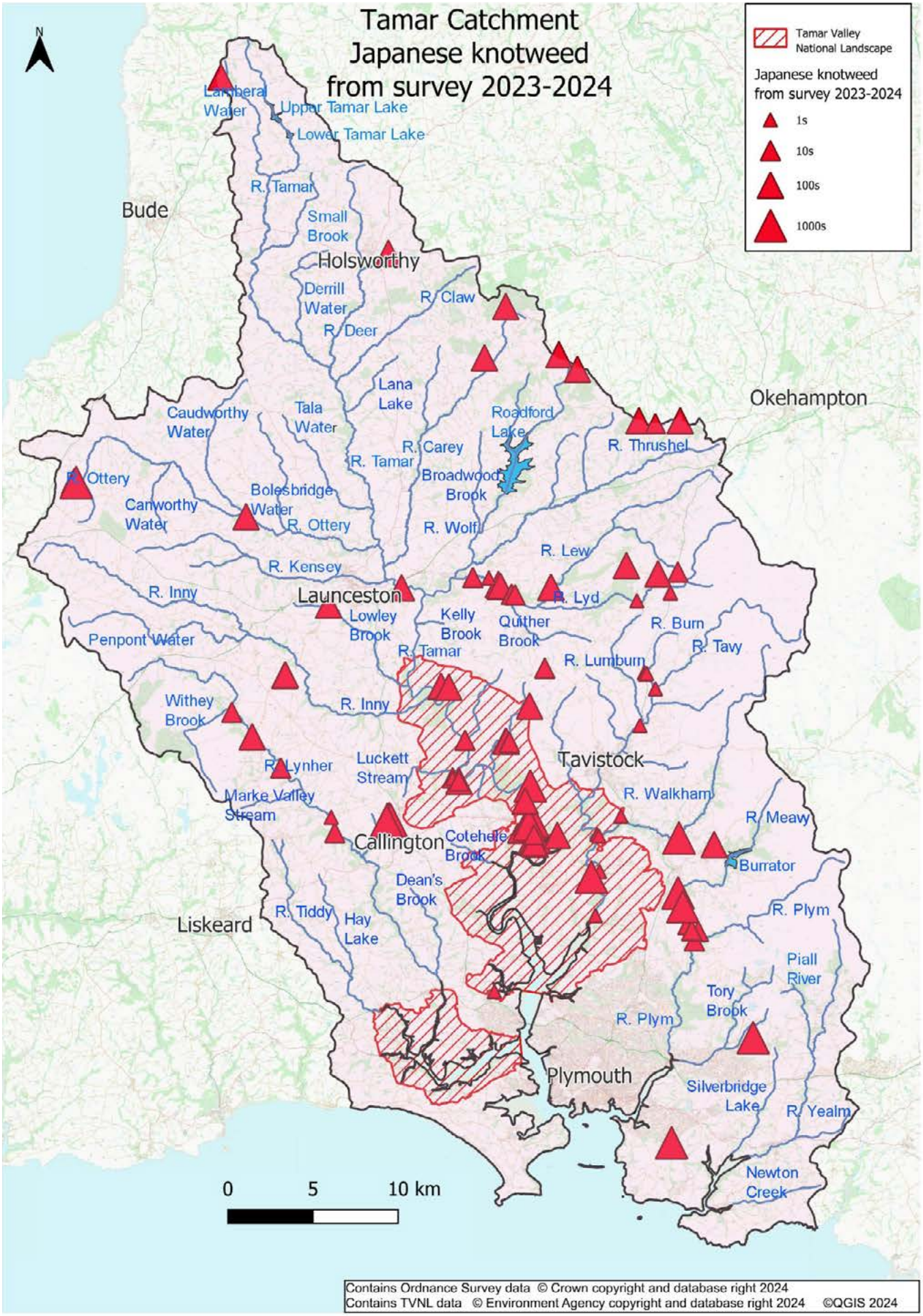


Fig. 12 Japanese knotweed records - Tamar catchment 2010 to 2024

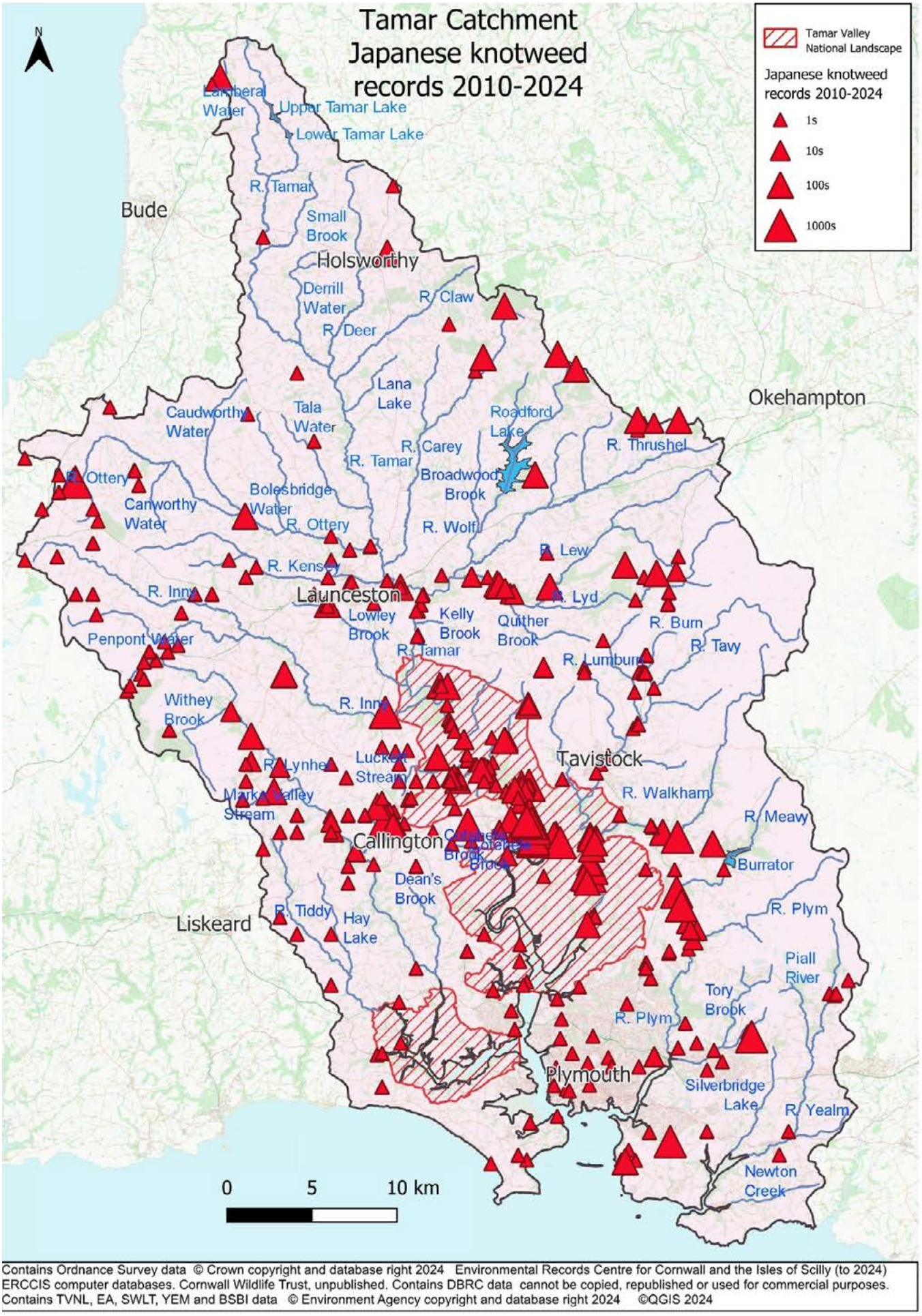
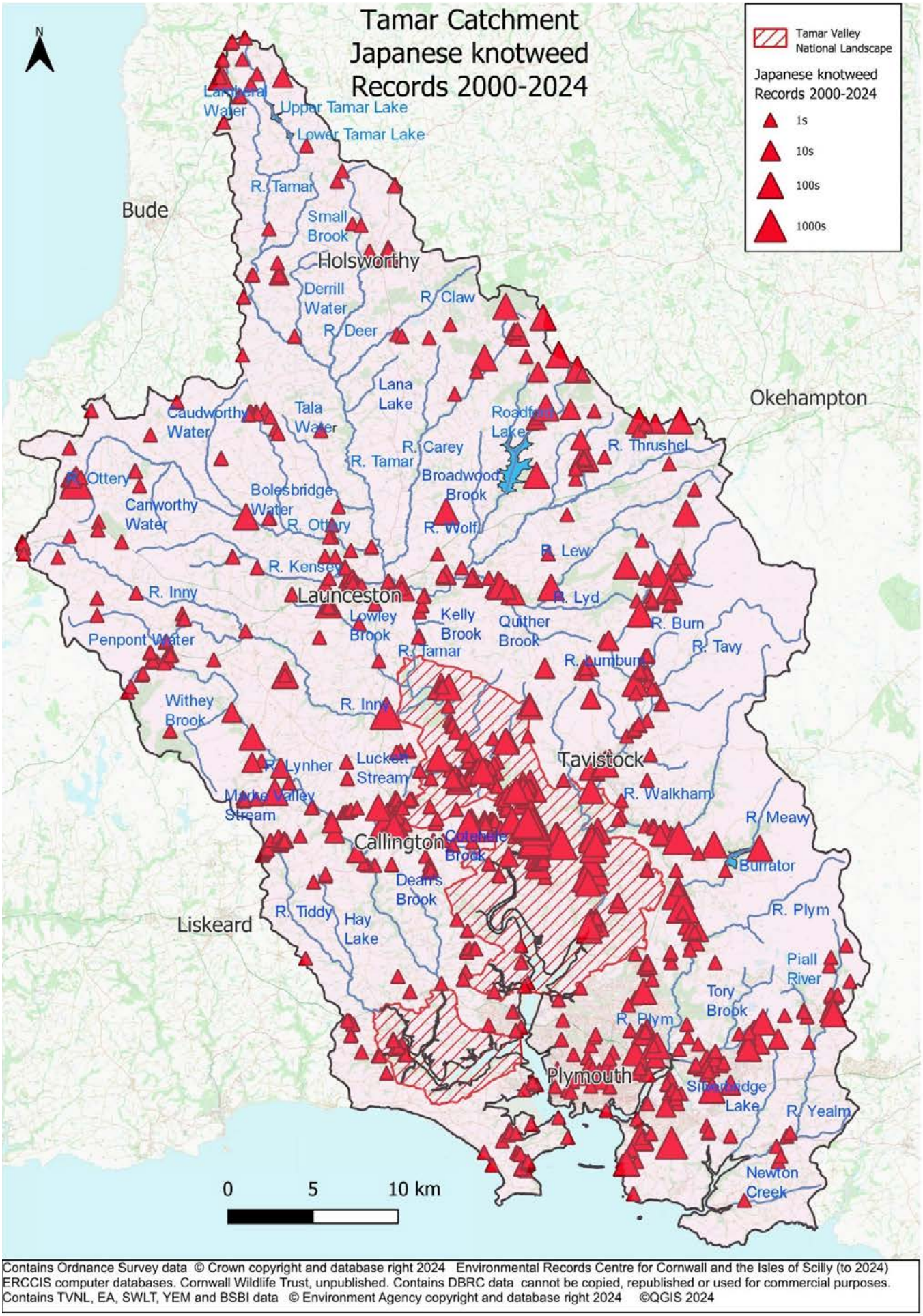


Fig. 13 Japanese knotweed records - Tamar catchment 2000 to 2024

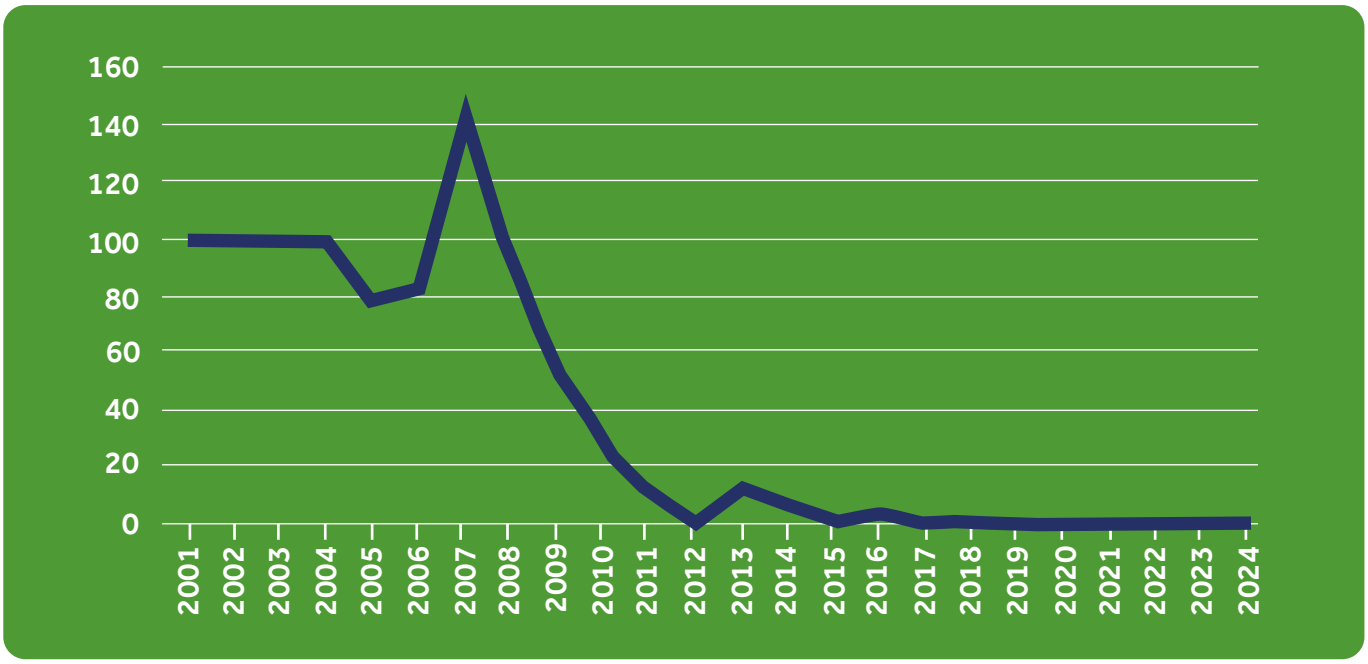


Japanese knotweed - Methods of control

The options for control include mechanical, chemical, physical (burying, mulch mat, steam), electrical and biological.

Mechanical - It is possible to dig out Japanese knotweed but as the rhizomes can go down a long way (metres), you are likely to break off sections of the rhizome and you still have the problem of how to dispose of the excavated material. Burning is a possible solution but would need to be done under Environment Agency advice. Removal from the site would also invoke the need for a waste transfer certificate and it would have to go to a specialist receiving site for either burning or burial, making it time-consuming and expensive. Continuous cutting is said to work if carried out for long enough (and the cut material not allowed to exacerbate the problem) as that is thought to keep weakening the plant. This can also ensure that the Japanese knotweed does not dominate the site even though it is still present. However, the risk is that once the manual control is stopped, for whatever reason, the Japanese knotweed can return to dominance. Such manual control like this might not work on a large scale as it is so labour-intensive as witnessed in the following example (Fig.14) (Marshall, 2023).

Fig. 14 Barn Park Copse (River Carey) - Japanese knotweed stems removed from a 3m x 2m site between 2001 to 2024



The example above, from independent control work carried out in the River Carey catchment (H. Marshall), shows how difficult it might be to remove Japanese knotweed thoroughly by mechanical means and without the use of herbicides. But the takeaway shouldn't just be in terms of years for the long timespan to successful control, but should consider the effort involved, which in this case for one 2 to 3 metre clump involved at least 117 recorded visits to the site! Only the last five of these visits were monitoring for any regrowth, whereas cutting, pulling or digging out was required on all of the previous 112 visits where the material removed was placed on a corrugated iron sheet or burnt so it could not re-establish.

Chemical - in practice, herbicidal sprays containing the active ingredient glyphosate are billed as the most effective route to Japanese knotweed control. A three year trial of 19 different control methods on replicated plots in and near Swansea was carried out (Jones *et al*., 2018) testing the 3 main approaches to Japanese knotweed control of physical (covering), chemical (herbicide) and integrated (cutting before use of herbicide). They assessed 58 x 225 m^2 treatment plots and 348 x 4 m^2 sampling plots each year, comparing spring and later control methods of excavation, resource restriction and/or disruption of above and below ground growth. https://doi.org/10.1007/s10530-018-1684-5.

The main finding was that the greatest control of Japanese knotweed growth was obtained by using glyphosate alone (i.e. with adjuvant but not auxins or other inhibitors) at the best time (when the plant is in full leaf) of summer into the autumn (June to October). Also, it was noted that stem injection required over 15 times more glyphosate per unit area than the spray treatments and was more labour intensive to apply.

In practice, many of the stands that would be encountered along the Tamar and its tributaries will not have been tackled at all and the density of stems would preclude stem injection for the first year at least anyway. However, in a hedge context this method might still be preferable in order to minimise the detrimental effect of the herbicide on any native plants present.

However, there is a growing movement that is concerned about the increased use and presence of glyphosate in the environment and particularly with a potential detrimental effect on insects. One way around the insect issue might be to carry out any spray control before the plants flower and attract insects. The flowering period usually start from late August into September. But to ensure that the remedy is not worse than the continued widespread presence of the plant, it would be prudent to check with a professional study that no damage is being done to aquatic plant or animal life in the watercourses where herbicide treatment is being undertaken.

Below: Japanese knotweed in the tidal Tamar at Calstock 27/6/2024

Physical - burying is part of the control advocated when Japanese knotweed contaminated material is moved off site with a suitable waste transfer note. In practice, there are said to be few sites that can take this material as it has to be buried at least 7 metres down to prevent regrowth. It might also work on a contaminated site to avoid moving the material off site, but then a root-proof membrane would be advocated to help contain the material.

Covering the Japanese knotweed rhizomes with a thick light-proof membrane is also advocated although this will have to cover a much larger area than the Japanese knotweed stand itself and will need to be anchored securely so that it remains in place. Five years has been suggested as a likely timescale for this method.

Electrocide - the Exmoor Non-native Invasive Species (ENNIS) Project trialled Rootwave on a serious of species, including Japanese knotweed. This device delivers 5,000 volts into the plant to which it is attached. However, it seems that every stem needed to be dealt with and perhaps with several (4) treatments per year to be effective. Given that it is quite heavy and would need to be run with a generator, it is difficult to see it being a practical solution on a river bank. However, it may yet prove useful on organic farm sites if vehicle access to the site is an option. ENNIS is nearing the end of a five year trial of this technology and it would be worth checking with the project team regarding its effectiveness in practice before choosing this route.

Japanese knotweed - Biological control

Two separate routes of biological control have been considered recently by the Centre for Agriculture and Biosciences International (CABI). These have been a sap-sucking psyllid and a leaf-spot fungus, both of which were reported on in CABI's 2023 review of its biocontrol projects:

'Releases of the Kyushu line of the psyllid *Aphalara itadori* (from 2010 onwards) demonstrated the safety of this agent. Reproduction was observed on *R. japonica* at several release sites, with some overwintering recorded, however, long-term establishment and persistent overwintering have proved elusive. To tackle these issues, better climatically-matched psyllid cultures, which were observed to cause extensive and severe leaf-curling damage in Japan, were collected from Murakami, further north in Japan. Host-specificity testing proved that the Murakami line is also a specialist on Japanese knotweeds. Defra approval for release of the Murakami psyllid line was obtained in 2021 and the line was released at one *R. japonica* and one *F. x bohemica* site during the summer. The psyllid releases were undertaken at the same sites in 2022 and field monitoring showed characteristic curling damage on plants at the *F. x bohemica* site during the season, where overwintered adults had been found in the spring. Field experiments showed that leaf-curling on *F. x bohemica* promoted nymphal survival and predation did not cause significant psyllid mortality. The Murakami psyllid was also released in the Netherlands and Canada, and field results are now being shared between all countries.' (CABI, 2023)

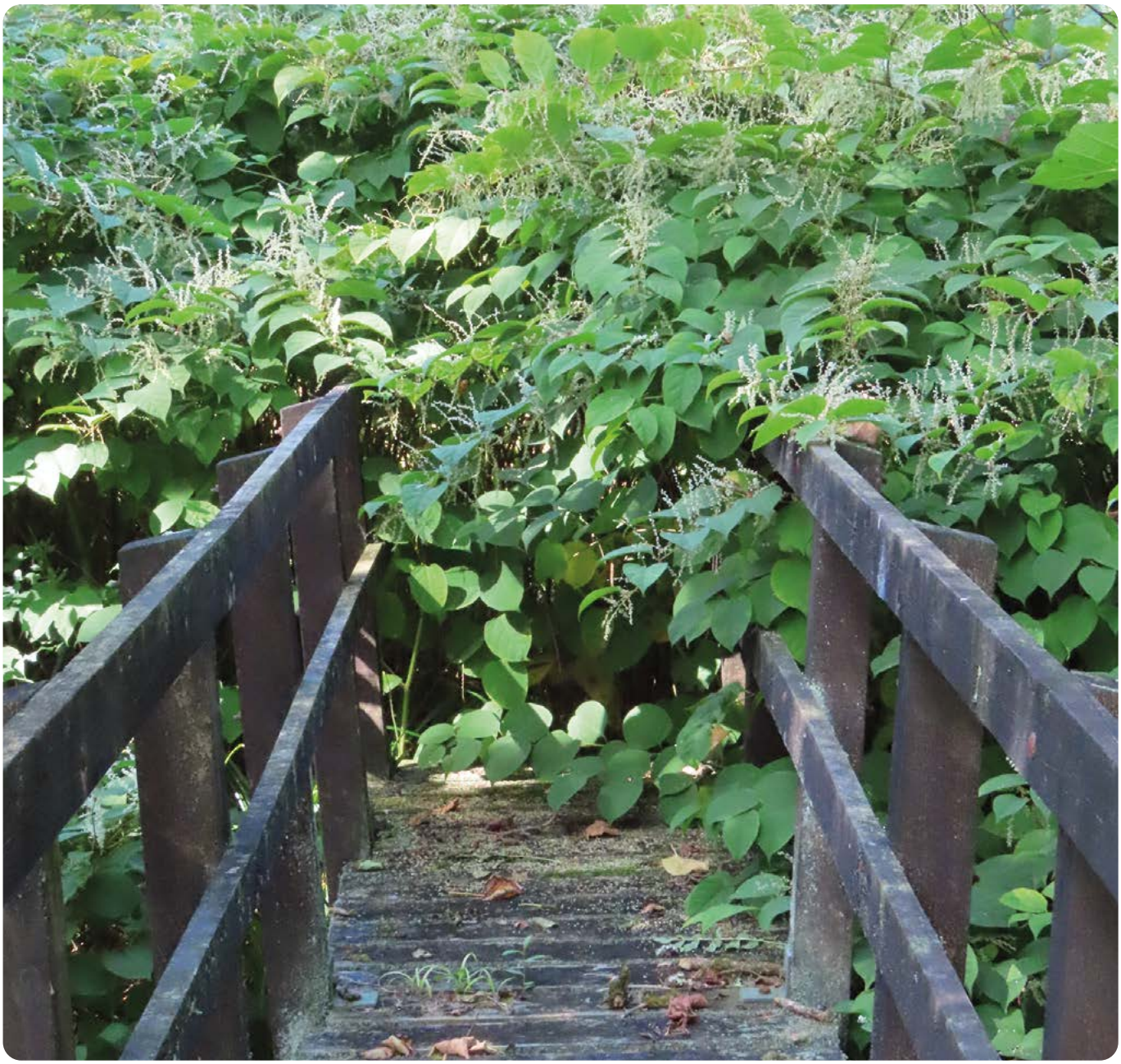
'The leaf-spot fungus *Mycosphaerella polygoni-cuspidati* has been under evaluation for use as a mycoherbicide as studies showed that under quarantine conditions the pathogen can cause restricted disease symptoms on selected non-target plant species; the agent is thus currently not considered for classical biocontrol.'
(CABI, 2023)

Below: Japanese knotweed 8/9/2024

Japanese knotweed - Next steps

1. In setting up an INNS control programme, the offer of controlling Japanese knotweed found could be used as an incentive.
2. Eventually each river will need to be fully surveyed but that need not stop work from starting.
3. This can only be achieved with full landowner access permissions - this needs landowners on side first.
4. Start with the sites where people are asking for help. They will help spread the word.
5. When stand locations and size are known, contracts can be let to include each of the tributaries and sub-catchments.
6. Aim to secure one Environment Agency licence for the entire river system for this work.
7. Use early spring to survey the stretches for Japanese knotweed and Himalayan balsam and any American skunk cabbage or giant hogweed and this can inform the respective control efforts.
8. Record stand size and position with GPS to get accurate grid references.
9. Consider marking appropriate sites with paint-topped posts so on subsequent visits it is easier for contract staff to find the Japanese knotweed. This is more likely to be helpful at sites away from the river.
10. Contact CABI with offer of helping to trial its biological control (particularly relevant if organic holdings cannot be tackled in any other way)

Japanese knotweed blocking footpath footbridge on the River Lew 17/9/2024



Japanese knotweed and Himalayan balsam on the Lyd 3/7/2024

Himalayan balsam

Himalayan balsam
Impatiens glandulifera

Himalayan balsam - Records

Part of the point of the 2023-24 survey was to establish where the Himalayan balsam (purple dots on the map) started on each river and so this has been narrowed down by also showing where there was no Himalayan balsam seen (green dots) (Fig. 15). Some sites on the Tavy headwaters that were surveyed in 2019 are also shown (hollow green dots). It should be remembered that these records are mostly from a bridge survey with only some publicly accessible sections or sections with landowner permissions (Ottery, Lyd, Lew and Wolf). Also, many of the visits were between November and March which is likely to have led to this species being under-represented.

The 1,812 Himalayan balsam records shown for 2000-2024 (Fig. 16) will be an underestimate of the overall position as the gaps between the dots have not been visited as part of this survey. Also, most of the 740 original desktop survey records only indicated presence with no scale of abundance so one could reasonably assume that once there is a more recent record of 100s or 1,000s on a river, there is every chance that this will be repeated downstream. From a recording point of view, Himalayan balsam has been under-recorded historically, partly because it became abundant very quickly and people don't tend to record the commonest species and perhaps also because it is difficult to record the size of a stand of balsam anyway with a point record.

Himalayan balsam stand by mid July

Fig. 15 Himalayan balsam records - Tamar catchment 2023 to 2024

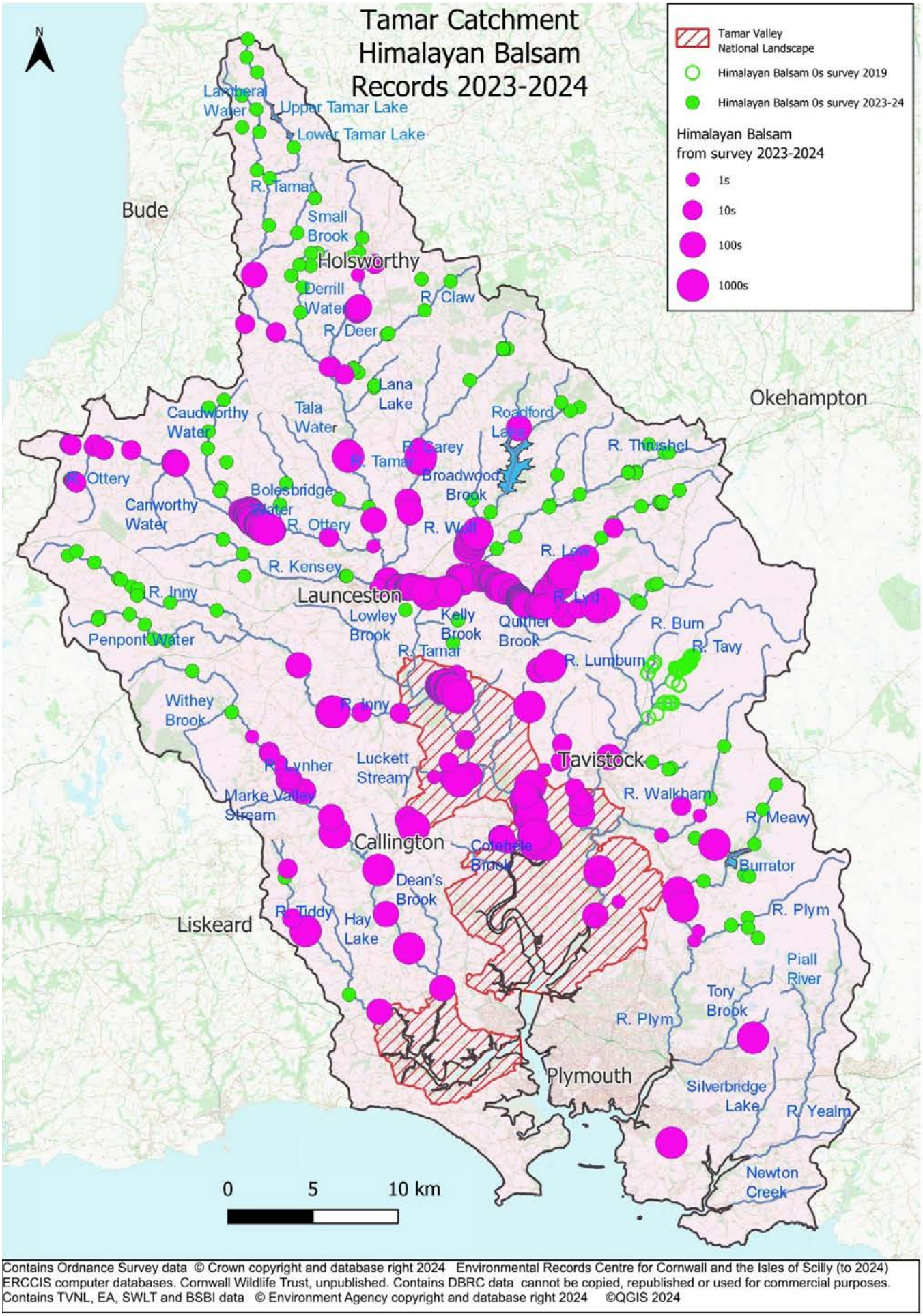
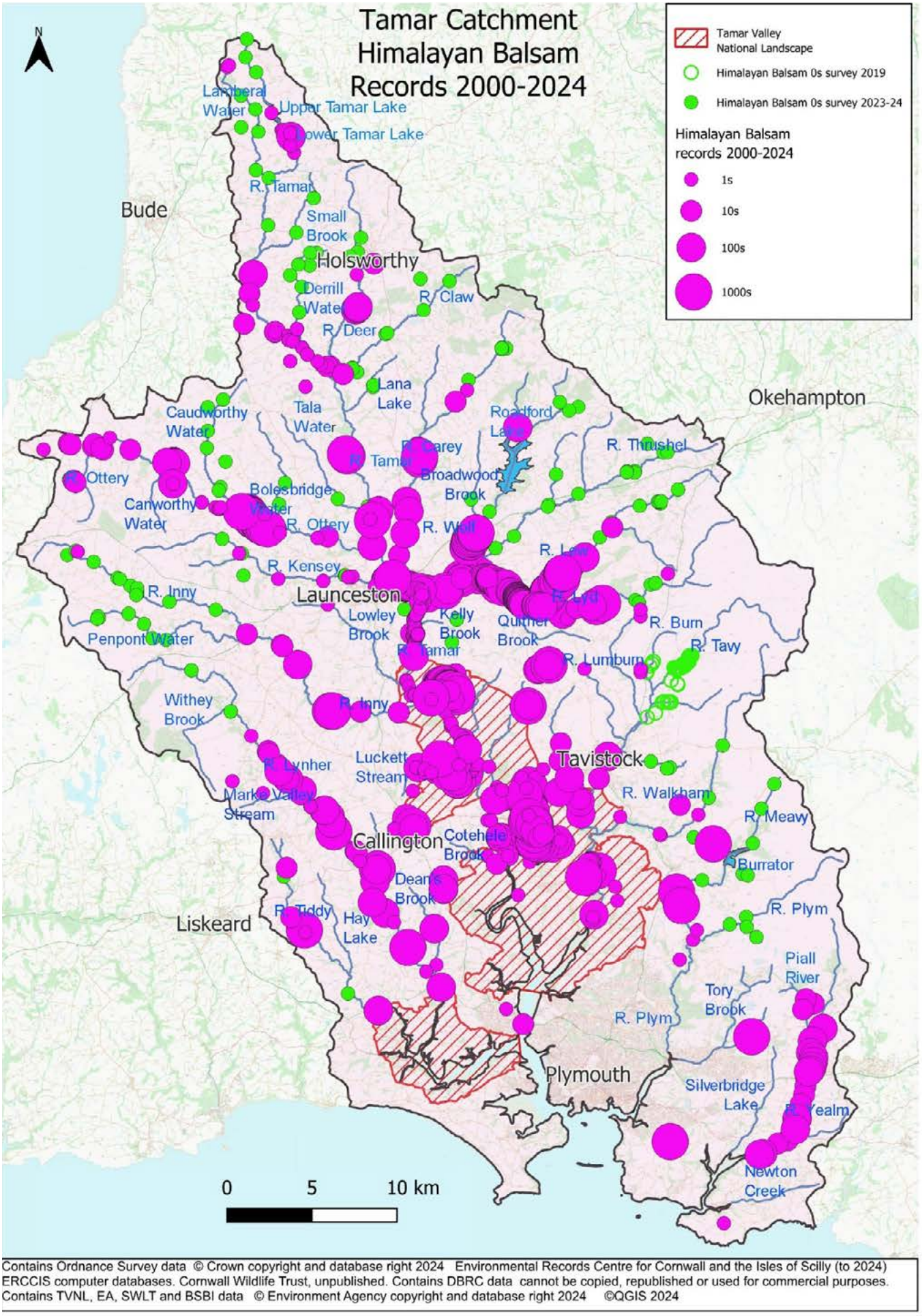


Fig. 16 Himalayan balsam records - Tamar catchment 2000 to 2024



Himalayan balsam - Ecology

As an annual, Himalayan balsam only lasts long enough to flower and disperse its several hundred seeds, which it does in late summer and autumn when the ripe seed pods are disturbed. On release, the seeds sink but can be carried in flood waters and come to rest wherever they drop out of the flood flow. This is often on a newly formed sand, silt, gravel or stone bar in the river and here they can exploit the high nutrient levels and wetted ground and pioneer the new site in the absence of established competitors. Once the winter is over, the synchronous germination of its seeds at any one site can result in large stands of the plant which contribute to its success in suppressing native species.

However, between sites there does appear to be variation in the breaking of seed dormancy given different circumstances and so germination can be from January through to May depending on ground and weather conditions. For this reason, multiple visits to the same site are required if Himalayan balsam eradication is the aim.

If a seed thrown from the seed pod's explosive dehiscence (hence the generic *Impatiens* - impatient) comes to rest on land, it dries out a certain amount over weeks or months at which point it can float and so has another chance of finding its way downstream on a subsequent flood and may be caught in brash from or deposited on damp receptive soil at the fullest flood reach. However, once growing at the side of the river, the balsam's seed spread can allow it to colonise higher up the bank as well as to contribute more seeds to the water. In subsequent years, once a stand of Himalayan balsam is established on the river bank, the first frosts and floods of the autumn ensure that there is no cover left on the river bank and little root system to hold the soil in place. Consequently, the riverbanks that have been dominated by balsam are more prone to erosion. Soil re-deposited as silt then cloaks the gravels that fish need clear for successful spawning. Also, more silt in the river means less space for flood water and so the river is more likely to break out of its normal channel to cause flooding. Many of the Himalayan balsam plants themselves are also taking up space in the watercourse, increasing the flood risk, and their eventual breakdown in the water will use up oxygen from the water and make more nutrients available in the river.

As the tallest annual in the UK and the one that produces the most nectar, most quickly, Himalayan balsam is doing a huge disservice to our native plants and insects at many levels. Because of its height and nectar abundance, it serves to distract bees particularly from pollinating native plants which, if they have not been shaded out, may not get cross-pollinated.

Extensive roadside stand of Himalayan balsam at Hurlditch Down 7/7/2024.

Conventionally, it is assumed that the spread of Himalayan balsam is downstream which is still the main route but now that it is so ubiquitous in the environment, it is likely to be moved between catchments by birds, deer and domestic stock feeding on it and inadvertently by people in the tread of vehicles (Moser, 2013) or boots. The spread of balsam to road verges is only going to make its control more difficult as the seed will be spread along the roads very quickly by the draught from passing cars and then spread away from the roads by their ditches and drains.

The presence of vehicular fords throughout the catchment is also going to provide a potential route as stream or river water washes mud holding seed off tyres or wheels/wheel arches into that watercourse. Himalayan balsam has also been moved in hay cut from balsam-contaminated meadows and sold to upland farmers when they have not been able to produce it themselves such as in a wet year. This seems to have happened on at least two occasions on Dartmoor and may have happened on Bodmin Moor near Henwood (north of Liskeard).

Himalayan balsam in the road verges with meadowsweet, valerian and rosebay willowherb by Quither Common near Brent Tor 27/7/2024. The balsam here perhaps should be hand-pulled to leave the native plants intact.

Originally, there was clearly a horticultural element to the dispersal as seeds were sold even by mail order and people encouraged it in gardens and sometimes for bee-keeping purposes. For the latter, Himalayan balsam helped in extending the honey-producing season and at the same time deflecting the bees from nectaring on the less favoured late season native alternative of ivy.

It is said that Himalayan balsam does not have a persistent seed bank and the only conventional experiment to ascertain the seed longevity showed that 99% of surviving seeds germinated the following year, with the remainder germinating the year after (Perglova *et al.*, 2009). However, others have found it lasting up to four years (Saegesser, *et al*., 2016; Skalova *et al*., 2019) although only a very small proportion of the seeds lasted this long. However, the original trial was conducted with planted seeds in Eastern Europe and subject to a colder more continental climate. It would be useful to carry out an equivalent trial in the conditions now being found in the warmer and wetter winters in the UK.

Mature Himalayan balsam seeds significantly lose viability after two years (Ellison *et al*., 2019). However, this may also be a numbers game in that with a starting point of 6 to 7,000 seeds per square metre under a monoculture stand of Himalayan balsam, there is likely to be variation in seed size, weight and maturity at pod burst as well as differences in where the ejected seeds come to rest, and these differences may all play a part in the variation seen in practice in seed germination in the wild.

Himalayan balsam is favoured by high humidity and wet ground and is semi-shade tolerant. It is said to be' drought-intolerant and quickly wilts, and plants can survive only if the drought period is short.' (Beerling and Perrins, 1993).

Himalayan balsam seeds - the dark ones are from seed pods ready to explode (approximately 2x life size)

However, balsam control work for the Axe Invasives and Dartmoor Invasives Projects found that approximately one in 200 plants has a segment of lower stem full of water and that this apparent natural reservoir will presumably ensure that at least some plants survive even a period of drought. Also, a tall stand of Himalayan balsam will help to keep higher humidity between the plants and, therefore, more moisture in the soil through reduced evaporation. So, as well as reducing the light availability to other native plants, the increased soil moisture will also be exerting some control on what can live there.

Work by CABI showed a negative effect on both foliar and ground-living invertebrates at lower abundance levels in Himalayan balsam, although below-ground invertebrates did not appear to be adversely affected. **https://blog.invasive-species.org/2013/12/10/himalayan-balsam-and-its-impact-on-uk-invertebrates/**.

Himalayan balsam does well on receptive bare ground such as the silts from a river or the muddy tracks in new forestry plantations and particularly around newly constructed ponds. The plants are in the open in full light, not short of water and have little or no established competitors. Along the rivers there appear to be two recent drivers of Himalayan balsam increase. These are the fencing out of stock from the river where there is no follow-up management between the fence and the river and the loss of trees along an otherwise treed riverbank. Latterly, this has often been from ash dieback disease.

Himalayan balsam growing in light gap left by lost trees, River Lyd 3/9/2024

This is not by any means a plea for re-planting trees by the rivers as without light on the water, the river cannot function as it should. Rather, it is confirmation that now is the time to be controlling Himalayan balsam to make sure that it cannot dominate the riverbanks like this.

As with many INNS, Himalayan balsam out of its native context is able to grow and reproduce without being troubled by herbivory or at least not on any significant level. This is perhaps because few of our herbivores choose to use it as a food source (with a few exceptions like some blackfly and one hawkmoth caterpillar and occasional slugs).

Elephant hawk-moth caterpillar on Himalayan balsam

Blackfly being farmed on Himalayan balsam by red ants

Slug damage to the leaves of an isolated Himalayan balsam plant 28/6/2023

This may be from a distaste for the chemicals in the plant and its leaves that include a phytotoxic naphthoquinone (involved in the plant's allelopathy) and a fungicidal naphthoquinone 'lawsone'. These are found throughout the plant but in higher quantities in the extrafloral nectaries (Block *et al*., 2019). The extrafloral nectaries are the small glands on the balsam plant's leaf stalks that give this species its name 'glandulifera' or bearing small glands.

From a practical point of view, if a Himalayan balsam plant is blown or knocked over, the high concentration of allelopathic naphthoquinone from the extrafloral nectaries would be able to assist the plant's re-rooting from the nodes that are then in contact with the ground to allow the plant to continue through flowering and seeding. When shaded or wet, Himalayan balsam can grow roots that can serve to buttress a tall plant or re-establish a fallen plant.

Small glands on the leaf stalks of Himalayan balsam.

Shaded Himalayan balsam forming new roots from its lower nodes 24/8/2021

It is not quite clear what part these glands play. They could be attracting ants or other insects perhaps that might serve to deflect herbivores. They could be distracting insects or larger herbivores from otherwise eating or damaging the leaves. The presence of lawsone (the red-orange dye present in the leaves of the henna plant) may account for the red colouration of Himalayan balsam but chemically is likely to play a part in protecting the balsam's rich nectar from fungal growth (Block et al., 2019).

When the plants are standing as normal, the naphthoquinones washed off the plants 'may contribute to the invasion success of *Impatiens glandulifera*' (Ruckli *et al*., 2014). So, far from wanting to demonise this plant, the call should be to better understand what it is doing and the effect on our insects and watercourses of the chemicals that it produces. Lawsone, for example, is considered to have 'pharmacological effects like anti-inflammatory, antioxidant, anti-bacterial, anti-fungal and anti-cancer properties' (Nair *et al*., 2024). But whilst Himalayan balsam may yet help people through a better understanding of its chemicals and their effects, it should not be assumed that in the meantime, everything in the garden (or the riverside) is rosy!

Lodged Himalayan balsam extending adventitious roots at the water's edge

Himalayan balsam - Bee issues

It is becoming clearer that there is another potential problem with this intentional or incidental use of Himalayan balsam by domesticated honey bees. One of the biggest problems affecting European honey bees nationally and internationally is the presence of the varroa mite (*Varroa destructor*) which as a parasite weakens bees but also carry viruses such as deformed wing virus (DWV) and acute bee paralysis virus (ABPV) which contribute to colony loss.

Himalayan balsam through its height, flower shape, colour and high nectar production (more than any other flower in the UK) is particularly attractive to bees whether honey bees or bumble bees. But it is known 'that the shared use of flowers leads to pathogen transmission between plants and their pollinators and that floral traits may influence disease transmission' (Najberek *et al*., 2023). Such pathogens could be microbial, fungal or viral and a bee brushing past the anthers can inadvertently be dislodging a parasite, microbes, fungal spores or virus particles. These can then be acquired by the next bee that arrives at the flower which may be from a different hive, colony or species.

The long balsam flower lifetime and the quick replenishment of the nectar mean that the overall number of visits to each flower is high (250) (Vervoort *et al*., 2011). But as well as having the potential for direct infection, the bee-favoured balsam flower is also a route for the varroa mite and other ectoparasites to switch between hosts either by choice or by accident if they are brushed off. This creates further problems as the mites and any viral loads can switch between colonies or bee species, indirectly infecting wild bumble bees. This is more likely to happen on a bee-receptive flower with high visit numbers - Himalayan balsam.

Common carder bee exiting Himalayan balsam flower, River Lyd 12/9/2024

The big attraction posed by a stand of Himalayan balsam presents another potential issue in that the bees are not getting a varied diet if they are relying on this monoculture and so may become more susceptible to the pathogens to which they are being exposed. 'Pollinators in monofloral crop areas, with reduced floral diversity and nutritional resources, are more susceptible to diseases' (Gonzalez *et al*., 2024). Conversely, 'colonies with pollen of diverse botanical origins showed reduced viral infection levels, suggesting that an adequate nutrition is important for the development of healthy colonies' (Antunez *et al*., 2015).

The effects go further than the bees and one study found that two of the most dangerous fungal pathogens, *Botrytis cinerea* and *Fusarium graminearum* were facilitated in their transmission by *Impatiens glandulifera* invasion, potentially decreasing crop production and increasing economic losses (Najberek *et al*., 2023). The former affects crops like tomato, cucumber and courgette as well as grapes, raspberry and strawberry, whilst the latter infects both wheat and forage maize. The potential for agricultural economic loss should surely lead to further study in this area as well as providing several added incentives to control Himalayan balsam at the very least, acting on the precautionary principle, until any evidence to the contrary is presented.

Himalayan balsam adjacent to forage maize, River Lyd 7/9/2024

Himalayan balsam - Summary of problems

- Detrimental shading effect on native plants of Himalayan balsam as the tallest annual present in the UK.
- Himalayan balsam plants will take advantage of nutrients lost to the river and its silts.
- Larger plants will throw more shade and produce more flowers and seeds and be able to eject them further from a greater height.
- Allelopathic interference of Himalayan balsam with native plants and trees.
- The high concentrations of the phytotoxic alkaloid naphthoquinone from the extrafloral nectaries as well as from the nectaries, leaves and roots are likely to be damaging to aquatic environments with both phytoplankton and zooplankton (for example, *Daphnia* sp.) potentially affected.
- Himalayan balsam takes up space in or by a river when living or dead, contributing to greater flood risk.
- The degradation of the dead plants then takes oxygen from the river on decomposing, releasing nutrients into the river on its breakdown.
- Distraction of bees from pollinating native plants.
- The loss of native plants or change of season of native plants has a knock-on effect on insects and consequently on insectivores, omnivores or carnivores like brown trout.
- Disadvantage to bees from the rich/quick nectar ingestion and single species pollen source.
- Disadvantage to hive by providing late season honey crop to people instead of storing food for winter.
- Disadvantage to bees' health from reducing the variety of plant species that they use.
- Likely transmission route for varroa mite and its associated detrimental bee viruses.
- High visitation rate to Himalayan balsam flowers increasing the likelihood of transfer of varroa mite to the flowers and so between honeybees and, therefore, between hives, but also to wild bee species and bumble bees.
- Likelihood of transfer of viruses and parasites between bees of the same and different species via the much visited bee-receptive balsam flowers.
- Likely transfer of fungal pathogens to agricultural crops, including wheat, forage maize, grapes, tomato, courgette and cucumber via the balsam flowers.

Siltation

- Increase of silt that can cover fish spawning beds.
- The silts increase water turbidity which is a problem to fish.
- Increased water turbidity inhibits aquatic plant growth, limiting oxygenation of the water and reducing the chances of shelter for insects and fish.
- Reduced aquatic plant growth limits the ability of channelling water flow between plant clumps that cleans the gravels that are potential fish spawning areas.

Himalayan balsam - Methods of control

The options for control include grazing, herbicide use, mechanical or manual cutting and hand pulling the plants. The herbicide option is usually dismissed as so often the balsam stands are by a watercourse and as there are alternative methods that can be used for control, it is not usually worth the risk. At the moment, the non-chemical control options for the species are grazing, manual, either hand pulling the whole plant or cutting the stems with a hand implement or mechanical, for example, using a strimmer (string blade) or brushcutter (hard blade) or biological.

Mechanical - Strimmers may work for balsam only with its relatively soft stem early in the season, but as soon as the balsam is mixed in with bramble, bracken and nettle, a brushcutter with a hard blade such as a 'scrub blade' is going to be a better option. The only exception might be where the flint-like chert predominates and a string blade would be safer as the chert may flake dangerously. It is recognised that the scale of the problem is such that most farmers and landowners will need help to clear it not least because the timing requires it to be controlled from May to August when they are likely to be busy with farming operations.

Manual - Pulling up the Himalayan balsam stems carefully by hand ensures that the whole plant is removed and that any remaining part should not regrow. If the stem breaks when it is pulled, every effort should be made to reach and remove the root and any remaining section of stem. The main advantage of this approach is that it is selective and so other non-target plants can be retained intact. Once removed, the balsam stem should be crushed or broken at its base and the remainder left draped over a branch or a bramble to desiccate.

If there is a significant stand of balsam it may not be possible to hang up all of the stems to dry out and these should then be heaped up on the ground but out of the flood reach of the watercourse. For completeness, the balsam heaps can also be trampled or cut up to ensure that no intact plants, particularly on top of the pile, can make it through flowering to seeding. There may still be some survivors on such a pile but these heaps can be checked on another visit to ensure that no flowers survive to set seed. If the stand of balsam is beyond the means of an individual or group to tackle, a brushcutter can be used to clear that section.

Below: Himalayan balsam control with volunteers. Photo: Piers Griffin

Getting the INNS messages across and recruiting volunteers

However, because of the likelihood of balsam plants flowering at different times and that some may be missed on any one visit, a second and even a third visit may be necessary in any one year to make sure a section is clear of balsam. The golden rule is not to take on more than you can defend in that year.

Once any large stands of balsam are cut for a year or two, they should be able to be controlled subsequently by hand pulling as the residual seed bank should have been exhausted. So, it may take two years of control to see a big change in the balsam prevalence.

Given the scale of the catchment, it needs to be broken down into more manageable units, but even the tributary split (Table 1) leaves several very large sections and a mammoth logistical challenge to any organiser/s of balsam control. As with the Japanese knotweed, the starting point is getting the landowners' permissions to visit and agreement to tackle any balsam found.

One problem is that the rivers can't really be controlled sequentially as there would be little beneficial effect seen downstream if even one river remained uncontrolled. This means that, perhaps within two or three years, there should be work started on controlling balsam on all of the watercourses and other areas where balsam will be found within the catchment.

Once there are large monoculture stands present in any catchment it is likely that they will be encountered sooner rather than later by birds or animals. Once used to feeding on it, they may end up seeking it as a resource which will guarantee its spread further afield.

If balsam work can be encouraged in all the rivers of the Tamar catchment and this may take some years to get to that point, it would then be worth trying to encourage the next neighbouring catchments such as the Camel and the Torridge to consider restarting the efforts made in those areas too.

Himalayan balsam - Biological control

Work started on this potential line of control in 2006 when 'surveys to look for suitable natural enemies were undertaken from 2006 to 2010 in the foothills of the Himalayas in western India and Pakistan.' 'A range of insects and fungal pathogens were found to cause significant damage to *Impatiens glandulifera* although the insects were found to have too broad a host range. 'A rust fungus *Puccinia komarovii var. glanduliferae* was observed to infect Himalayan balsam throughout the areas surveyed, causing significant damage to infected plants both at the seedling stage (stem infection, usually leading to plant death) and leaves of maturing plants and, therefore, was prioritised for further study.' (Varia *et al*., 2016).

Much more was learnt about this rust which was new to science and so had to be named, along the way, including that all five of its life stages occur on *Impatiens glandulifera*. After a long quarantine in India and extensive tests in the UK to make sure that it was not going to damage other species or even other closely related plants in the same family (such as the horticulturally important busy lizzies), this rust from India was released into test sites in the UK in 2014 and a second strain from Pakistan was released in 2017. Subsequent molecular level analysis has established that there were at least three different introductions of Himalayan balsam into the UK and these rusts only affect the one in the north of the UK (CABI, 2023).

Subsequently, one strain of the rust collected from the Astore District, Gilgit-Baltistan, Pakistan has been established under quarantine and its pathogenicity and virulence to Himalayan balsam in the UK is being determined (CABI, 2023).

However, given that this rust overwinters in the fallen leaves of the balsam plants, it is difficult to see how effective this could be in a riverine context where winter floods are likely to flush away much if not all of the previous year's stems and leaves unless they are caught up in bramble or similar. Away from the rivers, on sites such as railway embankments and in wet woodlands, when a practical product emerges, it may yet prove an invaluable addition to the balsam control toolbox.

***Puccinia komarovii* var. *glanduliferae uredinospore* infection in a Himalayan balsam (*Impatiens glandulifera*) leaf (CABI)**

Himalayan balsam - Next steps

1. Employ an organiser to advise and assist in the formation of landowner-led volunteer groups for each river.
2. Establish ownerships of both banks.
3. Check whether any rivers could be tackled by supporting existing/planned work.
4. With landowner support, offer what help is available for INNS project work for that river, whether it is in the form of grant aid or help with contractors if funds permit for either Himalayan balsam or Japanese knotweed.
5. For each river, encourage and support one or more landowners to host an INNS meeting of the riparian landowners.
6. Liaise with any existing local volunteer groups in case they could to adopt a river for balsam work or help with other aspects of INNS work.
7. The guiding principle should be to only take on what you can defend that year given the number of people involved.
8. In the first year, the river needs to be walked by the group formed to establish what problem species are where.
9. Start manual control with volunteers in late May or early June to extend the season. Revisit in July, August and early September.
10. Balsam control needs to start at the furthest upstream outcrop but that should not preclude others working on balsam further down the valley if their stands have not been acquired from the river's flooding.
11. Any disturbed ground whether from pond creation to forestry operations are as likely to acquire balsam from vehicles or animals and so can and should be tackled independently of what may be happening on the main river.
12. If accessible by tractor, large stands can be cut with a swipe. If not accessible by tractor, contractors may be required to cut any extensive stands of balsam for a couple of years until it is at a level that volunteers can tackle adequately.
13. Funding will be required for brushcutter work where there are stands of solid balsam or balsam in bramble, bracken or nettle.
14. Increase engagement (landowners, volunteers) have flyers that can be given to anyone interested in helping or being helped. The flyers should be QR coded to facilitate the link with planned balsam control days.
15. Establish a website that can link to any websites set up by individual river groups or support those and others without their own website with up-to-date information on planned balsam or other work day dates as well as any other events.
16. Up-to-date information on the species, the need for control and the methods of control can all be included.
17. The website should also give illustrated feedback on work carried out, both through the season and at the end of each year .
18. The website can encourage the recording of the INNS found/tackled.
19. Map what is found in a consistent way so it can be compared to subsequent years. Himalayan balsam is more difficult to represent accurately with a point record so consider using increasing dot-size to represent 1s, 10s, 100s, 1,000s, 10,000s.
20. By agreement, data could be shared with Records Centres and the NBN.

American skunk cabbage

American skunk cabbage
Lysichiton americanus

American or Western 'skunk cabbage' (*Lysichiton americanus*) is an herbaceous perennial plant of the Araceae family native to western North America where it is found in swamps, wet woodlands and along streams. It was first recorded 'in the wild' in Devon at Lydford Gorge in 1980 and in Cornwall at Cotehele in 1979. However, since then it has escaped from gardens and begun to colonise several rivers in the catchment (Figs. 17 and 18). For example, it was being recorded on the Carey near St Giles on the Heath by 2017 with plants being dug out almost every year since to 2023 (Marshall, 2023). This survey found significant numbers on the River Lyd below the original source which has now been cleared but has left the legacy of many plants downstream. It was banned from sale in Europe by 1 January 2016.

The plant is striking from the first emergence of a yellow petal-like spathe in the early spring (February, March, April) right through to the plant in full leaf by April, May or June. The leaves can be more than a metre in length and 50 cm wide and when the plants are closely spaced their combined leaf coverage lets little light in so shading out other plants. The flower stalk or spadix carries approximately 500 flowers which start female and later transition to male giving the best chance of cross pollination first but making sure of self-pollination if no other plants are available nearby. The plant and the flower have a pungent and strong smell to attract insects so giving it the 'skunk cabbage' epithet. It is also known as the 'swamp lantern'. Some of the flower stalks bend and so often the seeds end up on or in the ground nearby which may result in multiple daughter plants close to the original. Others near water will be floated away when the spadix disintegrates later in the summer by July or August.

Mature plants have a deep vertical root of 30 cm or more from the base of which multiple horizontal rhizomes emanate. Plants are growing for three years or more before they throw any flower spikes and a seed bank can be established with seeds said to be viable for up to eight years. The yellow petal-like bract of the American skunk cabbage helps to protect the flower spike before it emerges and then serves to attract insects to the flowers.

American skunk cabbage 4/4/2023

American skunk cabbage - Records

Fig. 17 American skunk cabbage - Tamar catchment 2023 to 2024

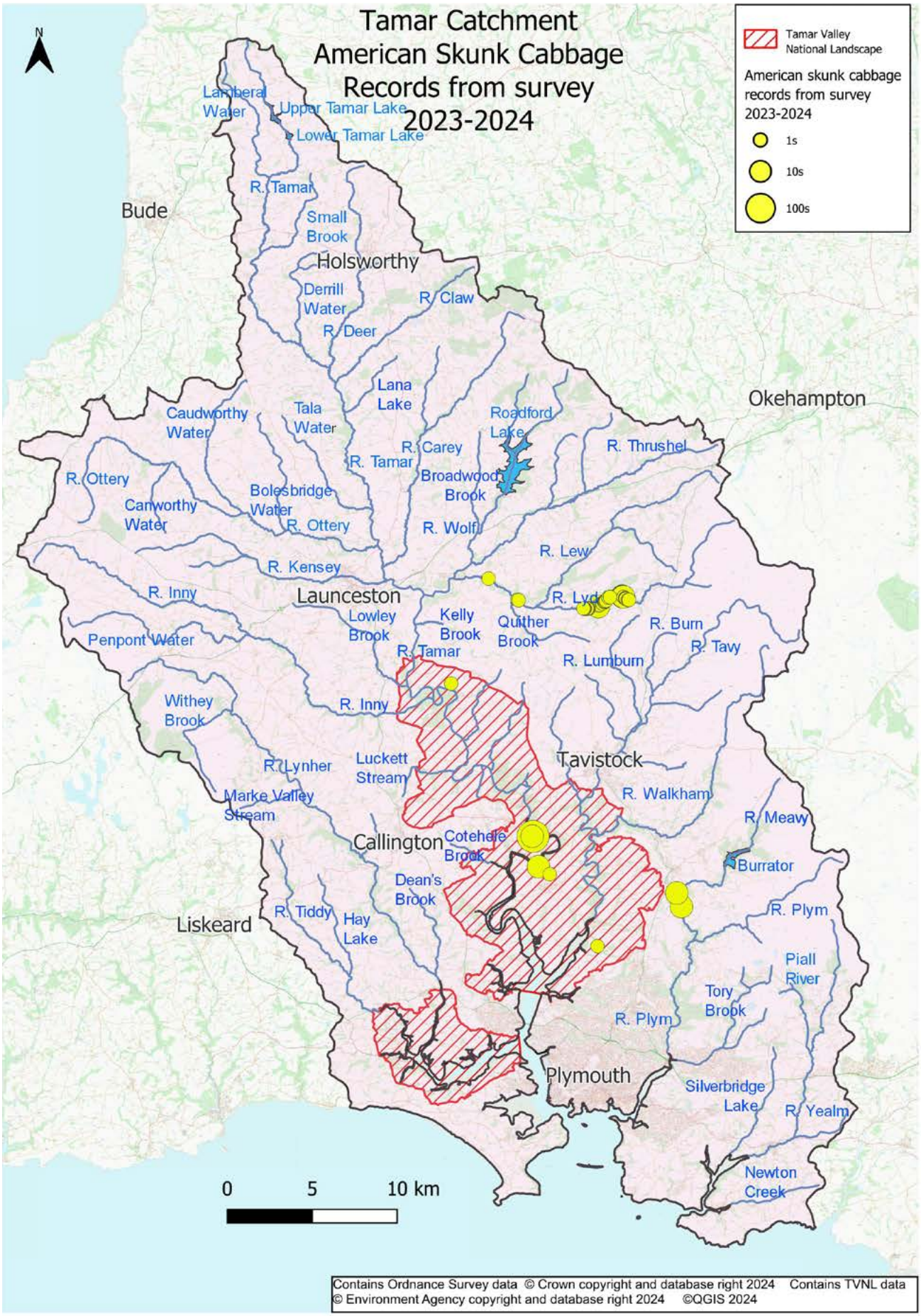
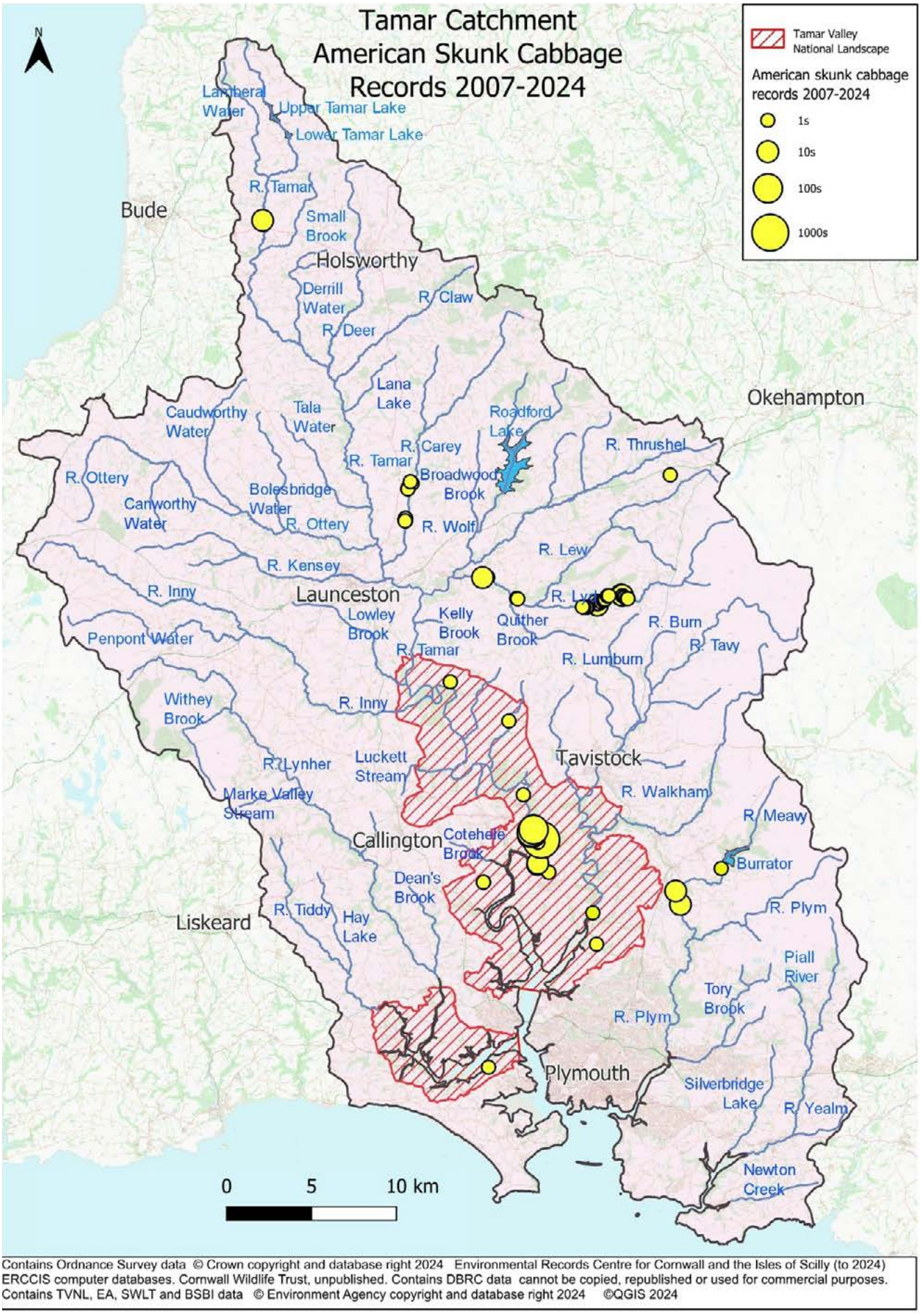


Fig. 18 American skunk cabbage - Tamar catchment 2007 to 2024



American skunk cabbage Methods of control

Mechanical - Digging it out is an option, although in silty mud this is likely to obscure plants quickly as the ground gets churned and subsequent visits will be needed even to get all of this year's plants. This is very time consuming and it is still not 100% clear whether there is regrowth from small sections of the rootlets which are likely to get dislodged from larger plants as the main vertical root is dug out. It is also likely that some of these will be lost to the watercourse accidentally. It would be useful to know whether these could result in new plants or whether they can only do this if still attached to the much larger vertical root that acts as the main energy store. However, by the time you are dealing with young (1st, 2nd 3rd year) plants, digging out is effective as many can be removed intact once the soil is lifted with a fork, for example. Plants that are dug out need to be cut from their roots and then all the material stored off the ground in a stack perhaps laid on dead branches, out of contact with the soil.

In ground that is not wet, adding water while the plant is dug out has been found to allow more of the plant's vertical root and rhizomes to be extracted intact. If the vertical root is cut through, it is likely that the horizontal rhizomes attached to the remainder will be able to create further plants in subsequent years.

Digging out American skunk cabbage with drain spades

Chemical - One application of a glyphosate-based herbicide can subdue even the large individual plants. They do have quite shiny leaves though so a suitable surfactant will be needed. The herbicide would be best applied when the plant is in full leaf, perhaps from May. Return visits will be required in subsequent years as, when well-established in a large cluster of plants, some leaves will be overlapping whole but smaller plants and these will then be free to thrive if not treated in following years. After three years or so, it may be simpler to dig out seedlings rather than trying to find them to spray. As these plants are likely to be on or near a watercourse, a licence from the Environment Agency would be required.

As spraying is likely to take place after the flowers have been fertilised, it will be worth removing any flower stalks before the spray treatment to ensure that there are no viable seeds from that year's flower crop. They are best left on site but off the ground and out of the flood reach of the watercourse that they are near. One disadvantage of spraying is that the large leaves of the mature plants will be sheltering many smaller plants and seedlings and these will be ready to take over in subsequent years. So, it may take some years of spraying before all the plants are actually reached with the herbicide.

American skunk cabbage - Next steps

1. Licences should be applied for to cover the known sites identified.
2. Take fixed point photographs before work starts on each of the main sites. Repeat each year as this will give a visual record of progress. Dates on or with the photographs are a useful part of the record.
3. Contractor should be engaged to spray large stands from May or June.
4. If spraying is not arranged for the current year, all the sites should have flower spikes removed from all of the plants to save any further seed dispersal. Cutting off the flower spike is only a stop gap measure and can only prevent that year's successful seeding.
5. After a couple of years, any American skunk cabbage spraying could be alongside Japanese knotweed work on sites with both, but would need to be at the start of the Japanese knot weed season (June or July) as otherwise American skunk cabbage leaves may be dying back, particularly in a hot year.
6. Sites where digging out is required could be done in spring (March, April, May) or autumn (September, October) and with volunteers.
7. A volunteer co-ordinator would be required if digging out is done other than with contractors. Digging out is labour intensive but can be outside of the balsam season.
8. The seed bank is said to be seven to eight years, so all the sites will need to be revisited early enough in the year for action to be taken

Below: The American skunk cabbage problem in wet woodland 23/4/2021

Strategy

Whilst it is clear from the remedial action necessary for each of the four target species what needs to be done, they are all perhaps at different stages in the process. It has taken more than 20 years of giant hogweed control to get to the present position and much has been learned from that experience. Fig. 19 illustrates the combined records for all four species from the 2023 -2024 field surveys.

Given the disproportionate costs of tackling giant hogweed, Japanese knotweed and American skunk cabbage compared to controlling Himalayan balsam (with no guarantee of success on the latter) it might make more sense to launch an INNS control programme that would tackle all of the first three species for the whole catchment but only start on a limited subset of rivers for Himalayan balsam control. Given that the work on Himalayan balsam is likely to be so reliant on volunteers, this would gauge the waters by setting up what is needed say for two or three rivers initially (such as the Lyd, Ottery and Tavy) to see if there is the necessary response and goodwill to extend the Himalayan balsam control work on to other rivers in the catchment.

Funding should be sought from all sources, but with the aim of making a permanent contribution to the health of the river and its water. The owners themselves and corporate interests such as house builders or the water company could be approached too. It doesn't stop the government bodies and agencies from contributing as much or as often as they can. Obviously, large grant bids to the National Lottery Heritage Fund (HLF) are relevant here, but they are unlikely to be forthcoming for an INNS-only project in this area at this time. West Cornwall and North Devon are currently the priority areas for their attention.

An INNS programme should aim not just at the straight reduction and eradication of the INNS where possible, but at education in the broadest sense so many more people of all ages are more knowledgeable about INNS and what they may be able to do directly or indirectly to help their river and its water quality.

A full-time position for the INNS control should be established to help run different aspects of the work on these four species. Given the size of the overall Tamar catchment, it would make sense to break it down into more manageable sections (see Table 1, Page 17). This will make it easier to plan and to administer works whether carried out by paid contractors, willing volunteers or a mix of the two.

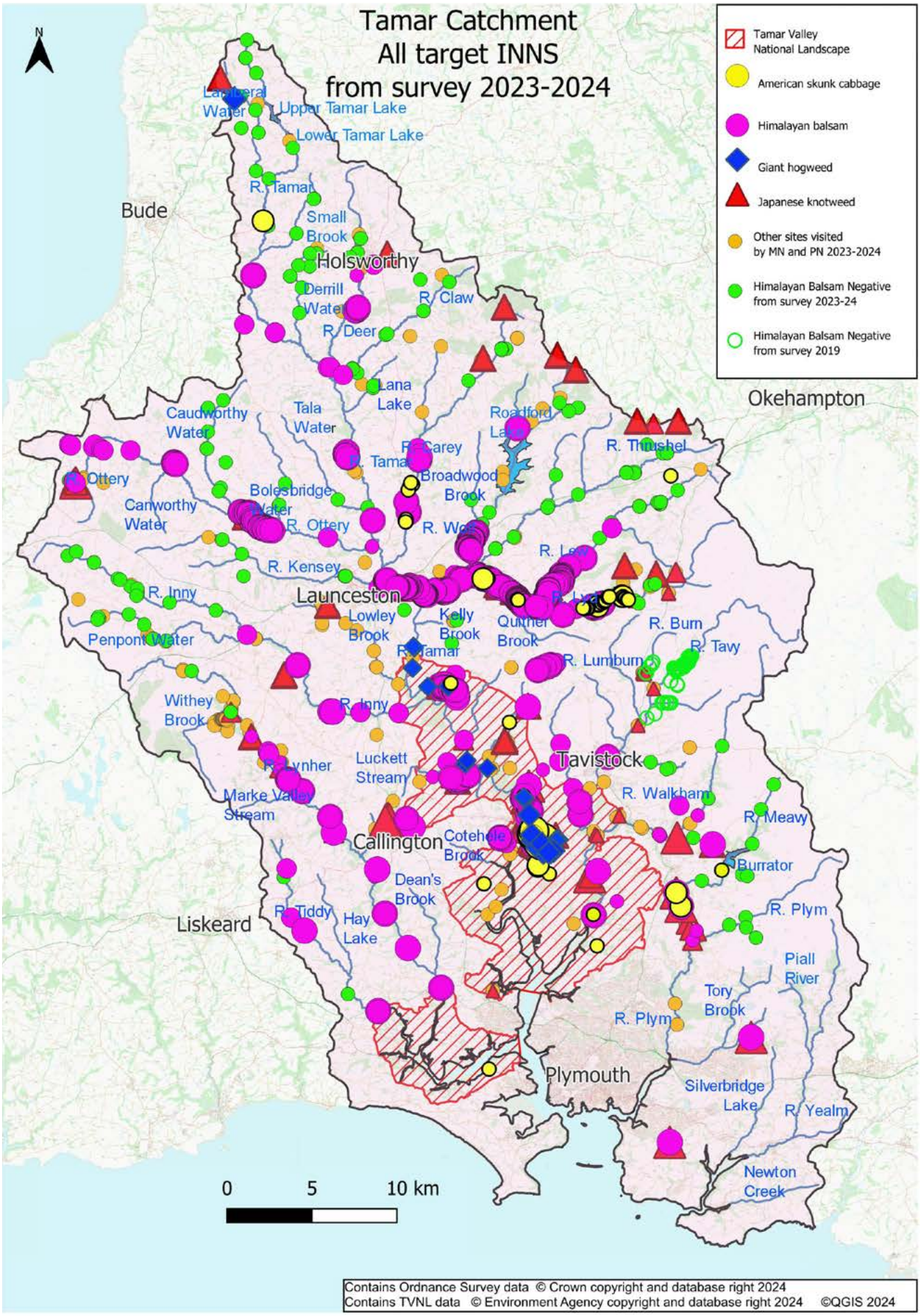
When funds are forthcoming, there should be a plan to keep the **giant hogweed** work running on a similar basis, preferably with the same contractor but encouraging more people to help carry out the spring surveys.

Japanese knotweed control work should be set up on riparian and nearby land. This can be with contractors or a combination of contractors and training volunteers to carry out the work. A blanket licence for this work will need to be applied for from the Environment Agency, if Natural England are in agreement on affected designated sites.

There should be liaison with both Cornwall Council and Devon County Council on their part in dealing with the roadside stands of Japanese knotweed. This is crucial because unless Devon County Council is prepared to pull its weight from now on, it is difficult to see how Japanese knotweed can be kept out of the river system. Other knotweeds such as lesser knotweed, Himalayan knotweed, giant knotweed or hybrids should be treated in the same way as Japanese knotweed wherever encountered such as at the roadside or in the river corridor.

Landowners should be encouraged to contribute to the costs of controlling Japanese knotweed if appropriate, but as with giant hogweed, people should not be put off by the cost if it can be covered in a different way. It is more important that the work is carried out than losing goodwill and risking the plants being spread further.

Fig. 19 Combined records for all four target species from the 2023 -2024 field surveys



American skunk cabbage control work should be set up on the same basis, with spraying the large concentrations of plants initially on Lower Tamar floodplains and at other more dispersed sites on the Lyd, manual digging out perhaps with volunteers for the river stretches below the Lydford Gorge National Trust site and spraying the off-river clusters in Lydford Forest and nearby marshy grassland, with the owners' agreement and permission.

Whether or not it is planned to control **Himalayan balsam** in the catchment, there would appear to be enough information of concern regarding its negative effects on both honey bees and bumble bees, on water quality through its release of phytotoxins, and on its potential role in hosting/transferring a number of pathogens of economic crops to suggest that it would be timely to instigate research into all these areas. If the negative effects are measurable now, then changes would be likely to be seen if Himalayan balsam was able to be cleared, first at a river scale and then at a catchment scale. This could tie in with both water quality monitoring (for the phytotoxins concerned), insect and fly life monitoring, bee health at a hive/colony level and crop health. If it is well planned, such work could help to get farmers, landowners and beekeepers on side, and if the results are significant at a catchment level, this would likely result in Himalayan balsam control work being restarted in the neighbouring river catchments. In the long run, this would help prevent its return to the catchment.

Landowner-led Himalayan balsam control groups should be set up on as many of the Tamar tributary rivers as possible. There is not likely to be enough project funding available to consider simultaneous contractor-led working over the 24 or more rivers and tributaries that constitute the catchment. Even if there were funding initially, it is unlikely it would be sustainable for the timescales needed to clear the rivers to an acceptable level.

Where project funding would help is in kick starting initial efforts on any river system where it is known that there are large single-species stands of balsam that could be cut much more effectively than hand-pulled by volunteers. The middle ground here is to supply the necessary equipment and personal protective equipment (PPE) and to train the volunteers to use the brushcutters necessary to control large stands of balsam effectively.

Another advantage though to encouraging more local involvement by volunteers is that there could be a greater reconnection of people to their local river and understanding and acting on this INNS aspect of the river's health. This method also means that other INNS could be tackled where they are considered a local nuisance. Working through landowner-led groups would also allow an interchange of knowledge in both directions which would be likely to benefit all parties.

Recent good examples of community involvement on INNS, water quality and the wider considerations are the work carried out by both the Yealm Estuary to Moor group on the River Yealm https://yemcorridor.com/ (YEM, 2024) and the Plymouth River Keepers on the Tamerton stream (PRK, 2024) **https://issuu.com/westcountryriverstrust/docs/prk_final_report_march2024_public_external**

Timescales for effective control - whole catchment

Species	7 years	25 years
Giant hogweed	Very Likely	Highly Likely
Japanese knotweed	50% done	Very Likely
Himalayan balsam	Unlikely	Possible
American skunk cabbage	Very Likely	Highly Likely

Table 3 Tamar INNS Control - likely monthly activities calendar

Species Month	Giant hogweed	Japanese knotweed	American skunk cabbage	Himalyan balsam
January	Scrub control to allow access	Find land ownerships Liaise with both County Councils on knotweed control Scrub control to allow sprayer access	Find land ownerships	Scrub control to allow access Recruit volunteers
February	Seek landowner permission	Seek landowner permissions	Seek landowner permissions	Landowner permissions Recruit volunteers
March	Survey (Apply for licence/s)	Survey Apply for spray licences	Survey Apply for spray licences	Landowner permissions Plan volunteer visits schedule Recruit volunteers
April	Survey/control Digging out plants	Survey/invitations to tender	Survey/spray control Digging out plants	Survey Recruit volunteers Submit newspaper and magazine articles
May	Control Digging out plants	Arrange and let contracts Make photo record of stands	Spray control/ removal of spadix as last resort for that year	Run volunteer work parties Contractor brushcutting balsam at selected sites Submit newspaper and magazine articles Recruit volunteers
June	Control/survey Check for reports from all sources and respond	Contractor herbicide control	Spray control	Run volunteer work parties Contractor brushcutting balsam at selected sites. Get TV coverage Submit newspaper articles Recruit volunteers
July	Check for reports from all sources and respond	Contractor herbicide control		Run volunteer work parties Recruit volunteers
August	Update records, maps and website with what has been found and done	Contractor herbicide control		Run volunteer work parties Recruit volunteers
September		Contractor herbicide control survey	Control by digging out	Host landowner meetings to establish volunteer groups
October	Help plan follow-on funding	Survey Japanese knotweed and lesser knotweed (now flowering)	Control by digging out Help plan follow-on funding	Enter new records, update maps Report on year's work Advise volunteers
November	Help apply for funding	Liaise with both County Councils on knotweed control Update records, maps and website	Help apply for funding Update maps	Write articles; Talks to groups, Keep/recruit volunteers Apply for funding
December	Scrub control to allow access	Scrub control to allow sprayer access	Map records and sites	Collate photos, plan next work, apply for funding

Costs

Giant hogweed

Annual survey and control costs - one contractor + volunteers £10,000 for 5 years, reducing although even without treating any plants, the search survey to look where they used to be and where they might likely be is still labour intensive.

£10,000 pa

Japanese knotweed

Riverside Japanese knotweed estimate of 1,500 stands at perhaps an average five stands per site, 1.5 hours per site, four sites per day, twenty stands per 2-person day. 75 x 2-person days @ £600 per 2-person day = £45,000, potentially reducing but in practice more new sites will be found for a few years and so probably not reducing the base cost figure for three years or so. Roadside Japanese knotweed would be noted and the record passed on to the respective county councils whose responsibility it is. Japanese knotweed on or over the adjacent boundary needs to be tackled too either by the landowner or by agreement, by those treating Japanese knotweed on the verge. There would need to be firm assurance from the county councils that this roadside Japanese knotweed burden would be tackled as the verge or hedge cut material is likely to be contributing to the problems along the rivers as the Japanese knotweed pieces will ultimately be washed into them.

£45,000 pa

American skunk cabbage

Initially work on this plant would best be done with contractors particularly on the sites with hundreds or even thousands of skunk cabbage plants present. In later years a paid organiser and trained volunteers could take over this role once the numbers are much reduced, but they would still need to be trained and have suitable equipment and PPE supplied. Realistically it might be better if volunteers were asked to deal with digging out new seedling plants once all mature skunk cabbage plants have been controlled with herbicide treatment. Contractor spraying on estimated 7,000 plants on multiple sites, 500 plants per person day, 14 days @ £300 per day = £4,200. Survey - 3 days = £750. £4,950 per year for at least 5 years, reducing by years 6 to 8.

£4,950 pa

The costs proposed for the work on giant hogweed are based on the existing spend and so are likely to be the most accurate. The true costs for Japanese knotweed and American skunk cabbage are going to depend on how many more stands of these plants are found when a fuller knowledge of the catchment is gained. For skunk cabbage plants in the edge of the river, it may be preferable to dig these out rather than spray them to minimise herbicide loss to the river. This would take longer though than herbicide treatment.

Himalayan balsam

Whilst it may be possible to pay enough contractors to concentrate solely on Himalayan balsam control, using a mix of brushcutter work and organised volunteer effort, there are disadvantages in that only paying people for half the year is likely to lead to the loss of at least some of the 10 or more people that would be needed to cover the 39 river sections into which the catchment could be sensibly divided. Costs of £200,000 or more per year could easily be envisaged and little in the way of legacy achieved once the funding falters.

Instead, as part of a Tamar INNS Programme, work on Himalayan balsam might best be concentrated on setting up and supporting river management groups that could undertake a wide range of work on each river from water quality monitoring to balsam control and bankside tree work. Ultimately, this could provide a link between farmers/landowners and the natural world and what might be done to help it and them. Whilst keen local organisers would be essential, help could be offered on many levels, from arranging venues for initial meetings to organising minibuses for volunteers.

Dorchester Mid-Week Volunteers

A full-time paid manager (£30-£35,000) would be needed to run the Invasives Programme. They would be responsible for planning the contract work and for finding local organisers for river groups and helping them to set up balsam control for their local river/s. Training would be needed at least for the organisers and probably for other members of their groups. This might need to include: first aid, minibus driving, plant identification, brushcutter work, chainsaw courses, herbicide spraying. Training would also attract and allow younger people to help but with the acceptance that they are likely to be more employable afterwards and so might only be able to help for a limited period. However, there could clearly be a link to any contracted control work for either Himalayan balsam or Japanese knotweed.

Two or three separate groups could be set up from the first year with equipment shared. But realistically, a core of willing volunteers is much more likely to come from the towns than the wider rural landscape. For this reason, it would be important to include a minibus or use of a minibus as part of the programme. It wouldn't have to be new, but it would need to be properly maintained to ensure safety and minimise the risk of breakdowns. This could be branded to advertise the work being done and as another way of encouraging people to volunteer.

Local meetings could be advertised at a parish level, with talks on the rivers, water quality, invasive non-native species or other related topics as a way of raising interest and volunteers to form regular groups to help tackle the balsam from the following summer.

It will soon become clear if this is going to be a viable route and whether the Himalayan balsam in more rivers could be tackled in the same way by encouraging and supporting more river management groups in the areas not yet tackled. Ultimately, at least 7 or 8 groups might be needed to help clear balsam from all the rivers in the overall catchment, but these would need to be built up over time. Also, they would very soon be able to help each other with skills and equipment so each successive group started should get more of a helping hand, with information and advice on what works and the best way to proceed.

What is known from the experience of other groups is that for many sites, the balsam will be in dense stands and it will be much more efficient to cut these than pull them. So, there will be a need for either contractor brushcutting or for some or all of the volunteer groups to be equipped with brushcutters, suitable PPE and, of course, training on how to use them. As a general rule, it would be better to keep brushcutting work separate from volunteer balsam-pulling days both from safety and noise considerations. However, modern electric strimmers might provide a realistic level of mechanical support for areas with stands of balsam or balsam in bramble and or bracken, and these are quiet enough to work in roughly the same area as the other volunteers. Alternatively, any required brushcutting could be done on separate days, with two or more people just concentrating on that.

In Dorset, one Community Interest Company (CIC) group that consistently fields good numbers of volunteers (15 to 20 per week) has bought its own minibus and does a regular route from the nearby town to collect its workforce. It has also trained people on both brushcutters and chainsaws and has enough equipment to field half a dozen operators if needed.

£74,500 pa

Table 4 Himalayan balsam control costs

Himalayan balsam control costs (£)	Year 1	Year 2	Year 3	Year 4	Year 5	5 Year Total
Brushcutter training (x 6)	2,400	2,400	2,700	2,700	3,000	13,200
Brushcutter equipment (x 6 petrol)	7,000	7,000	2,000	2,000	2,500	20,500
Chainsaw training	1,500	1,500	1,650	1,650	1800	8,100
Chainsaw equipment	2,500	2,500	2,800	2,800	3,000	13,600
Brushcutter equipment (x 3 electric)	4,500	4,500	4,950	4,950	1,500	20,400
PPE (x 6 pa)	1,500	1,500	1650	1650	1800	8,100
Brushcutter mowers	3,000	3,000	300	300	300	6,900
Fuel	1,000	1,500	2,000	2,000	2,000	8,500
Public liability insurance	1,000	2,000	2,000	2,200	2,200	9,400
Minibus	20,000	2,000	2,000	2,500	22,000	48,500
Minibus training	900	900	1,200	1,200	1,300	5500
Minibus insurance	1250	1350	1450	1600	1700	7350
Pickup truck	15,000	1,500	1,500	1650	18,000	37,650
Light industrial unit at Launceston	25,000	25,000	27,500	27,500	30,000	135,000
Hall hire	400	600	800	500	500	2800
Contractor assistance	5,000	5,000	6,000	6,000	5,000	27000
Totals	**91,950**	**62,250**	**60,500**	**61,200**	**96,600**	**372,500**

INNS programme manager

Taking on an INNS programme manager would be a starting point for all of the subsequent work on these four species. Their tasks could include:

- Recruit Volunteers
- Recruit local organisers
- Seek landowners permissions
- Collate landowner database
- Host landowner meetings to establish volunteer groups
- Undertake INNS surveys
- Train organisers in running volunteer workdays
- Submit newspaper and magazine articles
- Get TV, Radio and Podcast coverage
- Organise contractor working
- Organise herbicide licenses
- Collate INNS records
- Produce GIS maps
- Talk to groups
- Help with funding applications.

£32,500 pa

INNS Programme costs summary

Table 5 INNS Programme costs summary

Item	Average cost per year (£)	Total cost after 5 years (£)
Giant hogweed	10,000	50,000
Japanese knotweed	45,000	225,000
Himalayan balsam	74,500	372,500*
American skunk cabbage	4,950	24,750
INNS Programme Manager	32,500	162,500
First aid courses	1,800	9,000
Total	**168,750**	**843,750***See Table*

**See Table 4 for a breakdown of the Himalayan balsam costs*

After 5 years, there is a good chance that the giant hogweed monitoring work can be covered by the survey/monitoring for Japanese knotweed, which, in turn, should be much reduced in both number of sites and stand size. The American skunk cabbage sites would still need checking only at the original sites, particularly the ones where the plants numbered in hundreds or even thousands initially.

After that 5 years, there is a high likelihood that both giant hogweed and all the known American skunk cabbage will be cleared within the catchment. All of the Japanese knotweed sites will be much reduced and a good proportion cleared completely. Some of the smaller and less affected rivers may even have been cleared of balsam in that time. Most of the larger rivers will still have significant stands of balsam and it will be some time before the lower reaches of the bigger rivers can be tackled without the near certainty of re-invasion by seed from balsam still upstream.

The cost of attempting to control Himalayan balsam (Tables 4 and 5) looks disproportionate until you consider what has been spent already on giant hogweed and, in Cornwall at least, on Japanese knotweed. Although it may seem high, there are few labour costs included as it is still relying on a huge amount of goodwill and that the right people can be found to lead a number of teams of fellow volunteers. They would need the right motivational skills to encourage people to turn out in all weathers, once a week for most of the summer at least. Doing the same balsam work with contractors would be considerably more expensive and carry no guarantee of better results. The costs of setting up volunteer groups to be self-sufficient would level out after 5 or 6 years and then the ongoing costs of insurance, training, fuel and equipment repairs or replacement could likely be covered by a more nominal annual figure of £15 to 20,000.

It is possible, if a decent level of effort (10 to 20 volunteers per group, one day a week from mid-May through to September) is maintained consistently, that most of the rivers of the Tamar catchment could be free of Himalayan balsam within 10 to 15 years. Subsequently, there would still be a monitoring effort required to continue long after any eventual eradication of Himalayan balsam is achieved.

Monitoring should be part of what such a programme is trying to achieve anyway, with more attention being paid to the river by the local population on water quality, water quantity and the varied wildlife that it can contain and support on its way to the sea. The return to the local farmers and their families could be a valuable link to a world from which they may have become increasingly isolated and unfriended. Advice and ideas could be exchanged without partiality, and farmers and landowners encouraged to engage with opportunities offered by a range of agencies and opportunities with which they may not all be familiar.

As well as applying to likely sources (such as the Water Restoration Fund) for project funds, it would make sense if all the potential stakeholders included an element of INNS work in every project bid that was submitted to help ensure that the work can be kept going in the long term. There are, of course, many more INNS out there and so the work would not finish with the removal of any or all of these four named species. But hopefully a system would be in place that can recognise the potential threats early enough to make it easier for farmers and landowners to get the help they need to remove them and for the planned volunteer groups to get the support and funding they need to keep running well into the future.

Contractor treating American skunk cabbage in amongst lesser knotweed

Potential funding sources

Government funding

Agri-environment schemes

Countryside Stewardship Higher Tier – SP4: Control of invasive plant species supplement supports the active management and eradication of particularly severe infestations of invasive non-native species that are damaging a feature of interest, including Japanese knotweed and Himalayan balsam. Typically 5 year agreements (can extend to 10 or 20 years); £380/ha (2024).
https://www.gov.uk/countryside-stewardship-grants/control-of-invasive-plant-species-supplement-sp4

Environmental Land Management Schemes (ELMS)

ELMS – Sustainable Farming Incentive – Species Recovery and Management and Managing Wetland Habitats (priority raised lowland bog habitat, including reedbeds, fen and mosaics of wetland habitat, including mires and flushes). SFI encourages practices that reduce the spread of harmful invasive plants and supports the re-establishment of native species to provide competition and control. Typically 5 year agreements; Up to £380/ha dependent on target species (2024).
https://www.gov.uk/government/publications/sustainable-farming-incentive-scheme-expanded-offer-for-2024/sfi-scheme-information-expanded-offer-for-2024#about-the-sustainable-farming-incentive-scheme

ELMS – Landscape Recovery Fund – Large-scale projects, minimum 500ha, designed to create significant, sustainable environmental improvements and support local environmental priorities. Projects funded by the scheme often focus on restoring natural habitats and improving biodiversity, which can include managing and reducing the impact of INNS. Individual or group applications. 20+ year agreements; Fund round 1 totalled £19.5m including £12 million to support 22 farmer-led projects and £7.5 million project development budget.
https://defrafarming.blog.gov.uk/2024/02/12/landscape-recovery-building-long-term-agreements/

ELMS – Farming in Protected Landscapes (FiPL) (via National Landscapes and National Parks for Defra) – Majority of grant funds allocated and may not continue beyond March 2026. FiPL, which is part of Defra's Agricultural Transition Plan in England providing funding to farmers and land managers in Protected Landscapes, can include the management of INNS as needed to enhance the natural environment, often a key component of these projects to protect and restore native biodiversity. Agreement delivery within financial year; No min up to £250K.
https://www.gov.uk/guidance/funding-for-farmers-in-protected-landscapes

Other government funding

Water Environment Improvement Fund (Environment Agency) – Initiative to support projects aimed at improving water quality and the overall environment. Currently, WEIF does not provide funding specifically for the eradication of INNS, however, priorities are reviewed annually, so this may change. Agreements typically last 5 years from the completion of the works; Grants ranging from £75,000 to £250,000 (development projects), £500,000 to £2 million (larger delivery projects). Low-risk collaborative agreements (LRCA) also available for smaller-scale, less complex, collaborative projects. Designed to be more flexible and accessible, enabling a wider range of participants to contribute to environmental improvements – the amount awarded varies depending on the project. https://www.gov.uk/government/publications/water-environment-improvement-fund-projects

Water Restoration Fund (Rural Payments Agency for Defra) – A grant scheme offered in England in 2024, aimed at restoring and improving water and wetland environments, including provision for addressing INNS. Up to £11 million was available (£2,150,000 for the South West Region) sourced from environmental fines and penalties collected from water and sewerage companies. WRF has not announced specific plans for 2025 yet however, given the fund's importance and the ongoing need for water and wetland restoration, it's possible that new funding rounds could be announced in the future.
https://www.gov.uk/government/publications/water-restoration-fund-guidance-for-applicants/about-the-water-restoration-fund

Angling Improvement Fund (AIF) (The Angling Trust and Environment Agency) – AIF income received through the sales of fishing rod licences, supports angling organisations and clubs to control the spread of invasive species and enhance biosecurity. Agreement delivery typically within the calendar year awarded; £5,000 to £10,000. https://anglingtrust.net/2024/10/01/angling-improvement-fund-now-open-for-projects-to-control-invasive-species-and-increase-biosecurity/

Non-government funding

There are a range of potential funding pathways, including the newly emerging Green Finance market, that might support a project which includes INNS management, such as:

Initiatives lead by corporate stakeholders – The Upstream Thinking project funded by South West Water (SWW) is a good example of a significant initiative aimed at improving water quality in the West Country. Farmers are encouraged and financially supported to adopt practices that protect water quality including better land management. https://catchmentbasedapproach.org/learn/upstream-thinking/

Biodiversity net gain (BNG) – Administered by local planning authorities which play a central role in consenting and enforcing BNG through the planning regime. Natural England manages the biodiversity gain site register and sells statutory biodiversity credits. Defra is responsible for guidance. Agreements typically 30 years. https://www.gov.uk/government/collections/biodiversity-net-gain

Offsetting – The use of carbon or nutrient neutrality credits. While these do not specifically fund INNS control programmes, managing INNS within monitored schemes is required. Higher quality schemes generally can charge higher for their units.

Local Investment in Nature Cornwall (LINC) – Cornwall Council's platform for BNG and other green finance opportunities, including funding from private companies, philanthropists etc. Habitat restoration projects can be funded, which can include INNS management. https://www.linc-cornwall.com/hub/what-is-linc

Devon Environment Foundation – This organisation directs funds from various sources businesses and philanthropists to grassroots nature regeneration projects in Devon. It also uses crowdfunding, a method of raising money from a large number of people, typically via the internet. https://devonenvironment.org/about-us/

Environmental, social and governance (ESG) – ESG refers to a set of standards used to evaluate a company's operations and performance in three key areas, including environmental. ESG initiatives could support projects related to the management of INNS, as they often include environmental stewardship, sustainable land and water management practices, enhancing biodiversity, and protecting native species.

Corporate social responsibility (CSR) – CSR is a self-regulating business model that helps companies be socially accountable to themselves, their stakeholders, and the public, by allocating a portion of their profits to fund projects that align with their social and environmental goals. This could include supporting projects related to INNS management by promoting CSR goals of biodiversity, protecting native species, and enhancing ecosystem health. You can apply directly to private companies for grants through CSR programmes, with funding typically administered internally by the companies themselves. Corporate volunteer days are a CSR approach, where free labour is provided by company employees, could also be harnessed for balsam-bashing work parties.

National Lottery Landscapes Connections Fund (NLHF) – The NLHF supports large scale collaborative schemes and projects which could include an INNS management element. The Landscapes Connection Fund, launched in 2024, is a £150 million initiative to enhance and protect the UK's Protected Landscapes, including supporting nature recovery. Over the next 10 years, the fund will invest in around 20 projects, working with local communities, organisations, landowners, and farmers to restore entire landscapes and habitats. https://www.heritagefund.org.uk/news/ps150million-funding-enhance-and-protect-uksworld-class-landscapes

Landowner contributions – The Exmoor Non-Native Invasive Species (ENNIS) project on Exmoor has invested in building strong relationships with landowners. While this project was only possible through grant funding, landowners were also willing to make some small contributions to further support the work.

Monitoring

When starting out 'There is a clear need for baseline data in any new INNS control programme. This data may take a number of different forms but the most valuable, in clearly visualising the progress of any control work, must be fixed point photography. Fixed point photography allows for a visual comparison of 'before and after' at a given control site and is a simple but effective means of monitoring progress as reductions in INNS infestation can be easily assessed by eye. In addition to fixed point photography, ongoing monitoring data is collated by the control team using GPS devices during the course of normal control work, usually in the form of walkover surveys.' (Tweed, 2020).

For the Tamar, fixed point photography of Japanese knotweed and American skunk cabbage is likely to be useful in proving the effectiveness of the control effort on large stands of either species. Equivalent stands of Himalayan balsam are likely to be dealt with before flowers are showing (at least in the year any work starts) so would not have quite the same impact in 'before and after' photos. What would be useful though is to ensure that all groups of helpers are photographed when balsam pulling, partly as a record, partly to show that it can be fun and perhaps most importantly as a thank you for being there in the first place! After 22 years of work on giant hogweed, for most sites, there will relatively small, first and second year plants, without flower spikes and so there are likely to be far fewer opportunities to start using photography as a record of control effectiveness. However, it would be worth retaking key photos at sites where major infestations have been cleared, particularly if an obvious landmark is still present to confirm that the two pictures are of the same site.

From the 'Assessment of the impact of long term chemical control of invasive non-native riparian plants - Japanese Knotweed, Giant Hogweed and Skunk Cabbage in the Tweed catchment and the restoration of native biodiversity' it was concluded that: 'Where the non-native plants have been effectively controlled, there is evidence from the plants species found in the survey, that the habitat is reverting to the type that would have been expected prior to the invasive plants taking over' (Magee, 2020). This is certainly reassuring and if repeated along the Tamar would make a useful study or student project.

Monitoring using a GPS to get grid references that relate to more exact numbers (giant hogweed and American skunk cabbage) and stand sizes (JK and HB) will allow the year-to-year changes to be seen when this data is mapped. The benefits of this are that a lot of information can be shown quickly and made relatable to a landowner or to a wider audience.

Remote sensing is unlikely to be helpful given the wide area to be covered. Such coverage could realistically only be affordable using satellite technology and, at the moment, the available resolution would not be much greater than 30 cm per pixel even if the satellite time were available. But at that resolution, probably only a giant hogweed in flower could be picked out remotely. It is really hoped that we are nearly past that stage with the giant hogweed in the Tamar. Aerial photography using a small or medium drone would be able to improve the pixel resolution to perhaps 1 or 2 cm and this would work well over a relatively small area such as a nature reserve or a re-wetted area in the tidal stretches, particularly if used with AI analysis of multi-spectral imaging. However, this is currently unlikely to be practical on the full extent of the river and all its tributaries from a time, cost and permissions perspective. Ultimately, while there is great anticipation and desire to use new technology, there does not appear to be a readymade product that would help identify these INNS remotely. Much time, money and effort would be needed to get it to this next stage, and ultimately that is still only going to tell you which plants are where. You still have to deal with them.

Recording

There are several routes available for recording the INNS information and some competing apps to get members of the public to report whatever they see.

App/website	Notes
INNS Mapper app (Yorkshire Wildlife Trust/ GBNNSS) https://innsmapper.org/map	Advocated by the NNSS. This is likely to be the most useful as it also includes INNS management recording.
iRecord app (UK Biological Records Centre) https://irecord.org.uk/app	Records are verified by local and national experts Managed by the Biological Records Centre as part of the work of the UK Centre for Ecology and Hydrology.
iNaturalist app (American -California Academy of Sciences and the National Geographic Society) https://www.inaturalist.org/	Community-based monitoring. Dartmoor National Park uses iNaturalist for its citizen science/engagement. This has also proved successful in the Exmoor National Park where visitors with differing plant identification skills are still able to contribute useful new records. The ENNIS project on Exmoor National Park has encouraged the use of iNaturalist for INNS identification as people are more likely to report a new INNS record using it - this had proved invaluable.
Cartographer (Cartographer Studios Ltd, UK) https://cartographer.io/	Citizen scientists from the Westcountry Rivers Trust (WRT) Citizen Science Investigations (CSI) project are logging their data and, once checked, this is being displayed on an interactive map on the WRT CSI website.

The initial data may help fill some information gaps and ongoing data can help to monitor both the species involved and the effectiveness of the work on them. Ideally however, the information needs to go in two directions:

1. locally to the Tamar Invasives Group and active INNS control programmes, to use with GIS software to enable the production of maps and reports

2. using one of these apps to help inform the county, regional and national view

In some ways, the debate as to which of these mapping and reporting routes to take is perhaps missing the point. Whilst it is clearly necessary to know where plants are where before you can deal with them or even plan how to deal with them, this is still only a means to an end and the plants still need to be dealt with.

How much of such reporting is passing the responsibility on to others and expecting them to do something about it? The flip side being that if INNS records are reported to you and nothing is done, you are storing up trouble both from the INNS themselves and politically when it becomes known that nothing has been done about them. So, it would help to engage with those reporting the INNS who may want to be more involved in controlling them, then or later, particularly with some encouragement or assistance.

Exit strategy

It is conventional now when setting up a project also to consider an 'exit strategy' as thinking about project outcomes after completion dates is the responsible thing to do for any organisation but perhaps particularly for any local government body. No-one wants to enter into a project that is seen as open-ended.

It has been said that a good exit strategy can 'help clarify and define a sponsor's role to host communities and other partners as being time-limited, reducing the potential for misunderstandings and future dependency' (Exit Strategy, 2023) and is aimed at planning for the 'handing over of the project management after completion.'

However, the long-term nature of dealing with invasive non-native species on this landscape scale realistically precludes setting an end date. Instead, it mitigates for setting up a programme that will run on into the future but without continued reliance on funds from public sources.

This isn't to stop the use of some money that becomes available from such sources, but rather to establish something that has other background backing that serves to ensure its continuity and improves the chances of success by ensuring that funding is available at the right time of year.

This still leaves a variety of potential funding sources at the moment such as:

- biodiversity net gain
- grant money from company fine sources
- other grants
- company money
- Heritage National Lottery Fund
- agri-environment scheme grants

Ultimately though what is needed is not about money but about giving local people, whether farmers, estate landowners or those with gardens that back onto a stream or river a much better understanding of the problems. And, at the same time, linking them to the individuals and groups that would be happy and willing to help them locally, particularly if adequate funding is available.

At the same time, access to these normally private areas of waterway would help to increase local knowledge and perhaps encourage heritage projects to be considered that might be obvious in their potential to a visitor, whilst an owner or tenant might not have seen things in that light. These could be ecological in terms of habitat creation or improvement or historical, field and place-names, architectural, landscape, geological, industrial archaeology, mining interest, agricultural machinery, examples of all of which were appreciated from this brief INNS survey.

Not setting an end date does not mean that significant milestones can't be marked. They can and should be and there would be many opportunities to mark significant steps that are taken or achievements reached. For example, these could be reporting:

- no giant hogweed being seen in the catchment for 'x' years
- how many American skunk cabbage plants have been removed or controlled
- how many sites that had Japanese knotweed have been free of it for how long
- how many kilometres of river have been cleared of Himalayan balsam
- how many owners have been helped
- how many people have been involved in helping.

Other INNS management initiatives

There are a few long-term INNS projects running such as the Tweed Invasives Project (2002-), which has also recognised that Japanese knotweed, Himalayan balsam and American skunk cabbage are all to be dealt with as well as finishing off the giant hogweed. The River Camel INNS work run by the Westcountry Rivers Trust (2004-) has been subject to the vagaries of fluctuating funding and support although it did benefit from a dedicated project officer for some years. The Wye Invasives Species Project run by Wye Valley National Landscape has recently produced a series of attractive and pertinent documents such as a 'Practical Guide to Balsam Bashing', a 'Balsam Bash Route Map', 'Taking Action Safely Guide', a 'Volunteer Registration Form' and a 'Get Involved Poster' as well as pages on the species of concern.

The two local National Parks of Exmoor and Dartmoor have each been running specific INNS projects for about five years, although Exmoor National Park Authority has been dealing with Japanese knotweed for over 20 years and continues to do so.

More recently, projects have been started on the Clyde, Irwell and Tees after extensive survey efforts. The Irwell survey flagged that: 'Additional non-target INNS (Bamboo) created very difficult conditions in some areas as not only did they create physical obstacles but also concealed other target INNS growing in amongst them meaning extra time was spent forming an accurate survey' (Plant, 2023).

Another river-scale project was run in the south-west in recent years: the Axe Invasives Project (2012 to 2017) in East Devon, Dorset and Somerset was well supported by Natural England and Defra Water Framework Directive funding for four years but struggled to find the necessary level of support for the longer term. This project dealt with giant hogweed, Japanese knotweed and Himalayan balsam and (with support from the Donkey Sanctuary) at least one of the volunteer groups that helped from the outset (Dorchester Mid-week Volunteers) is still involved with Himalayan balsam control in the upper Axe Valley eight years later.

Tweed Invasives Project - **https://tweedforum.org/our-work/projects/tweed-invasives-project/**
River Camel INNS - **https://wrt.org.uk/project/camel-invasives/**
Wye Invasives Species Project - **https://www.wyevalley-nl.org.uk/caring-for-wye-valley-aonb/our-projects/wisp/**
Exmoor National Park - **https://www.exmoor-nationalpark.gov.uk/nature-and-landscape/nature-recovery/how-we-are-doing-more-for-nature/ennis-project**
Dartmoor National Park -
https://www.dartmoor.gov.uk/wildlife-and-heritage/our-conservation-work/tackling-invasive-plants
Clyde - **https://www.nature.scot/sites/default/files/2019-03/Publication%202019%20-%20SNH%20Research%20Report%20979%20-%20INNS%20Strategy%20for%20the%20Clyde%20Catchment%20-%20Strategy.pdf**
Irwell - **https://naturalcourse.co.uk/2023/01/09/findings-from-the-invasive-non-native-species-survey-of-the-river-irwell-released/**
Tees - **https://www.teesriverstrust.org/inns**
Axe Invasives Project - **https://connectingtheculm.com/wp-content/uploads/2021/04/Axe-Invasives-Report-2015-pdf.pdf**

Exmoor National Park

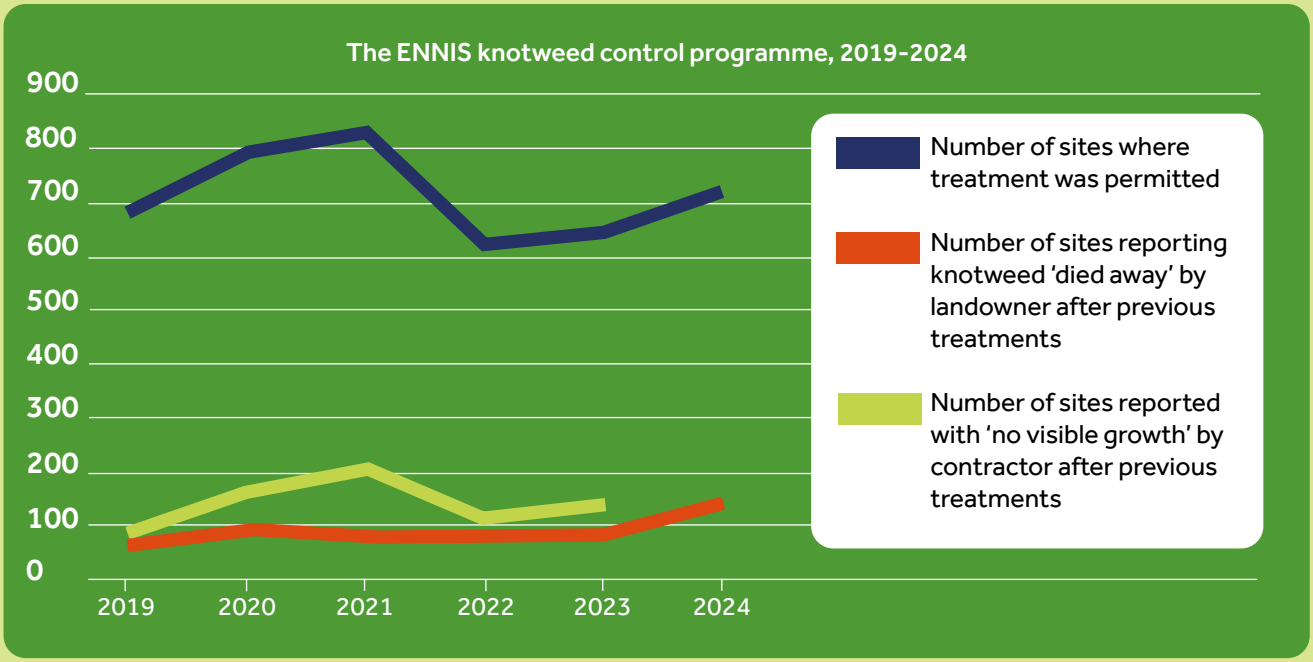
Exmoor Non-Native Invasives Species Project - ENNIS
Exmoor National Park Authority (ENPA) has been dealing with more than 1,200 Japanese knotweed sites, across the whole of the National Park for over 20 years, in recent years through the ENNIS project. Management of other INNS, including giant hogweed, Himalayan balsam, American skunk cabbage, montbretia and signal crayfish has also been undertaken. With Himalayan balsam control, in recent years the efforts have been concentrated on one river, 6.4km of the River Barle, rather than spreading the volunteer resource too thinly to be effective.

Given the uncertainty of funding which would threaten long-term management, every landowner is supplied with information on INNS and why they need to be treated. It has encouraged landowners who want to tackle the problem themselves and encouraged the inclusion of INNS control in grant applications such as FiPL. The Japanese knotweed treatment programme is run with the option of donations from landowners. Though this does not fully cover the costs of treatment, such donations are very helpful and contribute to the total cost of the programme. It has been found that most landowners are happy to donate some money towards this.

The number of sites where permission was granted to treat Japanese knotweed has fluctuated (Fig. 20). In 2020 and 2021 there were two project officers running the project, the rest of the time just one part time officer was employed. This highlights the value, if financially possible, of having at least one full time position on an INNS project, to be able to contact as many landowners as possible.

With Himalayan balsam control, the efforts have been concentrated on one river (Barle) in recent years rather than spreading the volunteer resource too thinly to be effective.

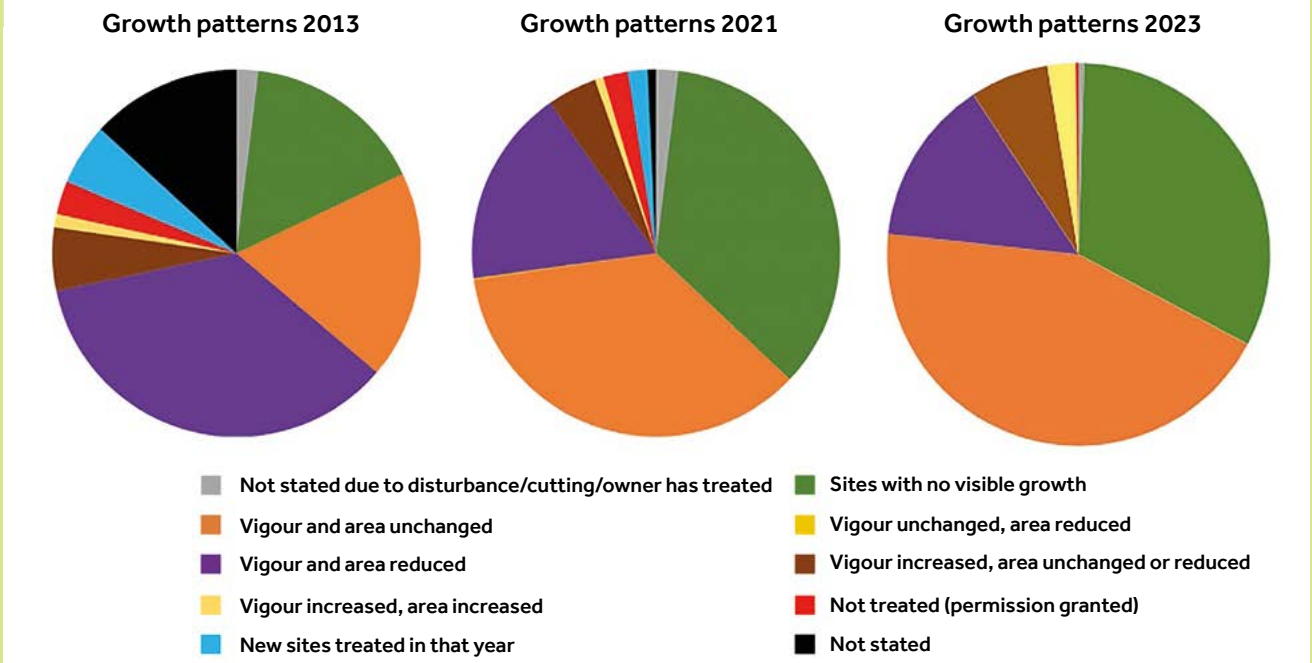
Fig. 20 Number of sites where permission was granted to treat Japanese knotweed in the last 5 years and where no growth reported



This change in permission may reflect how landowners are steadily seeing fewer sites with any growth - a good indicator of the success of the programme. Where knotweed sites are reported as having died away or have no visible growth, unless monitoring is requested or deemed necessary these are generally not visited by the project contractor.

The charts below (Fig. 21) show how knotweed growth patterns changed over time. Initially the knotweed stands were more vigorous and reduced back by treatments, as reported by the control contractor in 2013 (prior to the ENNIS project, when control was managed by the wider team). Fast forward to 2021 and 2023 when the ENNIS project was in place and the knotweed is much more under control through regular treatments.

Fig. 21 Japanese knotweed growth pattern changes over time



Trials on the effectiveness of an electric control method 'Rootwave' were also undertaken. Consistent and vigorous regrowth were observed at all sites, apart from giant hogweed which didn't recover to its former size and appeared to be suffering much more (due to the large taproot, it was easier to get an electric current through). So, while it takes longer than herbicide and there are logistic considerations regarding getting the equipment to difficult to reach sites, for giant hogweed this method could be a viable tool on organic sites, or sensitive areas etc. Many more years of treatment would be required to get knotweed and montbretia in particular under control using this method, which may not be preferable considering how easily they spread in the meantime.

ENPA has worked hard to build awareness and a culture of INNS control in the area, through face-to-face engagement. Having a dedicated Project Officer for ENNIS has widened the capacity of the project and allowed a greater range of species to be treated. This has also given the project longevity and it is more reliable having someone organise INNS management than leaving landowners to organise and/or fund it themselves. In the event of grant funding not becoming available for the Project Officer post, the fallback position is to revert the work of co-ordinating INNS management to the Ecology team. Whilst existing sites could still be treated, the increased workload would inevitably limit the ability to meet landowners and manage new INNS site identification and treatment.

A report on the ENNIS project will be available in 2025.

Exmoor National Park - https://www.exmoor-nationalpark.gov.uk/nature-and-landscape/nature-recovery/how-we-are-doing-more-for-nature/ennis-project

Roadford Lake 5/1/2024

South West lakes

The Southwest Regional INNS Management Plan (RIMP, 2018) identified as hotspots areas of high recreational use (for example, fishing or water sports), commercial use, or sites of economic value for the region which were either then threatened by INNS or posed a risk of spread to other sites. These included the several South West Water lakes within the catchment. These lakes are managed by South West Lakes Trust, including the Upper and Lower Tamar Lakes, Roadford Lake, Burrator Reservoir and Lopwell Dam. Giant hogweed, Japanese knotweed, Himalayan balsam and American skunk cabbage were not identified as posing a risk in any of these identified hotspot areas. Although knotweed, balsam and skunk cabbage have been recorded from some of them, it is known that they are being managed.

However, the lakes have their own set of problems, with INNS such as signal crayfish (*Pacifastacus leniusculus*) at Roadford Lake and Burrator and New Zealand pygmyweed (aka Australian swamp stonecrop - *Crassula helmsii*) at Roadford Lake. Unfortunately, the dams that impound the water also serve to trap silts and nutrients and particularly at lower water levels in warm dry years, algal blooms will occur and species like New Zealand pygmyweed and Canadian pondweed (*Elodea canadensis*) can grow unchecked and form rafts of plant material. Both South West Water and South West Lakes Trust have been at the forefront of practical work on biosecurity management in these areas and each has a team of people working on managing INNS.

However, there must be concern that plant propagules from the lakes will be released into the river system and whilst they may not necessarily be such an issue in the faster flowing waters, they are likely to invade all of the recently formed wetland areas (6) in the tidal stretch of the Tamar where the flood bank has been breached intentionally or otherwise.

Similarly, the raw water transfers back to reservoirs from the rivers would also need to be managed well to ensure that INNS are not inadvertently moved between rivers or upstream on the same river system. For all these reasons, South West Water and South West Lakes Trust must continue to be key partners in the work to combat the effect of INNS on the overall catchment.

Good practice

Lessons learnt from the Tamar Giant Hogweed Eradication Project Review 2001-21 (M Rule, 2022) and INNS management projects elsewhere in the SW on Exmoor (ENNIS, ENPA) and the Torridge (Torridge Restoration Project, DWT) highlight a number of points on what would constitute good practice for catchment-scale invasives control. All of these points have been considered within the present report.

INNS programme staff

- It may be more reliable to have someone organise INNS management, than leaving it up to busy landowners to organise and fund it themselves.
- INNS work needs to have its own programme, with dedicated staff on long-term retention. It ensures that sufficient relationships with landowners and communities can be forged to get into the source areas and support the work, and that enough seasons of work can be conducted to suppress the INNS presence and a greater range of species can be treated.

Work in partnership

- Identify interested organisations, landowners, other key stakeholders and local residents. Everyone has a role to play and can help to some degree. Make the most of the expertise and local knowledge available.
- Consider carefully how such a partnership is to be effectively managed, including administration and communication needs.
- Landowner willingness to let people onto their land can be a constraint, but face-to-face contact and stands at events are effective for engagement and help build a culture of INNS control in an area.
- A good network of local volunteers is essential, particularly for tackling Himalayan balsam. Offering a range of INNS management activities to volunteers is an effective recruitment tool and first contact can be made through websites or social media, although every opportunity for public engagement should be taken.

Employ and retain the best contractors available

- Use contractors (ideally local) who have a good knowledge of the project area. They must be experienced in INNS control, thorough and conscientious.
- Finding and settling on a single, very professional contractor is more useful than trying to 'shop around' too much for cheaper contractors. With INNS management, consistent treatments are essential - if the contractors carrying out the work aren't very reliable or effective, then it will be a false economy to go with the cheapest.
- Offering contracts of more than one year may help secure their service, which aids longer-term planning.
- A good contractor is worth a great deal not only because of their effectiveness, but also the positive reputation they bring for yourselves amongst the local community - for not only INNS control but also for the wider team and their other projects.

Understand the problem

- Survey first to identify the extent of the target INNS population, to understand the scale of the task in hand (from individual sites/waterbodies to catchment level), what control measures are viable and what is a realistic long-term goal - management or eradication.

Top-down - prioritise where you work and how you work

- Single out some tributaries to focus efforts. Work from the headwaters down - removing source of seed and/or viable INNS plant material from the top of the catchment.
- Do not take on more of the river than you can defend with the resources and volunteer capacity available locally.

Realistic timelines - be prepared for long-term commitment from the outset

- In the short term, site-specific control (especially on heavily infested or important ecological sites) may be less costly, but the long-term risk of reinfestation from the wider catchment has to be addressed.
- The limited timescale of most INNS projects is a constraint, but a long-term presence and repeated visits are going to be needed to ensure a true confidence in the effectiveness of the work. Short-term initiatives or projects will ultimately be fruitless, as INNS can spread so rapidly and cleared areas soon fill up again.
- Ideally, secure adequate medium to long-term funding before beginning a landscape-scale control programme.

Consider what an exit strategy might look like

- Research how the move from a control to a monitoring programme or exit strategy has been done in other similar projects, the level of success achieved, and how the risk of reinfestation was managed.
- It may be appropriate to transition at different times for different parts of the project area, or to do it in stages, depending on the engagement of specific landowners.

Consider what information you need to inform the programme

- Recording information and reporting on annual field work is essential for monitoring progress and for short to long-term planning. Consider the type and amount of information you require and the level of detail needed. What is its purpose? How will it be gathered, recorded and reported?
- Liaise with your contractor, taking into account the practicalities involved in carrying out a large-scale control programme, while simultaneously recording field data. Your contractor's team may not have experience of working in this way or may have time/logistic issues to deal with.

Be flexible

- It is necessary to continually reassess progress to inform the work plan and ensure the efficient and effective use of resources.
- There may be issues which make it impossible to achieve the goal of complete localised eradication of a target species. But if local communities and landowners are interested, taking action to avoid the worst level of infestation is possible and worthwhile.

Local Action Group meeting, February 2025 - such gatherings allow sharing of knowledge and best practice from INNS management programmes across the UK (GB Non-Native Species Secretariat, 2025) - https://www.nonnativespecies.org/local-action-groups-lags/about-lags

Other INNS

Many other invasive species were noted in this survey and are mapped in Appendix 2.

Several of these such as *Rhododendron ponticum* and laurel *Prunus laurocerasus* were already a significant presence and in places were dominating woodland understories or even open moorland. Even if it is felt that it will be spreading the effort too thinly to deal with all of them, once an INNS programme is set up, calls will be received about many species whether plant or animal and a great opportunity would be missed if they are turned away because they are not one of the four target species. So strong links would need to be forged with partner organisations like, for example, the Forestry Commission in the case of rhododendron and laurel and with the beekeepers regarding both the Himalayan balsam and the likely appearance sooner or later of the Asian hornet *Vespa velutina.*

Finally, there are some INNS that didn't feature as much as expected, monkey flower, for example, (one record on one river) and it would be well worth trying to ensure that balsam volunteer groups are primed to pull that species if and when they encounter it on that river when it is still in such low numbers.

Monkey flower

Conclusion

The costs do suggest that, given the lack of certainty of success in controlling Himalayan balsam, it would be more sensible to concentrate on the other three species, all of which have a good chance of reaching a satisfactory outcome, albeit over the medium term. It would be possible to clear some individual rivers of balsam in the medium term, but it is not clear that there is enough public support or financial assistance to consider tackling all of the rivers of the Tamar catchment at once. It would be trying to make up for four or five decades of inaction on most them.

So, a programme that could lead with Japanese knotweed and cover giant hogweed and American skunk cabbage over the whole catchment would be welcomed and could initially trial the clearance of Himalayan balsam on a few rivers. Having a presence on the ground would give opportunities to feed back information to farmers and landowners on grants and other opportunities and might be a useful adjunct to others trying to achieve good water quality and quantity within the catchment. There is enough of a link to try approaching South West Water and other companies to see if they would match fund any grants received to give the best chance of setting up a long-term programme that, by leading with the INNS, could also help in many other areas.

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Jenny Heskett	Cormac
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Jon Valters	River Carey
Hilary Marshall	River Carey
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Tim Yonge	Yealm Estuary to Moor
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Appendices

Appendix 1 - INNS Management – Legislation, strategies and plans

Legislation

International:

EU Regulation (1143/2014) on the prevention and management of the introduction and spread of invasive alien species. It was retained in UK domestic law under the European Union (Withdrawal) Act 2018 and amended through several statutory instruments to ensure operability following the UK's exit from the EU but applies to GB only. https://www.legislation.gov.uk/eur/2014/1143

Note, the **Invasive Alien Species (Enforcement and Permitting) Order 2019** transposes EU Invasive Alien Species (IAS) Regulation (1143/2014). It contains provisions relating to offences, penalties, enforcement, licensing and permitting in order to meet requirements of the Retained Regulation.
https://www.legislation.gov.uk/uksi/2019/527

Also, the **INNS (amendement etc.) (EU Exit) Regulations 2019** ensure the UK's legal framework for managing INNS remain effective after Brexit. These regulations amend existing EU legislation on invasive species to fit the UK's legal context post-EU exit
https://www.legislation.gov.uk/uksi/2019/223/contents/made

National:

Section 14(1) of the Wildlife and Countryside Act 1981 – Makes it an offence to plant or otherwise cause to grow in the wild any plant listed in Part II of Schedule 9 to the Act. It is also an offence to release or allow to escape into the wild any animal which is not ordinarily resident in GB and is not a regular visitor to GB in a wild state or is listed in Schedule 9 to the Act (note that this also includes some native animals).
https://www.legislation.gov.uk/ukpga/1981/69

Section 25 of Defra's 2011 advice note, on Section 14 of the Wildlife and Countryside Act 1981 – States 'negligent or reckless behaviour, such as inappropriate disposal of garden waste, where this results in a Schedule 9 species becoming established in the wild would constitute an offence'.
https://www.gov.uk/government/publications/preventing-the-release-into-the-wild-of-certain-plants-and-animals-guidance/guidance-on-section-14-of-the-wildlife-and-countryside-act

Section 23 of the Infrastructure Act 2015 – Amendment to the Wildlife and Countryside Act 1981 – new Schedule 9A introduces a new statutory regime of species control agreements and orders to ensure that landowners take action on INNS or permit others to enter the land and carry out those operations.
https://www.legislation.gov.uk/ukpga/2015/7/section/23

Disposal of INNS – In the UK, the disposal of INNS is regulated to prevent their spread and protect the environment. Giant hogweed, Japanese knotweed, Himalayan balsam and American skunk cabbage are classified as controlled waste. This means that any plant material, including soil contaminated with its seeds, must be handled and disposed of properly to prevent its spread. You can only transport it using a registered waste carrier to a suitably permitted or exempt site.
https://www.gov.uk/guidance/prevent-the-spread-of-harmful-invasive-and-non-native-plants#dispose-of-plant-material

The **Environmental Protection Act 1990** covers the illegal depositing, treatment, keeping or disposal of controlled waste, from littering and fly-tipping to mass illegal waste disposal. It has very limited provisions regarding INNS, the primary focus is on waste management and pollution control. However, soil and other waste containing viable propagules of invasive non-native plant species can be classified as controlled waste under this Act.
https://www.legislation.gov.uk/ukpga/1990/43/contents

Strategies and plans

International:

Convention on Biological Diversity (CBD) (1992) – Arose from the UN Conference on Environment and Development held in Rio in 1992. Within the framework of the convention there are 15 Guiding Principles for the prevention, introduction and mitigation of impacts of alien species that threaten ecosystems, habitats or species. The principles provide an international framework for governments and other organisations to develop effective strategies to prevent introduction, control and eradicate INNS. Article 8(h) states that each Contracting Party shall prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species. Invasive alien species are also formally addressed in the Global Strategy on Plant Conservation.
https://www.cbd.int/doc/legal/cbd-en.pdf

Bern Convention or Convention on the Conservation of European Wildlife and Natural Habitats (1979) – Requires that contracting parties must under Article 11 2 (b) 'strictly control the introduction of non-native species'. https://www.coe.int/en/web/bern-convention

European Strategy on Invasive Alien Species (2003) – Developed under the Bern Convention, stresses the importance of rapid implementation of eradication programmes and recommends that contracting parties should ensure that competent authorities are given sufficient powers to remove these alien species with a high potential to become invasive, including the power to issue emergency orders where urgent eradication is needed. Control programmes, on the other hand, should be based on a cost and benefit analysis, realistic priorities and appropriate monitoring; control methods 'should be selected with regard to their efficiency, and selectivity, with due consideration of the undesirable effects they may cause.'
https://www.cbd.int/doc/external/cop-09/bern-01-en.pdf

National:

The GB Non-native Species Secretariat (NNSS) Strategy (2023-2030) – Addresses, e.g. prevention, surveillance, early detection, monitoring and rapid response, prioritisation and risk analysis and emphasizes the importance of coordinated action and the role of different sectors in addressing the challenges posed by INNS.
https://publications.naturalengland.org.uk/publication/6283453993582592

Her (then) Majesty's Government's 25 year Environment Plan (2018) – Target 10 (Enhancing biosecurity) states 'We will enhance biosecurity to protect our wildlife and livestock, and boost the resilience of plants and trees. We will do this by: Managing and reducing the impact of existing plant and animal diseases; lowering the risk of new ones and tackling invasive non-native species.'
https://assets.publishing.service.gov.uk/media/5ab3a67840f0b65bb584297e/25-year-environment-plan.pdf

Regional:

Regional Invasive Management Plans (RIMP) – With GB NNSS support, APHA led on the production of the South West RIMP (2018) with recommendations regarding recording, good practice, stakeholder co-ordination, INNS pathways, education and awareness.
https://www.nonnativespecies.org/assets/Document-repository/RAPID_South_West_RIMP.pdf

South West River Basin Management Plan (RBMP) (2022) – The EA proposes a collaborative approach to tackling INNS throughout the catchment with measures to address negative effects of non-native invasive

species including; mitigation, control and eradication (to reduce extent), building awareness and understanding (to slow the spread), early detection, monitoring and rapid response (to reduce the risk of establishment) and preventing their introduction.
https://assets.publishing.service.gov.uk/media/635246fae90e07768c1a73a2/South_west_river_basin_management_plan_2022_HRA.pdf

Local:

Tamar Catchment Partnership Action Plan (2020) – Aims to develop a collaborative approach to tackle invasive non-native species in the catchment.
https://my-tamar.org/wp-content/uploads/2024/07/Tamar-Action-Plan-2020.pdf

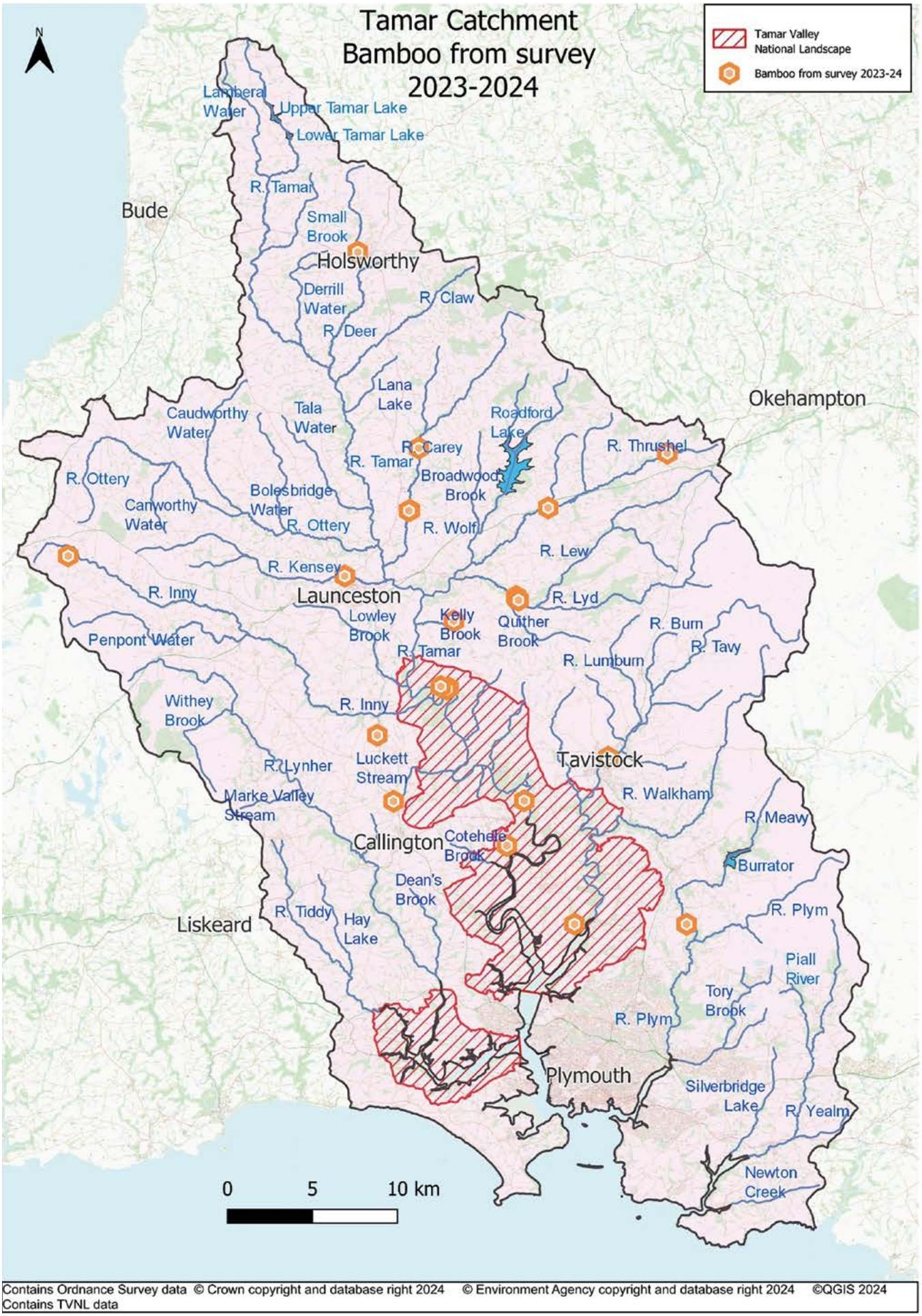
Tamar Valley National Landscape Management Plans 2019-2024 and 2025-2030 (Consultation Draft) – Include several policies and priorities relating to INNS and their impacts. The 2025-2030 management plan aims to support a collaborative approach to long-term control and monitoring of INNS at a catchment level.
https://www.tamarvalley-nl.org.uk/wp-content/uploads/2024/01/TVNL-Management-Plan-2019-2024-Full.pdf
https://www.tamarvalley-nl.org.uk/wp-content/uploads/2024/09/AW2_060924_DR_TAMAR-24-10301_MANAGEMENT_PLAN_SINGLE_PAGES1.pdf

Tamar Estuaries Consultative Forum Marine Biosecurity Plan (2018-2020) (recently updated) – Outlines measures to prevent the introduction and spread of INNS in the Tamar Estuaries and Plymouth Sound marine environment.
http://www.plymouth-mpa.uk/wp-content/uploads/2018/06/180613-Tamar-Estuaries-Marine-Biosecurity-Plan.pdf

Site Improvement Plan for Plymouth Sound & Estuaries SAC and Tamar Estuaries Complex SPA (2014) – Includes the need to investigate the impact of INNS and control if required.
https://publications.naturalengland.org.uk/publication/6283453993582592

Appendix 2 - Other INNS

Bamboo	*Bambuseae*
Buddleia	*Buddleja davidii*
Butterbur	*Petasites hybridus*
Canadian pondweed	*Elodea spp.*
Cotoneaster	*Cotoneaster spp.*
Cyprus	*Cypressus spp.*
Giant butterbur	*Petasites japonicus*
Gunnera	*Gunnera tinctoria or G. manicata*
Italian Arum	*Arum italicum*
Laurel	*Laurus nobilis*
Lesser knotweed	*Persicaria campanulata*
Lesser periwinkle	*Vinca minor*
Michaelmas daisy	*Aster spp.*
Monkeyflower	*Erythranthe guttata*
Montbretia	*Crocosmia × crocosmiiflora*
New Zealand pygmyweed	*Crassula helmsii*
Parrot's feather	*Myriophyllum aquaticum*
Piggybank plant	*Tolmiea Menziesii*
Pink purslane	*Claytonia sibirica*
Rhododendron	*Rhododendron ponticum*
Shrubby honeysuckle	*Lonicera nitida*
Snowberry	*Symphoricarpos albus*
Variegated yellow archangel	*Lamium galeobdolon subsp. argentatum*
Winter heliotrope	*Petasites fragrans*


Tamar Catchment
Bamboo from survey
2023-2024
N
Tamar Valley
National Landscape
Bamboo from survey 2023-24
Lamberal
Water
Upper Tamar Lake
Lower Tamar Lake
R. Tamar
Bude
Small
Brook
Holsworthy
Derrill
Water
R. Claw
R. Deer
Lana
Lake
Okehampton
Caudworthy
Water
Tala
Water
Roadford
Lake
R. Carey
R. Tamar
R. Thrushel
R. Ottery
Broadwood
Brook
Bolesbridge
Water
Canworthy
Water
R. Ottery
R. Wolf
R. Lew
R. Kensey
R. Inny
Launceston
R. Lyd
Lowley
Brook
Kelly
Brook
Quither
Brook
R. Burn
Penpont Water
R. Tamar
R. Tavy
R. Lumburn
Withey
Brook
R. Inny
Luckett
Stream
Tavistock
R. Lynher
R. Walkham
Marke Valley
Stream
R. Meavy
Cotehele
Brook
Callington
Burrator
Dean's
Brook
R. Tiddy
Hay
Lake
R. Plym
Liskeard
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River
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Brook
R. Plym
Plymouth
Silverbridge
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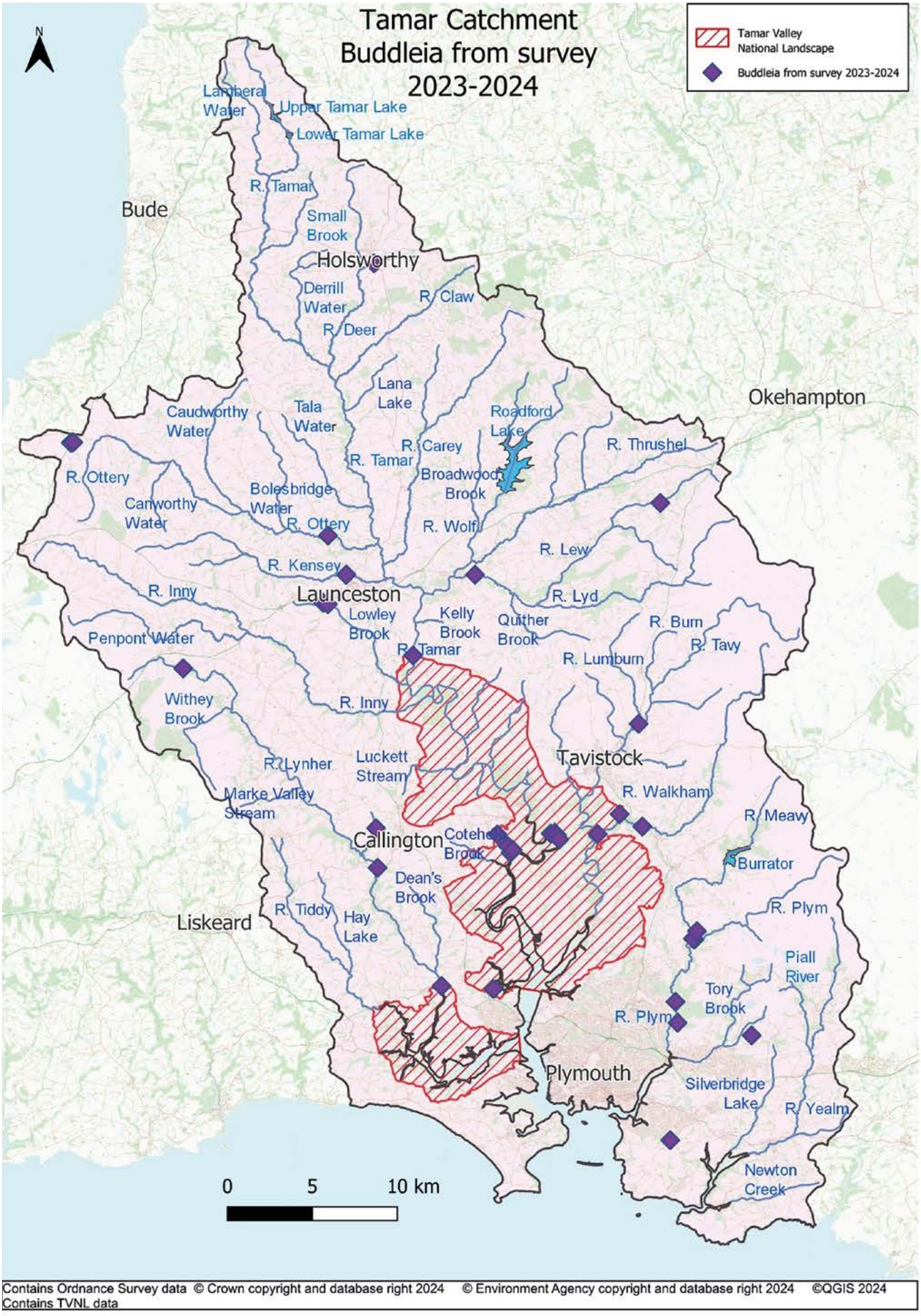

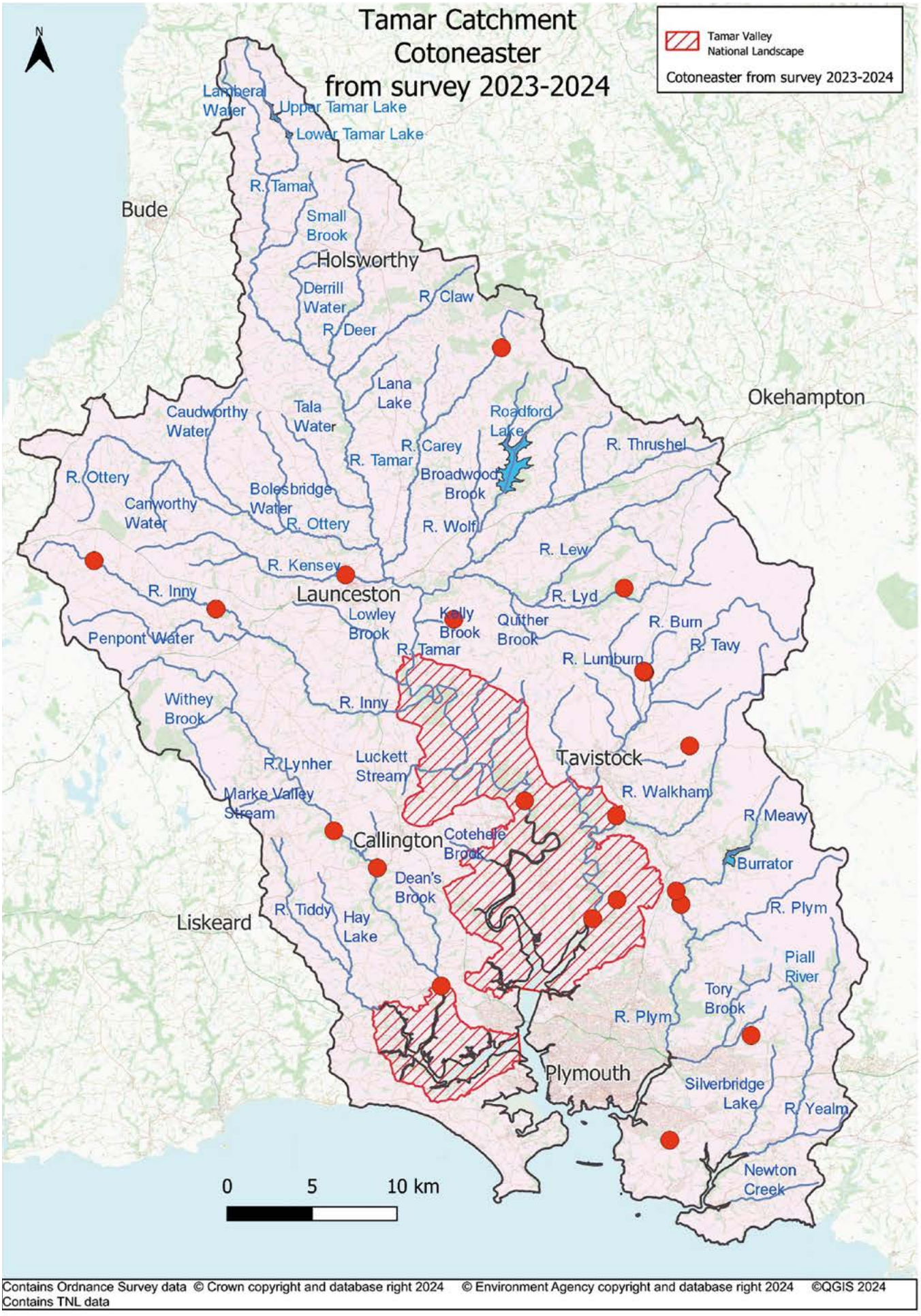

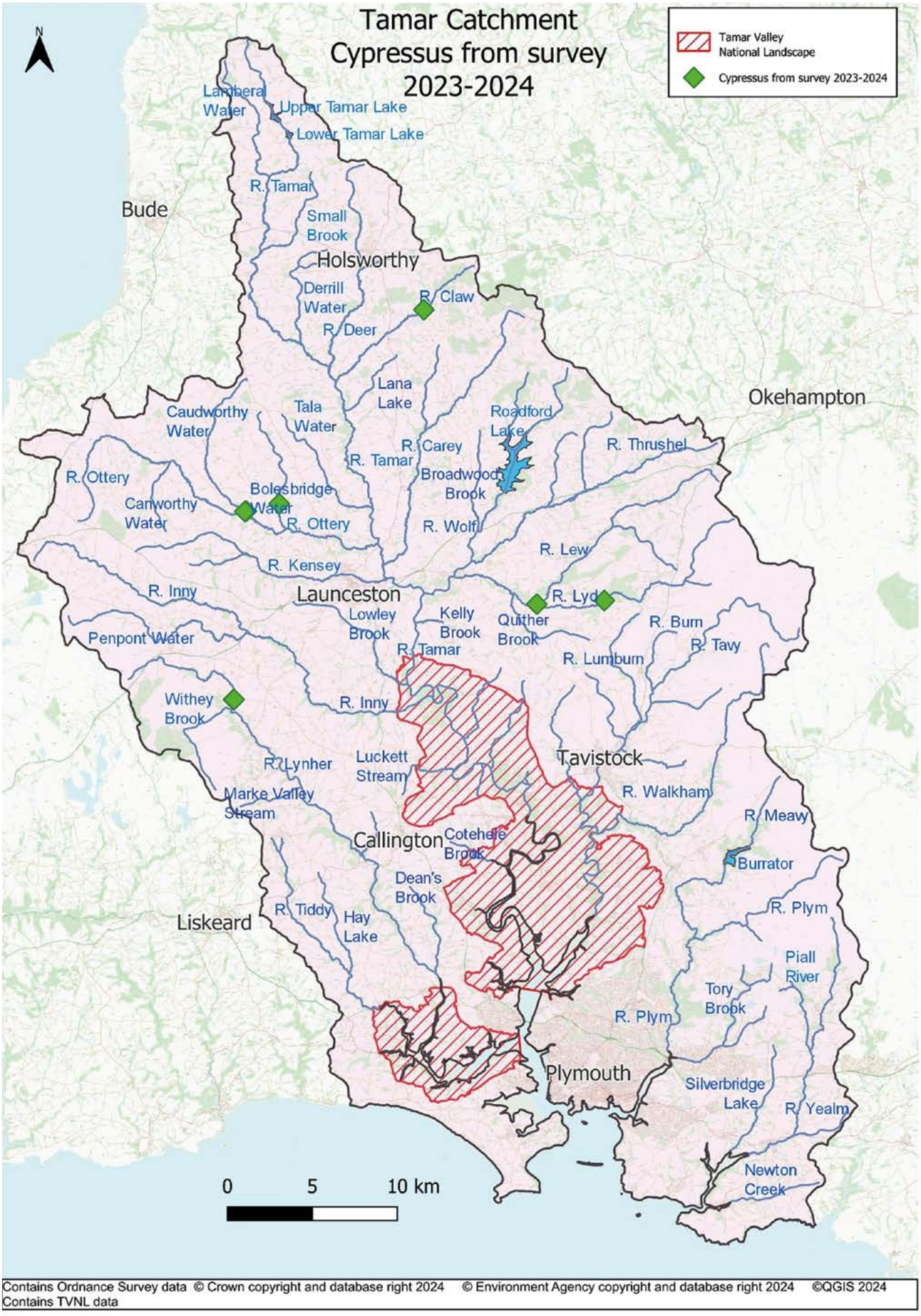
Tamar Catchment
Cypressus from survey
2023-2024
Tamar Valley
National Landscape
Cypressus from survey 2023-2024
N
Lambera
Water
Upper Tamar Lake
Lower Tamar Lake
R. Tamar
Bude
Small
Brook
Holsworthy
Derrill
Water
R. Claw
R. Deer
Lana
Lake
Okehampton
Caudworthy
Water
Tala
Water
Roadford
Lake
R. Carey
R. Tamar
R. Thrushel
R. Ottery
Broadwood
Brook
Bolesbridge
Water
Canworthy
Water
R. Ottery
R. Wolf
R. Lew
R. Kensey
R. Inny
Launceston
R. Lyd
Lowley
Brook
Kelly
Brook
Quither
Brook
R. Burn
R. Tavy
Penpont Water
R. Tamar
R. Lumburn
Withey
Brook
R. Inny
R. Lynher
Luckett
Stream
Tavistock
R. Walkham
Marke Valley
Stream
R. Meavy
Callington
Cotehele
Brook
Burrator
Dean's
Brook
R. Tiddy
R. Plym
Liskeard
Hay
Lake
Piall
River
Tory
Brook
R. Plym
Plymouth
Silverbridge
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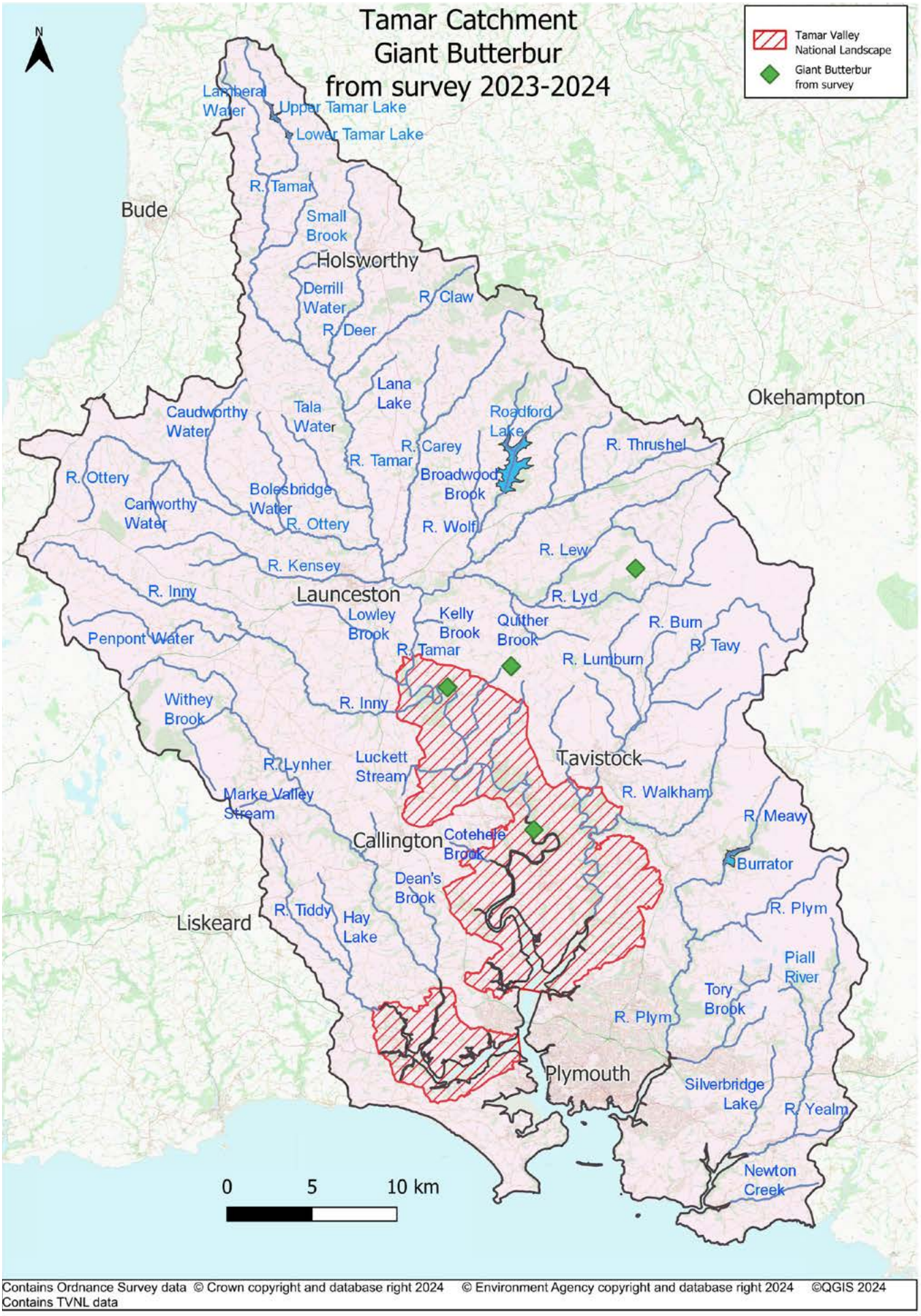
Tamar Catchment
Giant Butterbur
from survey 2023-2024
N
Tamar Valley National Landscape
Giant Butterbur from survey
Lamberal Water
Upper Tamar Lake
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R. Tamar
Bude
Small Brook
Holsworthy
Derrill Water
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Caudworthy Water
Tala Water
Roadford Lake
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Broadwood Brook
Bolesbridge Water
Canworthy Water
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Launceston
R. Lyd
Lowley Brook
Kelly Brook
Quither Brook
R. Burn
Penpont Water
R. Tamar
R. Tavy
R. Lumburn
Withey Brook
R. Inny
R. Lynher
Luckett Stream
Tavistock
Marke Valley Stream
R. Walkham
R. Meavy
Callington
Cotehele Brook
Burrator
Dean's Brook
R. Tiddy
Hay Lake
R. Plym
Liskeard
Piall River
Tory Brook
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Plymouth
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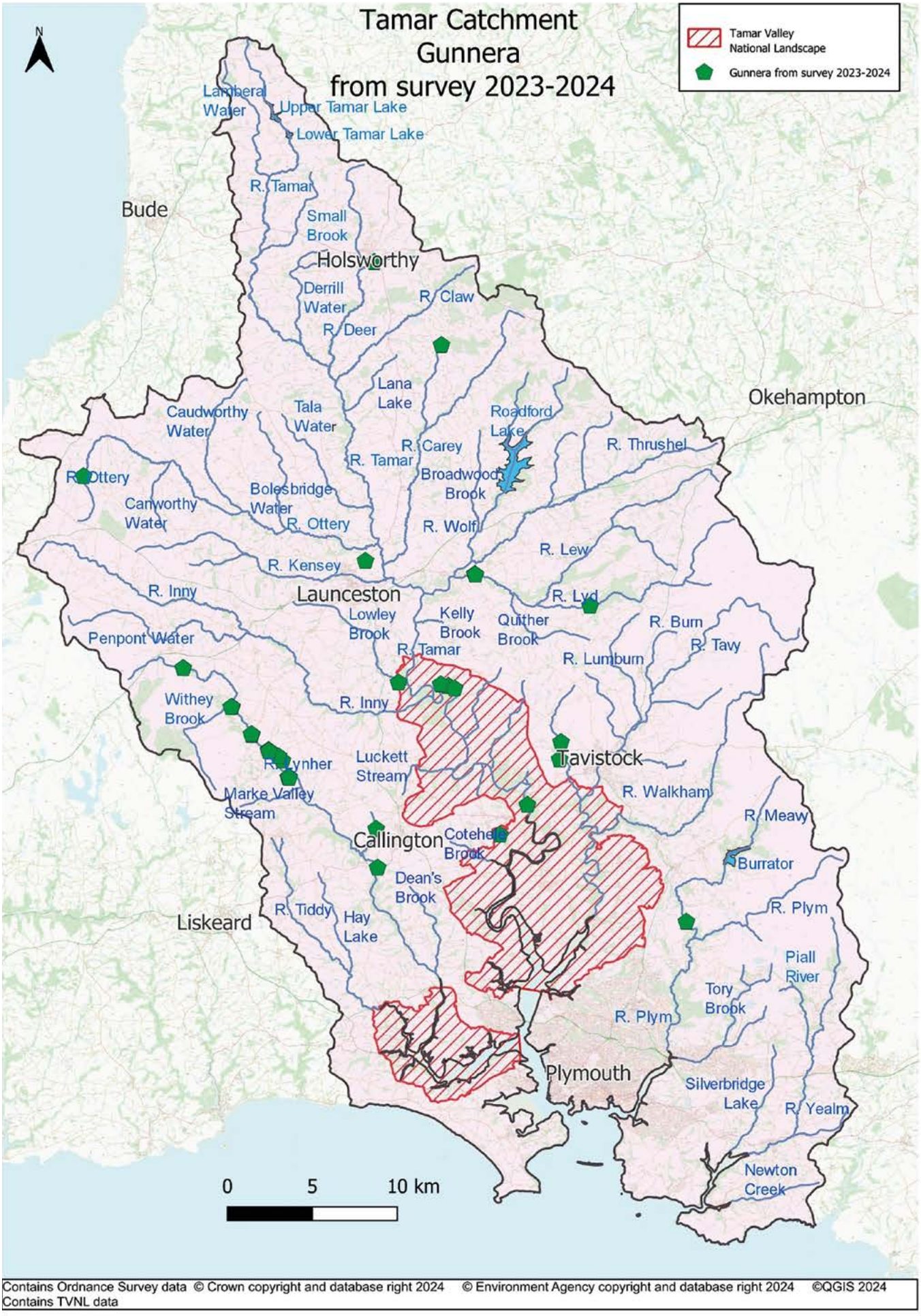
Tamar Catchment
Gunnera
from survey 2023-2024
Tamar Valley
National Landscape
Gunnera from survey 2023-2024
N
Lambera Water
Upper Tamar Lake
Lower Tamar Lake
R. Tamar
Bude
Small Brook
Holsworthy
Derrill Water
R. Claw
R. Deer
Lana Lake
Okehampton
Caudworthy Water
Tala Water
Roadford Lake
R. Carey
R. Tamar
R. Thrushel
R. Ottery
Broadwood Brook
Bolesbridge Water
Canworthy Water
R. Ottery
R. Wolf
R. Lew
R. Kensey
R. Inny
Launceston
R. Lyd
Lowley Brook
Kelly Brook
Quither Brook
R. Burn
R. Tavy
Penpont Water
R. Tamar
R. Lumburn
Withey Brook
R. Inny
R. Lynher
Luckett Stream
Tavistock
R. Walkham
Marke Valley Stream
R. Meavy
Callington
Cotehele Brook
Burrator
Dean's Brook
R. Tiddy
R. Plym
Liskeard
Hay Lake
Piall River
Tory Brook
R. Plym
Plymouth
Silverbridge Lake
R. Yealm
Newton Creek
0
5
10 km
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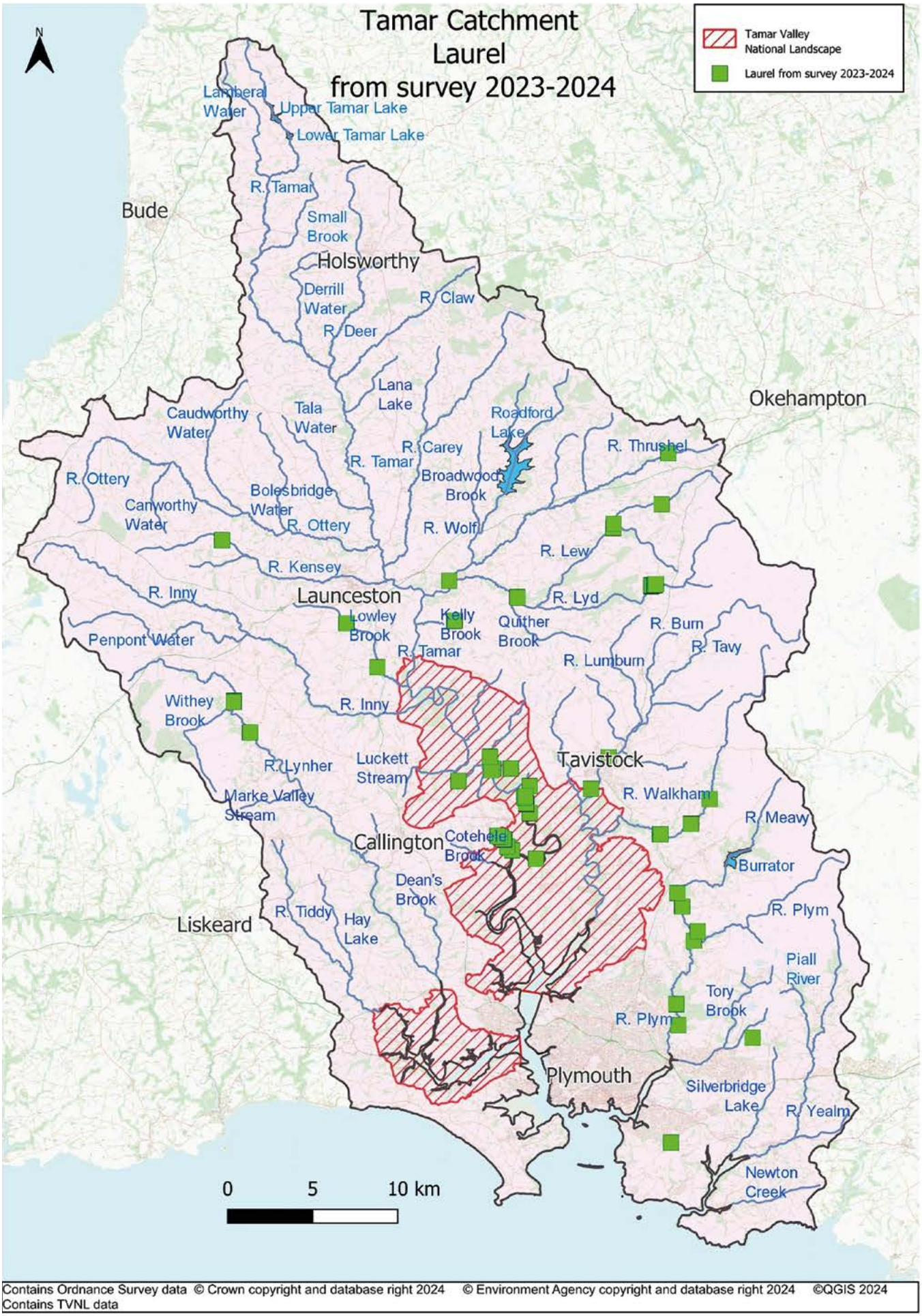
Contains TVNL data


Tamar Catchment
Laurel
from survey 2023-2024
Tamar Valley
National Landscape
Laurel from survey 2023-2024
N
Lambera
Water
Upper Tamar Lake
Lower Tamar Lake
R. Tamar
Bude
Small
Brook
Holsworthy
Derrill
Water
R. Claw
R. Deer
Lana
Lake
Okehampton
Caudworthy
Water
Tala
Water
Roadford
Lake
R. Carey
R. Tamar
R. Thrushel
R. Ottery
Broadwood
Brook
Bolesbridge
Water
Canworthy
Water
R. Ottery
R. Wolf
R. Lew
R. Kensey
R. Inny
Launceston
R. Lyd
Lowley
Brook
Kelly
Brook
Quither
Brook
R. Burn
R. Tavy
Penpont Water
R. Tamar
R. Lumburn
Withey
Brook
R. Inny
R. Lynher
Luckett
Stream
Tavistock
R. Walkham
Marke Valley
Stream
R. Meavy
Callington
Cotehele
Brook
Burrator
Dean's
Brook
R. Tiddy
Hay
Lake
R. Plym
Liskeard
Piall
River
Tory
Brook
R. Plym
Plymouth
Silverbridge
Lake
R. Yealm
Newton
Creek
0
5
10 km
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Contains TVNL data


Tamar Catchment
Lesser Knotweed from survey 2023-2024
N
Tamar Valley National Landscape
Lesser knotweed from survey 2023-2024
Lamberal Water
Upper Tamar Lake
Lower Tamar Lake
R. Tamar
Bude
Small Brook
Holsworthy
Derrill Water
R. Claw
R. Deer
Lana Lake
Okehampton
Caudworthy Water
Tala Water
Roadford Lake
R. Carey
R. Tamar
R. Thrushel
R. Ottery
Broadwood Brook
Bolesbridge Water
Canworthy Water
R. Ottery
R. Wolf
R. Lew
R. Kensey
R. Inny
Launceston
R. Lyd
Lowley Brook
Kelly Brook
Quither Brook
R. Burn
Penpont Water
R. Tamar
R. Tavy
R. Lumburn
Withey Brook
R. Inny
R. Lynher
Luckett Stream
Tavistock
R. Walkham
Marke Valley Stream
R. Meavy
Callington
Cotehele Brook
Burrator
Dean's Brook
R. Plym
R. Tiddy
Hay Lake
Liskeard
Piall River
Tory Brook
R. Plym
Plymouth
Silverbridge Lake
R. Yealm
Newton Creek
0
5
10 km
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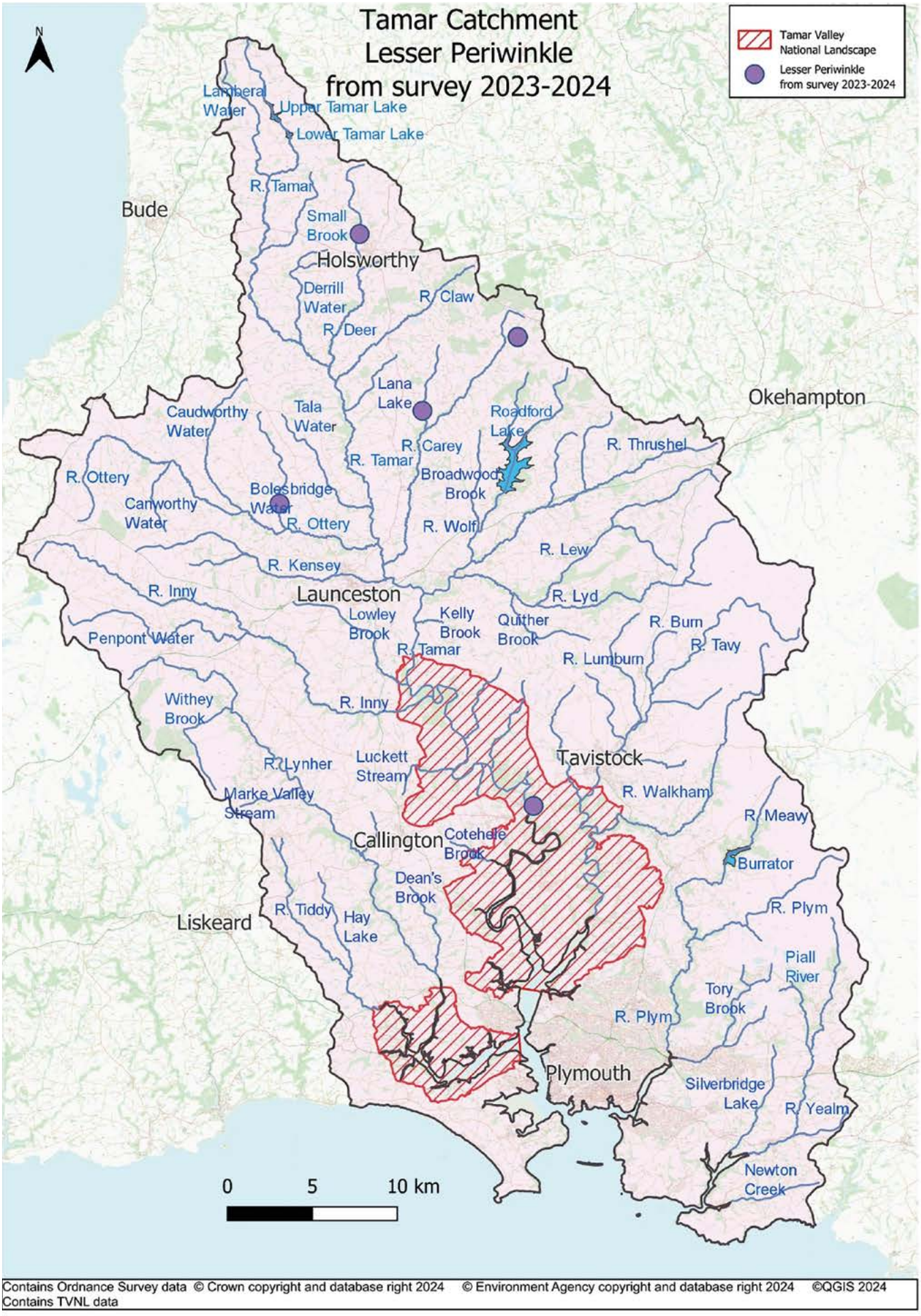
Contains TVNL data


Tamar Catchment
Lesser Periwinkle
from survey 2023-2024
Tamar Valley
National Landscape
Lesser Periwinkle
from survey 2023-2024
N
Lambera
Water
Upper Tamar Lake
Lower Tamar Lake
R. Tamar
Bude
Small
Brook
Holsworthy
Derrill
Water
R. Claw
R. Deer
Lana
Lake
Okehampton
Caudworthy
Water
Tala
Water
Roadford
Lake
R. Carey
R. Tamar
R. Thrushel
R. Ottery
Broadwood
Brook
Bolesbridge
Water
Canworthy
Water
R. Ottery
R. Wolf
R. Lew
R. Kensey
R. Inny
Launceston
R. Lyd
Lowley
Brook
Kelly
Brook
Quither
Brook
R. Burn
R. Tavy
Penpont Water
R. Tamar
R. Lumburn
Withey
Brook
R. Inny
R. Lynher
Luckett
Stream
Tavistock
R. Walkham
Marke Valley
Stream
R. Meavy
Callington
Cotehele
Brook
Burrator
Dean's
Brook
R. Tiddy
R. Plym
Liskeard
Hay
Lake
Piall
River
Tory
Brook
R. Plym
Plymouth
Silverbridge
Lake
R. Yealm
Newton
Creek
0
5
10 km
Contains Ordnance Survey data © Crown copyright and database right 2024 © Environment Agency copyright and database right 2024 ©QGIS 2024
Contains TVNL data


Tamar Catchment
Michaelmas Daisy
from survey 2023-2024
N
Tamar Valley National Landscape
Michaelmas Daisy
Lamberal Water
Upper Tamar Lake
Lower Tamar Lake
R. Tamar
Bude
Small Brook
Holsworthy
Derrill Water
R. Claw
R. Deer
Lana Lake
Okehampton
Caudworthy Water
Tala Water
Roadford Lake
R. Carey
R. Tamar
R. Thrushel
R. Ottery
Broadwood Brook
Bolesbridge Water
Canworthy Water
R. Ottery
R. Wolf
R. Lew
R. Kensey
R. Inny
Launceston
R. Lyd
Lowley Brook
Kelly Brook
Quither Brook
R. Burn
Penpont Water
R. Tamar
R. Tavy
R. Lumburn
Withey Brook
R. Inny
R. Lynher
Luckett Stream
Tavistock
R. Walkham
Marke Valley Stream
R. Meavy
Callington
Cotehele Brook
Burrator
Dean's Brook
R. Plym
R. Tiddy
Hay Lake
Liskeard
Piall River
Tory Brook
R. Plym
Plymouth
Silverbridge Lake
R. Yealm
Newton Creek
0
5
10 km
Contains Ordnance Survey data © Crown copyright and database right 2024 © Environment Agency copyright and database right 2024 ©QGIS 2024
Contains TVNL data


Tamar Catchment
Monkeyflower
from survey 2023-2024
Tamar Valley
National Landscape
Monkeyflower from survey 2023-2024
N
Lambera Water
Upper Tamar Lake
Lower Tamar Lake
R. Tamar
Bude
Small Brook
Holsworthy
Derrill Water
R. Claw
R. Deer
Lana Lake
Okehampton
Caudworthy Water
Tala Water
Roadford Lake
R. Carey
R. Tamar
R. Thrushel
R. Ottery
Broadwood Brook
Bolesbridge Water
Canworthy Water
R. Ottery
R. Wolf
R. Lew
R. Kensey
R. Inny
Launceston
R. Lyd
Lowley Brook
Kelly Brook
Quither Brook
R. Burn
R. Tavy
Penpont Water
R. Tamar
R. Lumburn
Withey Brook
R. Inny
R. Lynher
Luckett Stream
Tavistock
R. Walkham
Marke Valley Stream
R. Meavy
Callington
Cotehele Brook
Burrator
Dean's Brook
R. Plym
R. Tiddy
Hay Lake
Liskeard
Piall River
Tory Brook
R. Plym
Plymouth
Silverbridge Lake
R. Yealm
Newton Creek
0
5
10 km
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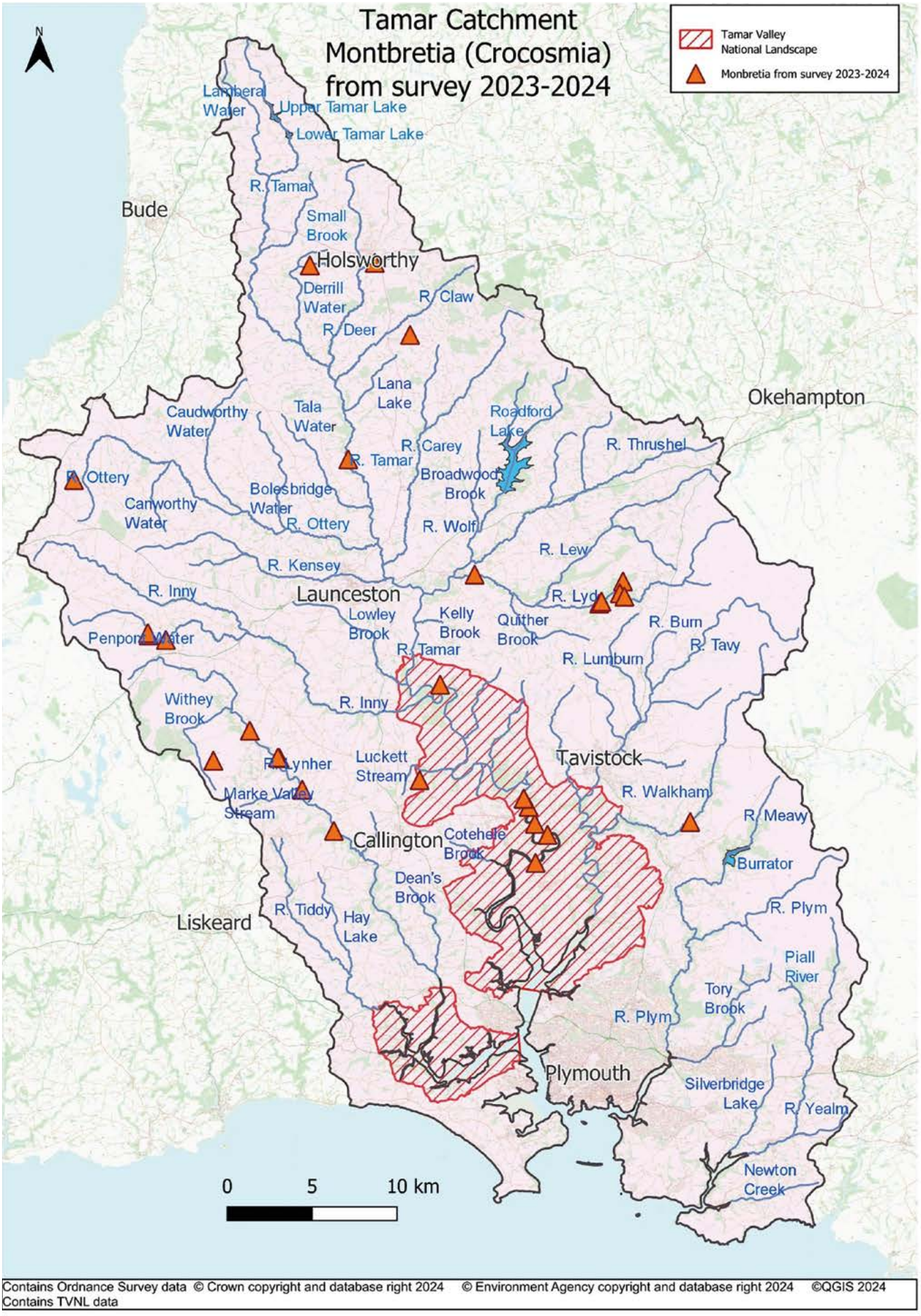
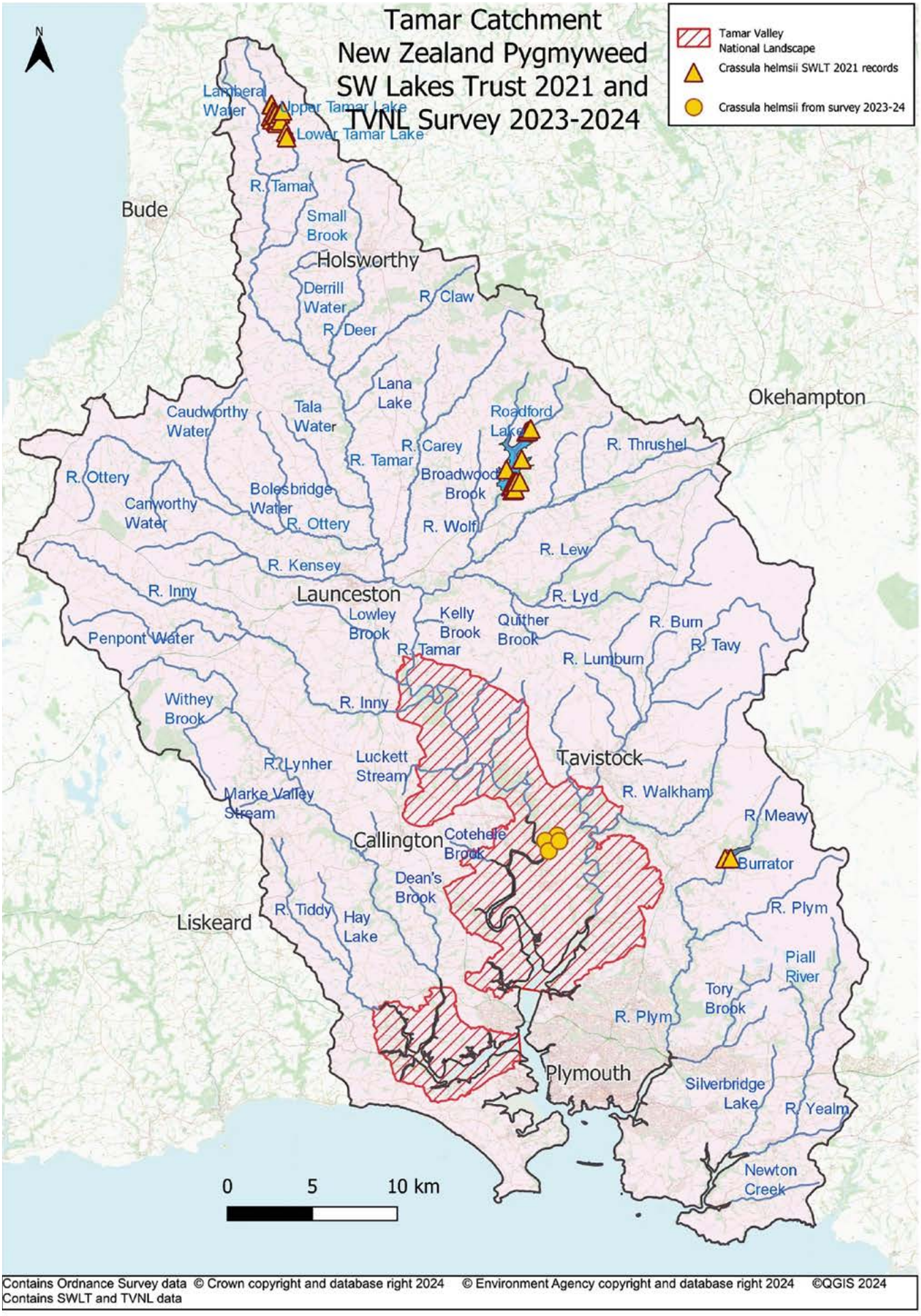
Contains TVNL data




Tamar Catchment
New Zealand Pygmyweed
SW Lakes Trust 2021 and
TVNL Survey 2023-2024
Tamar Valley
National Landscape
Crassula helmsii SWLT 2021 records
Crassula helmsii from survey 2023-24
N
Lambera Water
Upper Tamar Lake
Lower Tamar Lake
R. Tamar
Bude
Small Brook
Holsworthy
Derrill Water
R. Claw
R. Deer
Lana Lake
Okehampton
Caudworthy Water
Tala Water
Roadford Lake
R. Carey
R. Tamar
R. Thrushel
R. Ottery
Broadwood Brook
Bolesbridge Water
Canworthy Water
R. Ottery
R. Wolf
R. Lew
R. Kensey
R. Inny
Launceston
R. Lyd
Lowley Brook
Kelly Brook
Quither Brook
R. Burn
R. Tavy
Penpont Water
R. Tamar
R. Lumburn
Withey Brook
R. Inny
Tavistock
R. Lynher
Luckett Stream
R. Walkham
Marke Valley Stream
R. Meavy
Callington
Cotehele Brook
Burrator
Dean's Brook
R. Tiddy
R. Plym
Liskeard
Hay Lake
Piall River
Tory Brook
R. Plym
Plymouth
Silverbridge Lake
R. Yealm
Newton Creek
0
5
10 km
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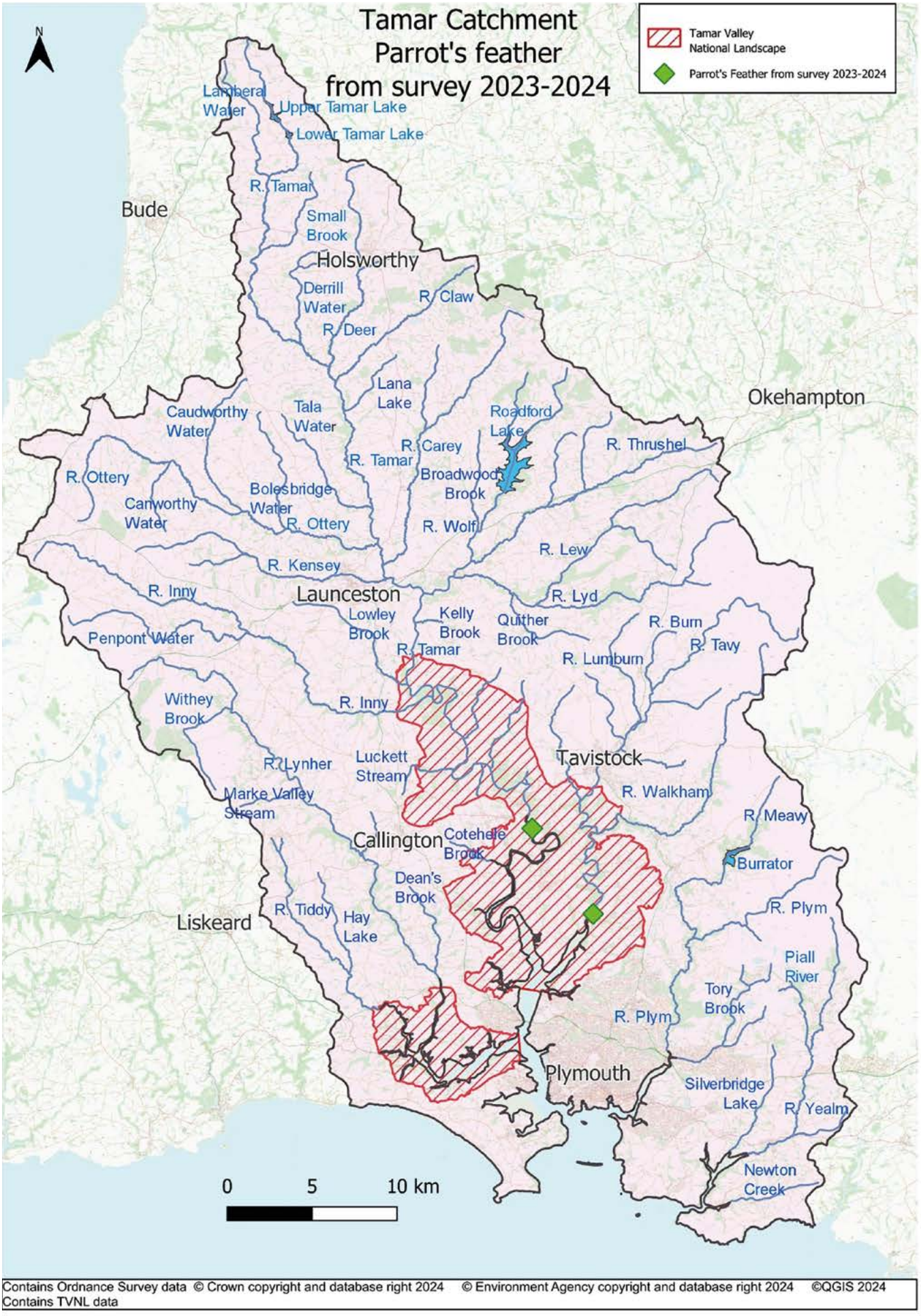
Contains SWLT and TVNL data




Tamar Catchment
Piggyback Plant
from survey 2023-2024
Tamar Valley
National Landscape
Piggyback Plant
from survey 2023-2024
N
Lambera
Water
Upper Tamar Lake
Lower Tamar Lake
R. Tamar
Bude
Small
Brook
Holsworthy
Derrill
Water
R. Claw
R. Deer
Lana
Lake
Okehampton
Caudworthy
Water
Tala
Water
Roadford
Lake
R. Carey
R. Tamar
R. Thrushel
R. Ottery
Broadwood
Brook
Bolesbridge
Water
Canworthy
Water
R. Ottery
R. Wolf
R. Lew
R. Kensey
R. Inny
Launceston
R. Lyd
Lowley
Brook
Kelly
Brook
Quither
Brook
R. Burn
R. Tavy
Penpont Water
R. Tamar
R. Lumburn
Withey
Brook
R. Inny
R. Lynher
Luckett
Stream
Tavistock
R. Walkham
Marke Valley
Stream
R. Meavy
Callington
Cotehele
Brook
Burrator
Dean's
Brook
R. Tiddy
R. Plym
Liskeard
Hay
Lake
Piall
River
Tory
Brook
R. Plym
Plymouth
Silverbridge
Lake
R. Yealm
Newton
Creek
0
5
10 km
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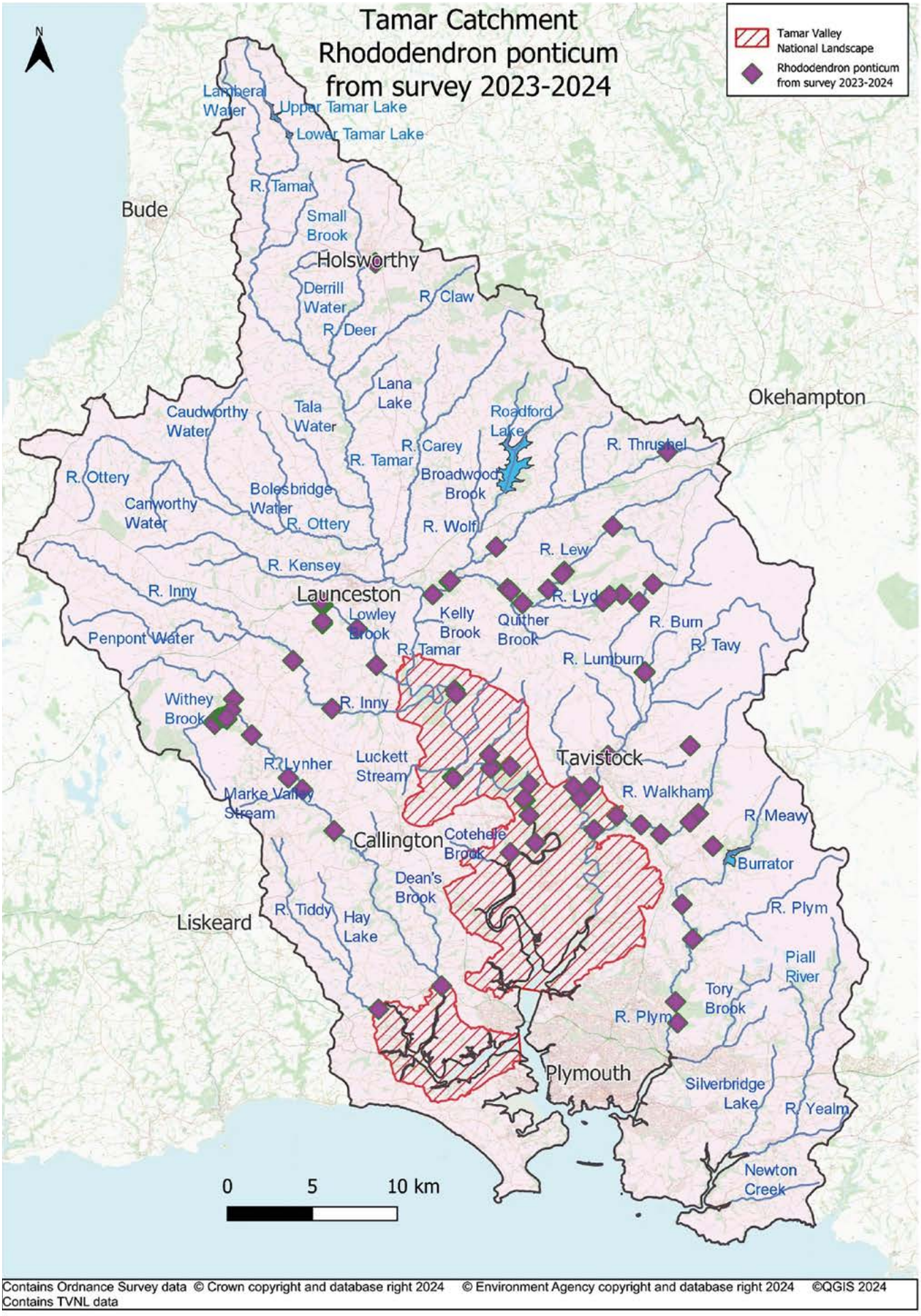
Contains TVNL data


Tamar Catchment
Rhododendron ponticum
from survey 2023-2024
Tamar Valley
National Landscape
Rhododendron ponticum
from survey 2023-2024
N
Lambera
Water
Upper Tamar Lake
Lower Tamar Lake
R. Tamar
Bude
Small
Brook
Holsworthy
Derrill
Water
R. Claw
R. Deer
Lana
Lake
Okehampton
Caudworthy
Water
Tala
Water
Roadford
Lake
R. Carey
R. Tamar
R. Thrushel
R. Ottery
Broadwood
Brook
Bolesbridge
Water
Canworthy
Water
R. Ottery
R. Wolf
R. Lew
R. Kensey
R. Inny
Launceston
R. Lyd
Lowley
Brook
Kelly
Brook
Quither
Brook
R. Burn
R. Tavy
Penpont Water
R. Tamar
R. Lumburn
Withey
Brook
R. Inny
Tavistock
R. Lynher
Luckett
Stream
R. Walkham
Marke Valley
Stream
R. Meavy
Callington
Cotehele
Brook
Burrator
Dean's
Brook
R. Tiddy
R. Plym
Liskeard
Hay
Lake
Piall
River
Tory
Brook
R. Plym
Plymouth
Silverbridge
Lake
R. Yealm
Newton
Creek
0
5
10 km
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Contains TVNL data


Tamar Catchment
Shrubby Honeysuckle
from survey 2023-2024
Tamar Valley
National Landscape
Shrubby Honeysuckle
from survey 2023-2024
N
Lamberal
Water
Upper Tamar Lake
Lower Tamar Lake
R. Tamar
Bude
Small
Brook
Holsworthy
Derrill
Water
R. Claw
R. Deer
Lana
Lake
Okehampton
Caudworthy
Water
Tala
Water
Roadford
Lake
R. Carey
R. Tamar
R. Thrushel
R. Ottery
Broadwood
Brook
Bolesbridge
Water
Canworthy
Water
R. Ottery
R. Wolf
R. Lew
R. Kensey
R. Inny
Launceston
R. Lyd
Lowley
Brook
Kelly
Brook
Quither
Brook
R. Burn
Penpont Water
R. Tamar
R. Tavy
R. Lumburn
Withey
Brook
R. Inny
R. Lynher
Luckett
Stream
Tavistock
R. Walkham
Marke Valley
Stream
R. Meavy
Callington
Cotehele
Brook
Burrator
Dean's
Brook
R. Tiddy
Hay
Lake
R. Plym
Liskeard
Piall
River
Tory
Brook
R. Plym
Plymouth
Silverbridge
Lake
R. Yealm
Newton
Creek
0
5
10 km
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Contains TVNL data


Tamar Catchment
Snowberry
from survey 2023-2024
Tamar Valley
National Landscape
Snowberry from survey 2023-2024
N
Lamberal
Water
Upper Tamar Lake
Lower Tamar Lake
R. Tamar
Bude
Small
Brook
Holsworthy
Derrill
Water
R. Claw
R. Deer
Lana
Lake
Okehampton
Caudworthy
Water
Tala
Water
Roadford
Lake
R. Carey
R. Tamar
R. Thrushel
R. Ottery
Broadwood
Brook
Bolesbridge
Water
Canworthy
Water
R. Ottery
R. Wolf
R. Lew
R. Kensey
R. Inny
Launceston
R. Lyd
Lowley
Brook
Kelly
Brook
Quither
Brook
R. Burn
R. Tavy
Penpont Water
R. Tamar
R. Lumburn
Withey
Brook
R. Inny
Tavistock
R. Lynher
Luckett
Stream
R. Walkham
Marke Valley
Stream
R. Meavy
Callington
Cotehele
Brook
Burrator
Dean's
Brook
R. Plym
R. Tiddy
Hay
Lake
Liskeard
Piall
River
Tory
Brook
R. Plym
Plymouth
Silverbridge
Lake
R. Yealm
Newton
Creek
0
5
10 km
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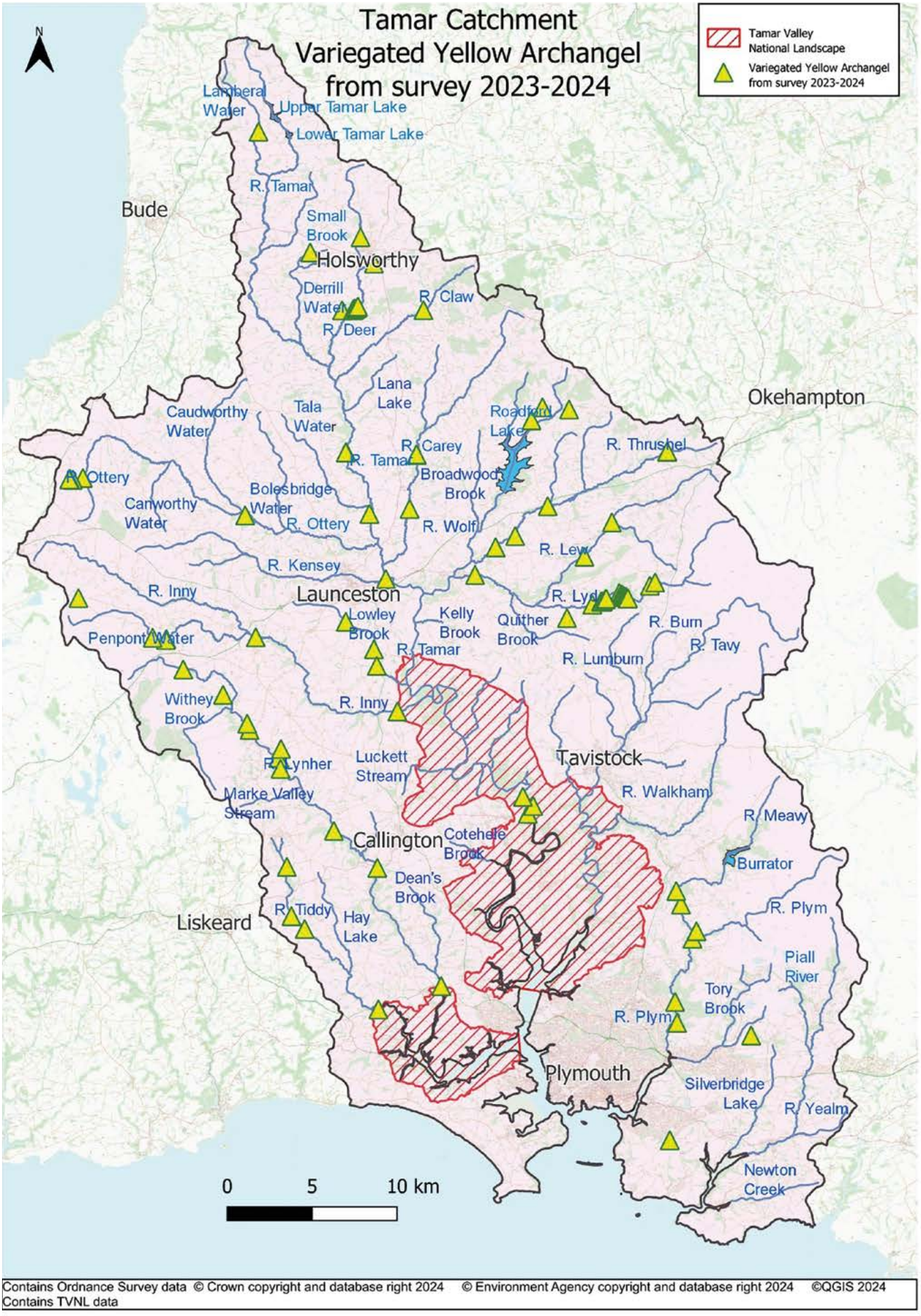
Contains TVNL data




Tamar Catchment
Winter Heliotrope
from survey 2023-2024
Tamar Valley
National Landscape
Winter Heliotrope
from survey 2023-2024
N
Lambera
Water
Upper Tamar Lake
Lower Tamar Lake
R. Tamar
Bude
Small
Brook
Holsworthy
Derrill
Water
R. Claw
R. Deer
Lana
Lake
Okehampton
Caudworthy
Water
Tala
Water
Roadford
Lake
R. Carey
R. Tamar
R. Thrushel
R. Ottery
Broadwood
Brook
Bolesbridge
Water
Canworthy
Water
R. Ottery
R. Wolf
R. Lew
R. Kensey
R. Inny
Launceston
R. Lyd
Lowley
Brook
Kelly
Brook
Quither
Brook
R. Burn
R. Tavy
Penpont Water
R. Tamar
R. Lumburn
Withey
Brook
R. Inny
R. Lynher
Luckett
Stream
Tavistock
R. Walkham
Marke Valley
Stream
R. Meavy
Callington
Cotehele
Brook
Burrator
Dean's
Brook
R. Tiddy
R. Plym
Liskeard
Hay
Lake
Piall
River
Tory
Brook
R. Plym
Plymouth
Silverbridge
Lake
R. Yealm
Newton
Creek
0
5
10 km
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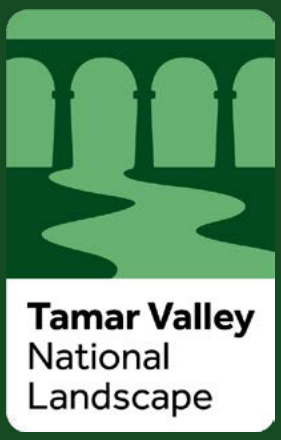
Contains TVNL data


Tamar Valley
National
Landscape