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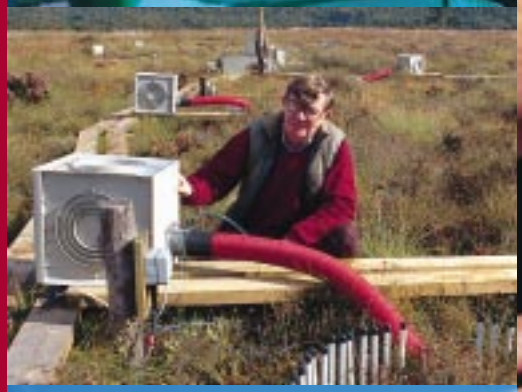
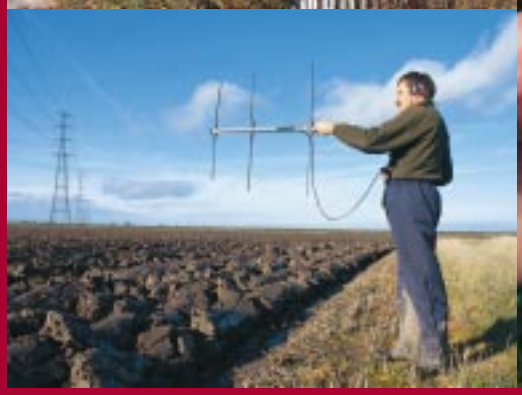
Strategic control of non-native invasive aquatic plants

English Nature Research Reports





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Strategic control of non-native invasive aquatic plants

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Summary

Invasive non-native species are recognised as a significant threat to biodiversity. Introduced plant species are a particular problem in freshwater and wetland environments where a number of species have shown the potential to be highly invasive, for example Australian swamp stonecrop *Crassula helmsii*. The scale and nature of many invasive aquatic plant problems means that isolated control and management work is unlikely to be successful in the long term because of the potential for reinvasion. A strategic approach dealing with the problem across a large but manageable geographic area, is advocated as an appropriate way of coordinating the activity of a range of stakeholders to tackle invasive aquatic plants in a holistic manner.

This report describes the development of a strategic approach to address non-native species within a focus area. The report is intended to be used as guidance and a checklist for those developing a strategy to deal with non-native invasive plants. Although the focus of this report is on aquatic plants it is envisaged that much of the content will be applicable to other non-native species problems. Throughout the report the River Avon catchment (Wiltshire and Hampshire) is used to illustrate the steps of the strategy in a series of boxed sections.

The report deals with steps involved in establishing a focus area and discusses the relative merits and disadvantages of different scales and boundaries for a focus area. Once a focus area has been identified it is recommended that a list of known and potential non-native aquatic plant species is determined and distribution data collated. Potential stakeholders and partners should be identified and guidance is given on prioritising control and funding and implementing a programme of work. The use of a project 'champion' is recommended to provide an impetus to the strategy and to lead the establishment of a working group or forum through which aims and objectives should be agreed and subsequently embedded in policy, and funding sought.

Emphasis is given to prevention of problems within a particular focus area acknowledging that managing a problem is costly and eradication very difficult. An important part of this prevention work is 'horizon scanning' to identify problems in neighbouring areas or in other countries. Having identified potential future problems it is much easier to justify and undertake early management should an invasion occur. To highlight the importance of preventative action, steps to prevent future invasions are dealt with separately from the overall strategy development.

A brief report of a workshop held in Peterborough in November 2004 is included as an appendix to the report. The purpose of this workshop was to consider the non-native invasive problem from a nature conservation perspective (as opposed to a flood defence perspective) and to reappraise English Nature's position in terms of controlling invasions. The workshop was also an opportunity to take stock of the range of management techniques available.

Glossary

In the document the following terms are used and their meaning is defined:

Aquatic plant: plants visible to the naked eye that have a requirement to grow permanently or intermittently in water – include higher plants, ferns, bryophytes and macroalgae (including stoneworts) and encompasses hydrophytes (perennial plants with renewal buds below water and with submerged or floating leaves), helophytes (perennial plants with renewal buds buried in soil or mud below water level) and marginal plants (annual and perennial plants with renewal buds not reliant on being in water).

Colonisation: the successful invasion of a new habitat by a species.

Invasive non-native species: a non-native species whose establishment and spread threaten ecosystems, habitats or species with economic or environmental harm. These are addressed under Article 8(h) of the Convention on Biological Diversity (Wittenberg and Cock 2001).

Non-native species (synonymous with alien, non-indigenous, foreign and exotic): a species, subspecies or lower taxon introduced outside its normal past or present distribution; includes any part, gamete, seeds eggs, or propagules of such species that might survive and subsequently reproduce (Wittenberg and Cock 2001).

Target species: the species at which management is aimed either to reduce its spread or eradicate it, or prevent its invading into an area.

Contents

1 Introduction

Non-native species can have considerable adverse impacts on native habitats and species. The issue of preventing or managing the introduction, establishment and spread of non-natives is today recognised as being of crucial importance in biodiversity conservation worldwide. Indeed, Article 8(h) of the Convention on Biological Diversity (of which the UK is a signatory) calls for 'contracting parties' to "prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species". Existing legislation relating to introduction and control of non-native species is spread across a wide variety of different UK acts and regulations.

The impacts of aquatic non-native plant species at freshwater sites can be particularly severe, and are considered to present a serious threat to biodiversity. The impact of invasive aquatic plants has recently been acknowledged as a risk to achieving the objectives of the EU Water Framework Directive in the UK (UK TAG 2004) and the presence of invasive aquatic plants is the cause of unfavourable condition at a number of Sites of Special Scientific Interest (SSSI) in England, and is also threatening a number of UK Biodiversity Action Plan (BAP) priority species. Tackling invasive aquatic plants will be required in order to achieve the government's public service agreement for 95% SSSIs (by area) to be in favourable or unfavourable recovering condition by 2010 and to ensure water bodies are at good ecological status by 2015 as required by the EU Water Framework Directive. The UK is not the only country experiencing significant threats from non-native aquatic plants, similar threats have been documented for countries such as New Zealand, Australia, France, North America and South Africa.

It is now widely recognised that a nationally co-ordinated effort to prevent or control the introduction and spread of invasive non-natives is required in order to tackle these threats. Piecemeal attempts at control ultimately fail due to rapid re-growth or re-colonisation and there is a need for coordinated action involving a wide range of agencies and stakeholders. Recognising the importance of a more holistic approach to non-native species control, Defra undertook a substantial review of policy and legislation relating to non-native species in this country and abroad in 2001, and set up a review group to provide recommendations to Parliament for reform of non-native species legislation and strategy (Defra 2003). This review made a number of key recommendations some of which have now been acted upon for example a code of conduct has been developed for the horticultural industry (Defra 2005).

This report is intended to outline the steps that are required in the development of a strategic approach to invasive aquatic plants at a regional or an area level. It is intended to be used a guidance for those developing a locally-based (eg catchment or local authority area, termed the 'focus area') and stakeholder-based non-native plant species strategy. Whilst many of the steps and areas to cover will be obvious it is hoped that this report will be useful as a checklist and help ensure consistent approaches between neighbouring strategies. The report does not provide details of management options (herbicides, mechanical methods etc).

The report focuses on non-native aquatic and riparian plant species which commonly cause problems for freshwater and terrestrial wetland habitats, however some of the species discussed such as Japanese knotweed are a problem across a wide range of habitats. A list of the major invasive aquatic plant species is provided in Table 1 along with a summary of their key characteristics. The focus of this report is invasive aquatic plants but it is likely that many

of the principles outlined may be applied to other invasive species, for example non-native crayfish.

A report of an English Nature workshop *Invasive plants of freshwater habitats and implications for nature conservation* held in November 2004 is also included in this report as an appendix. The purpose of the workshop was to reappraise English Nature's position in relation to invasive aquatic plants, to discuss the scale and nature of the problem from a nature conservation perspective and discuss latest control and management options.

Table 1. Invasive non-native aquatic/riparian plant species known to be present in the UK

Species		Growth form	Means of dispersal	Problems caused	Main sources
Azolla filiculoides	Water fern	Floating	Vegetative and spores	Deoxygenation and shading out submerged species impeding flow	Garden centres
Crassula helmsii	New Zealand Pygmyweed/ Australian Swamp Stonecrop	Submerged and/ or emergent	Vegetative through fragments and seeds	Displacing native species and impeding flow	Some garden centres
Fallopia japonica	Japanese knotweed	Marginal	Vegetative through and stem fragments	Displacing native species, damage to structures	Contaminated soil and cut stems
Elodea canadensis	Canadian pondweed	Submerged	Vegetative fragments	Impeding flow	From ponds and lakes etc
E. nuttallii	Nuttall's pondweed	Submerged	Vegetative fragments	Impeding flow	From ponds and lakes etc
Heracleum mantegazzianum	Giant hogweed	Marginal	Seeds	Health hazard, impeding flow, shading out other species	From gardens
Impatiens glandulifera	Himalayan balsam	Marginal	Seeds	Impeding flow and shading out other species	From gardens
Gunnera manicata	Gunnera	Marginal	Vegetative rhizome fragments	Impeding flow and shading out other species	From gardens
Hydrocotyle ranunculoides	Floating pennywort	Floating and emergent	Vegetative fragments and seeds		Garden centres
Lagarosiphon major	Curly waterweed/ Curly water thyme	Submerged	Vegetative fragments	Displacing native species	Garden centres
Lemna minuta	Least duckweed	Floating	Vegetative	Deoxygenation and shading	Natural spread
Ludwigia spp.	Water primroses	Emergent and floating	Vegetative seeds	Deoxygenation and shading	Natural spread
Pontederia cordata	Pickerelweed	Emergent		Impeding flow	Garden centres
Myriophyllum brasiliensis	Parrot's feather	Submerged and emergent	Vegetative fragments	Deoxygenating and shading out native species	Garden centres
Nymphaea cultivars	Water lily	Floating	Vegetative fragments	Shading out native species	Garden centres
Nymphoides peltata (non-native material)	Yellow floating heart or Fringed water-lily	Floating	Vegetative fragments	Shading out native species	Garden centres

2 Methods and outputs

The strategy approach has been based on a wide range of information from literature and web sites and the experience of the project team who have been involved in setting up Environment Agency led partnerships in a few areas. The work has also benefited from a study visit to Sydney, Australia (not directly part of the project) to visit and learn about projects to manage non-native aquatic plants. The strategy and a draft code of conduct for the horticultural industry formed the basis of a workshop on non-native invasive plants held at RPS Ecology, St Ives on 11 February 2004. Landscape architects and ecologists and environmental managers attending this workshop provided feedback which has been built into the strategy and this report. An outline of the strategy was presented at the annual Robson Meeting on aquatic plant management in February 2004, which prompted some questions and useful discussion. Again, feedback was incorporated into the strategy. The need for a strategy such as English Nature is developing was clearly stated.

2.1 Overview of strategy

A strategy has been developed for a) prevention and b) management/control of key non-native species within a defined geographical area. Consideration has been given to different geographical scales and boundaries for such an area, including natural features such as hydrology (eg river catchment basins) and political/administrative features (eg local authority boundaries).

Although a number of sites are mentioned in the report, the river Avon Special Area of Conservation (SAC) and catchment has been used to illustrate the strategy where appropriate. A programme of work on invasive aquatic plants is planned for this catchment associated with the recently awarded EU LIFE nature project – 'River Avon cSAC: demonstrating strategic restoration and management' LIFE05 NAT/UK/000143.

The strategy includes:

- current extent and distribution of known problem species in the catchment;
- consideration of risk assessment and prediction of both potential non-native introductions and potential sources of such species ('horizon-scanning'): risk assessments are currently conducted under international phytosanitary agreements under the auspices of the International Plant Protection Convention (IPPC), and such an approach may be adaptable to the needs of the model strategy;
- identification of modes and routes of the spread of non-natives;
- co-ordinated management/stakeholder involvement (including identification and recruitment of key stakeholders);
- monitoring and database management: consideration of the need to co-ordinate monitoring efforts between stakeholders such as English Nature (EN), Environment Agency (EA), the Wildlife Trusts, the Botanical Society of the British Isles (BSBI) and the potential involvement of other potential partners such as anglers, boat-owners, marina owners and riparian landowners;
- strategies for control, management and eradication of non-natives, including prioritisation: publications produced for the Global Invasive Species Project (GISP) and the Subsidiary Body for Scientific and Technical Advice (SBSTTA) to the

Convention on Biological Diversity provide a key starting point, and other relevant sources have been also be considered, eg Wittenberg and Cock (2001) and McNeeley (2001);

- awareness raising, particularly in key stakeholder organisations/agencies (not necessarily the general public) including the production of codes of conduct, eg construction industry and hauliers;
- establishing policy(ies) including organisational and planning processes to underpin the model/strategy;
- identification of a "champion" organisation which could be for an individual species or for invasive species as a whole;
- organising and delivering sensitively targeted and well structured training;
- recognition that management will need to be sustained over a number of years and that monitoring will need to be sustained indefinitely, and
- the critical importance of funding commensurate with management and its timescale.

Additionally work has been undertaken to:

- obtain and synthesise data on current distributions of key non-native species in the Avon catchment;
- identify relevant stakeholders; and
- identify potential sources of non-native species and main dispersal/invasion routes.

This has informed the draft strategy which includes priorities for control or eradication and the identification of future problem species and vulnerable habitats or species. Figure 1 summarises the key components of the strategy.

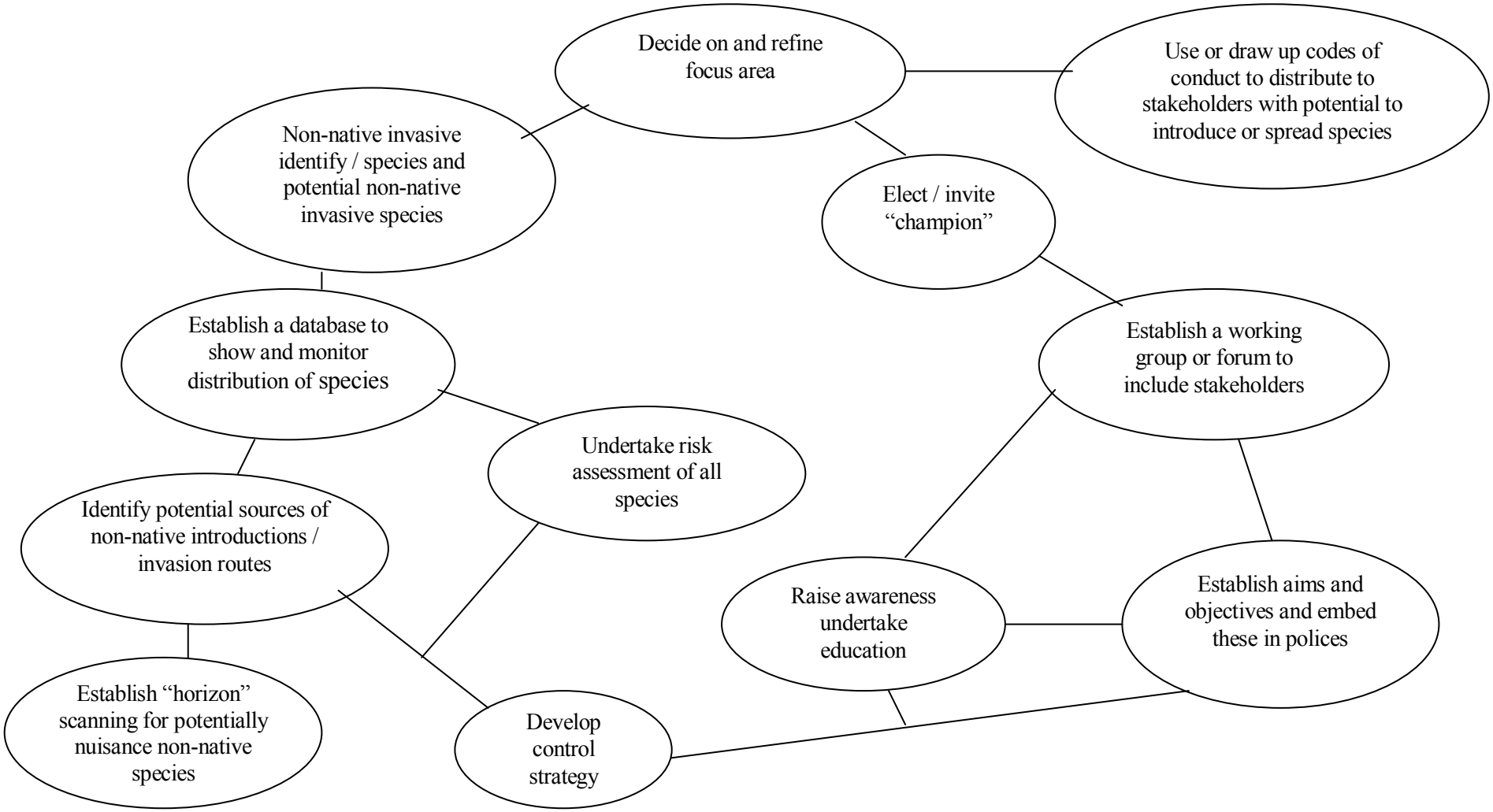

Figure 1 Key components of a strategy to manage non-native invasive aquatic plant species in a focus area

3 Strategic management of invasive plants

3.1 Introduction

A model is presented for dealing with the invasion by non-native aquatic plant species of an area of land such as a river catchment or local authority area. The development of an invasive species management strategy is described in a series of stages. Each of these stages is in turn broken up into its constituent parts, typically presented as a list. Where deemed appropriate, a particular part or aspect of a stage is considered in more detail.

For sake of convenience, the strategy is divided into two parts:

- managing an existing invasion, and
- preventing an invasion.

In a number of respects, the processes are very similar. The structure is valuable nevertheless, if only to emphasise the crucial importance of prevention.

Setting out to develop a strategy for managing the invasion of any non-native species is no small undertaking. There are a number of aspects which underline this statement:

- the invasion of a number of species such as Japanese knotweed, Australian swamp stonecrop and Himalayan balsam are at an advanced stage, and these species are now widespread, for example Japanese knotweed is found in 73% of 10 km squares in England, Scotland and Wales;
- some species, eg swamp stonecrop and Japanese knotweed are very hard to eradicate from a single site, and eradication over a wider area is therefore an onerous or impossible undertaking;
- the time taken to achieve successful management is measured in years if not decades;
- legislative support and appropriate policies, eg in Local Plans, are limited and at an early stage of emergence, which means that there is little established support for control of non-native species, and
- the funding required to manage a number of species over a wide area, eg a river catchment will be considerable.

Considering the time required for successful management in a little more detail, this will include the planning of the strategy and the preparation phase followed by implementation, ie management of the target species. The planning/strategy development phase will probably take two years to complete. It is envisaged that a year or best part thereof would be required to recruit stakeholders and set up a forum/task group with the remit of developing and implementing the strategy. Another initial task is the setting of financial targets and lobbying stakeholder organisations/agencies to achieve budget allocations for the following year. Ideally, a strategy will include the establishment of policies to underpin the planning and implementation, eg policies adopted by local authorities in their Structure Plans and Local Plans and embedded in Environment Agency catchment management objectives. These policies would then be available to lever funding. If policy formation and adoption is to be included at this level, then the planning/strategy development phase will take even longer.

The implementation phase is potentially an open-ended time period. Even assuming the target species are brought under control to the agreed level, monitoring will be required to ensure that this level of control is maintained. Additionally, unless prevention measures such as codes of conduct are completely successful, it is inevitable that new invasive non-native species will colonise the area and will need to be put under surveillance and/or controlled. Bringing a target species under control at a site could take a number of years, especially if it is not possible to use herbicides, or if the infestation is close to or in water. For example, controlling Japanese knotweed growing alongside a river can take up to three years even with two applications of herbicide each year.

It is to be expected that once the target species have been brought under the agreed level of control, the cost per annum of sustaining management will reduce.

3.1.1 Control and management techniques

An integral part of any strategic approach to invasive plant species is the control techniques themselves. Successful control and containment of problem species depends upon effective control techniques, however this report does not deal with the various methods of control available for specific problem species. Effective control often depends on assessing the scale and nature of the problem and adopting the method appropriate to the situation, consequently providing generic guidance is difficult. It is recommended that control programmes are developed through consultation with others who have experience in dealing with the particular species.

The Centre for Aquatic Plant Management has produced a series of information sheets detailing chemical, physical and biological control options for different species and these are a useful starting point for those considering work:
http://www.ceh.ac.uk/sections/wq/CAPMInformationsheets.htm

3.2 Focus area

There is a clear need to tackle invasive species problems at a range of different scales and inevitably some actions are better suited to particularly geographical scales. The Defra review (Defra 2003) highlighted issues that need to be addressed at a UK level, particularly in relation to risk assessment and the prevention of future problems and there have been a number of projects that have trialled control at the site level (eg ECUS 2005). This report focuses on an intermediate scale at which many organisations have some level of influence (as opposed to individual sites which may be privately owned) and where actions on individual sites can be integrated and coordinated. A strategic approach that involves a range of partner organisations and key stakeholders could be applied to area defined by:

- a river catchment;
- a lake catchment;
- an Internal Drainage Board (IDB) area;
- a canal system;
- a local authority area, eg borough or district council;
- a land holding, eg an estate or other property, and
- an angling or fishing reach, eg a length of river fished by a club.

A review of invasive non-native weed management in the UK and other parts of the world indicates that no particular area is obviously better than another. The areas most commonly encountered are local authority areas and river catchments. If the defined area for a strategy does not follow local authority and/or catchment boundaries, there should nevertheless be a strong link to the local authority and hydrological connectivity in terms of stakeholder consultation and implementation, routes of invasion and management strategy.

Local authorities have the following advantages:

- planning policies can be adopted which deal with non-native plant management;
- the local authority has a close link to local communities and hence engaging their support and encouraging involvement should be easier, and there are mechanisms set up to encourage voluntary support and experience of this;
- local authorities increasingly support and have access to county biological records centres;
- local authority areas have well recognised boundaries and there is a sense of responsibility in local communities;
- the areas covered by local authority jurisdiction are not too large to make implementation of a strategy overcomplicated, but neither are they too small that outside factors could interfere with the success of the strategy;
- funding can be attracted through the local authority including European Union funding;
- most local authorities undertake and have experience of some form of weed control, and
- in the City and County of Swansea, the land owner with most Japanese Knotweed was the local authority, and this is likely to be true to a greater or lesser extent in other infested areas, whereas in the case of other species, eg Himalayan Balsam and Giant Hogweed, it might be the Environment Agency.

A significant negative characteristic is that local authority areas typically have a poor relationship to hydrological continuity and river catchments. The use of a river catchment as a boundary for a strategy also has advantages, especially when dealing with aquatic non-native invasive species, as it enables an holistic approach to the problem (ie all problem areas relating to a river catchment would be covered), whereas one river catchment may encompass several local authorities. River catchments also map onto the Environment Agency's boundaries, and the Environment Agency has, and is continuing to develop, a management approach based on catchments, eg Local Environment Agency Plans (LEAPs) and Catchment Abstraction Management Strategy (CAMS). The latter encourages increasing stakeholder input and compliments the proposal for River Basin Plans under the EU Water Framework Directive.

A species such as giant hogweed can spread down a river system, and management based on a catchment can deal with the invasion in a structured fashion, ie moving down from the source of the invaded river. Spread down a river is only one means of dispersal and a number are independent of catchment boundaries, eg vehicle movements and Japanese knotweed, spread of swamp stonecrop from garden centres and the spread of parrot's feather by boats

transported by road from one catchment to another. Some river catchments are very large, which could make a single catchment-wide strategy difficult to implement.

The essential aim of a non-native species strategy is to encourage concerted action to tackle invasive non-native species. The area covered by the strategy is to a great extent a secondary factor, especially if it is recognised that the involvement of the local authority (or authorities) together with that of the Environment Agency and English Nature, will be essential for successful implementation whatever the focus area.

Criteria for the maximum size of a focus area would include:

- no more than one county council;
- no more than three borough and/or district councils;
- no more than one English Nature region;
- no more than one Environment Agency region, and
- no more than about 3,000 square kilometres.

Other factors important in deciding on the extent of the focus area include:

- can policies be developed for the proposed area which are able to be incorporated into an existing structure, eg local authority planning policy or catchment management plan?
- does the 'champion's' influence extend across the whole of the area?
- can resources be realistically raised to cover the area for a sustained period of time?
- does the area make sense ecologically? It is not ideal for the focus area boundary to cut across ecological entities, eg lengths of river or a lake;
- is the area recognisable by local communities such that they can relate to it and take ownership for aspects of the project?
- does the area take into consideration any neighbouring initiatives of a similar nature, including neighbouring areas abutting right up to the focus area, and
- does the proposed focus area make sense in terms of prospective stakeholders, ie it does not exclude any key organisation etc.?

Box 1 The Hampshire Avon Focus Area.

In the case of the Hampshire Avon, the focus area is that defined by the Environment Agency, which can provide a map showing its boundary. Consideration should be given to:

- excluding the catchment of the River Stour and its tributaries, itself a tributary of the Avon which has its confluence near Christchurch thereby removing consideration of the River Moors and Crane from the strategy, and
- defining a zone around the catchment boundary from which non-native aquatic species might reinvade or colonise in the future.

There could be merit in dividing a large river catchment down into sub-catchment units. Such units could be more easily recognised by local communities engendering more of a sense of responsibility/ownership.

Box 2 Invasive non-native species known to be a problem within the Avon catchment (Source: River Avon cSAC conservation strategy, Environment Agency data.)

- Giant hogweed *Heracleum mantegazzianum*
- Japanese knotweed *Fallopia japonica*
- Himalayan balsam *Impatiens glandulifera*
- Australian swamp stonecrop *Crassula helmsii*
- Parrot feather Myriophyllum aquaticum
- Least duckweed *Lemna minuta*
- Water fern *Azolla filiculoides*
- North American skunk cabbage *Lysichiton americanus*
- Monkey flower *Mimulus guttatus*

It is recommended that the catchment be broken down into sub-units that fit the above criteria and factors. The distributions of the above species can then be recorded on the basis of either particular sub-units or the catchment as a whole.

3.3 Managing an existing invasion

3.3.1 Current distribution of key non-native species, focussed surveys and surveillance

The knowledge of the distribution of invasive non-native plant species is an essential requirement in developing a strategy. Information on species distribution can include any or a combination of the following:

- date of first record(s) usually for the county(ies);
- information entry in the flora for the area (usually for the county(ies) – can include details of locations and sometimes a distribution map);

- details of distribution along main rivers (eg River Corridor Surveys and/or River Habitat Survey data held by the Environment Agency);
- data held by the local biological records centre (usually covering a county) – the quality of these data is extremely variable from one county to another; some records centres have computerised GIS systems which can produce printed distribution maps with supporting data, whereas others have no central office responsible for collating biological records - it is also not certain that a records centre would hold information on non-native species, but part of any strategy would involve the raising of awareness of the importance of reporting and collating distribution data on problematic non-native species, and
- the national Biological Records Centre, Monks Wood, hold data for all areas and would make a valuable contribution to the database underpinning the strategy.

The optimal database is one which has:

- collated existing records (past and present day);
- included a recent survey of the area which included non-nature invasive species (eg recording for a county flora);
- a link to a GIS system; and
- the ability to receive additional records and data.

In reality, such a database for non-native species is unlikely to exist at present, and therefore the development of a database should be a key component of a strategy and should be progressed at an early stage of the strategy development process, eg by conducting studies in unsurveyed parts of the area, and by ensuring that all data collected are compatible with a GIS system.

The management of non-native invasive species is a long-term process, and the use of a GIS system is very desirable and useful for centralised data management. It can:

- depict the current known distribution of species;
- receive records of new sites or sites where species have been eliminated;
- show records of where and when control measures have been applied, and what those measures were;
- relate the distribution of species to potential vectors/dispersal mechanisms and susceptible habitats;
- provide a basis for developing control strategies, eg by highlighting problem areas which require urgent control, and
- calculate data on the distribution of species, eg number of sites containing the species, and total area of infected land (provided that the data collected quantifies area occupied by the species as opposed to simple presence/absence data).

The most appropriate repository for data on non-native species is the local biological records centre, typically at a county level. Such centres typically have:

- databases for management of species records already set up (or at least systems in place to establish databases);
- networks through which records can be channelled or routed, eg links to local naturalist groups and BSBI recorders;
- specialist staff to manage the database;
- the ability to react to enquiries and the need to interrogate the database;
- experience of quality control of such databases, and
- the potential to relate invasions to GIS-based data on other features eg Sites of Special Scientific Interest (SSSIs), Sites of Importance for Nature Conservation and rivers.

Distribution data can be supplemented by a survey or surveys focused on a given non-native alien species or a number of such species. For some species, eg giant hogweed or Himalayan balsam, which are relatively easy to identify, it is possible for non-specialists to take part in such a survey. Examples of such of volunteer groups are the Wildlife Trusts, the members of river trusts, eg the Eden Rivers Trust (www.edenriverstrust.org.uk) and members of fishing clubs. It is important to carry out a quality check in such a case. For other less easily seen or recognised species it is preferable to use specialist surveyors. In all cases, training in survey methodology, identification and recording is essential.

It is also very desirable to have knowledge of the distribution of the plant in the area immediately outside the strategy boundary or present along ecological corridors or other routes along which species might move into the focus area. This information indicates which species might be potential invaders (or re-invaders) and can help identify possible invasion routes or corridors of transmission. The sources of such data will be similar to those listed above. Distribution maps produced at a national level can be helpful in this context. Establishment of a network of strategies in adjoining areas, with awareness of, and co-ordination between neighbouring partner organisations, would ultimately enable non-native species control to be effectively targeted.

When assessing distribution data, attention should be paid to:

- how accurate is the information, eg species identification?
- how detailed are the data, eg do they include the date on which a record was made and what is the spatial resolution?
- how complete are the data? It will be necessary to identify parts of the area which have not been surveyed, or surveyed a long time ago, and surveys will need to be commissioned/undertaken, and
- interpreting the data, eg distribution maps are typically cumulative and do not show areas where there has been decline: producing a number of maps for useful time periods is valuable.

The biological recording of alien species is most thorough in the early stage of colonisation, ie the first records of a species in an area. As the plant becomes more common, interest in it wanes and recording is typically poor. Maintaining interest in non-native species and linking this into the excellent infrastructure provided by the biological record centres would provide a good database on which future invasions could be monitored. The National Biodiversity Network also has a potential role to play in collating and providing these data.

Once a database has been established which will receive data on the species being managed, a programme of surveillance needs to be established. In some ways this is a continuation of any surveys that were undertaken to establish the distributions of the invasive species in the first place. Surveillance should focus on areas where management has been undertaken so that the success or otherwise of the management can be determined.

Box 3 Establishing current distribution for the Hampshire Avon.

The following recommendations are made:

- an agreement should be established with the county Biological Records Centre to collate and store the distribution data on the non-native species targeted by the strategy. The Hampshire Biodiversity Information Centre and Wiltshire and Swindon Biological Records Centre may appropriately take on this role: it may be necessary to provide some financial support to these centres to enable them to carry out this role and therefore this will need to be considered when planning funding requirements for the strategy;
- existing data should be reviewed in a comprehensive manner and the data collated and stored by the Biological Records Centre;
- sources of information that should be considered include:
    - River Avon cSAC Conservation Strategy Section 7;
    - Hampshire and Wiltshire Wildlife Trusts' archives and other sources of information;
    - local Environment Agency archives and other sources of information;
    - Hampshire Biodiversity Information Centre;
    - Wiltshire and Swindon Biological Records Centre, and
    - Centre for Ecology and Hydrology Biological Records Centre, Monks Wood.

3.3.2 Identifying a 'champion'

A successful strategy needs to be underpinned by either a 'champion' and/or a policy (or policies) to which the stakeholders can subscribe and work with/to. Good intentions help but of themselves will not see a strategy through to implementation.

A champion can be an organisation or an individual or both. Essentiality the champion needs to provide the impetus and commitment to see through the development of a strategy and its implementation. The Swansea City Council (now the City and County of Swansea) took on the role of champion in dealing with Japanese knotweed. This included bringing stakeholders together and the appointment of a Japanese knotweed Officer. Likewise the Environment Agency took the initiative in Cornwall to establish a Japanese knotweed Forum and through one member of staff in particular have worked with stakeholders to good effect. This approach has also been successful in achieving other objectives, eg the conservation of rare species.

Appendix 2 provides a summary review of a number of forums/groups in the United Kingdom that have brought together stakeholders and developed approaches for dealing with non-native species such as Japanese knotweed and giant hogweed.

Box 4 A champion for the Hampshire Avon:

A champion needs to be established (for either the catchment as a whole or one for each of the sub-units) which, in the first instance could be as part of the LIFE project: the LIFE project offers a high profile initiative on which to develop the strategy and it is likely that extra resources available to the project will establish a momentum to the strategy and a framework for future working.

3.3.3 Stakeholders relevant to the development and implementation of the strategy

There are a number of stakeholders who it would be important to include in the development of a strategy:

- English Nature;
- Environment Agency;
- local authority;
- wildlife trust,
- local Biodiversity Action Plan (BAP) groups and
- Biological Records Centre (if not the wildlife trust).

Other potentially valuable stakeholders include:

- British Waterways;
- angling/fishing clubs/syndicates;
- significant riparian landowners;
- weed control contractor(s);
- local garden centre(s);
- local community action/task groups, eg river groups;
- boating/water skiing groups;
- haulage companies and rail track companies;
- local further and/or higher education institutions, and
- British Trust for Conservation Volunteers.

Box 5 Stakeholders in the Hampshire Avon catchment

- English Nature;
- Environment Agency (South Wessex Region);
- Local authorities: county councils (Hampshire, Wiltshire, New Forest, and East Dorset), district and borough councils (Salisbury, West Wilts, Kennet and Christchurch);
- Hampshire and Isle of Wight Wildlife Trust and Wiltshire Wildlife Trust;
- Hampshire Biodiversity Information Centre;
- Wiltshire and Swindon Biological Records Centre;
- Wessex Water plc.;
- Farming and Wildlife Advisory Group;
- Examples of other types of stake holder: Ringwood and District Anglers Association, Test Valley Angling Club and Environmental Spraying Services;
- Wiltshire and Hampshire Biodiversity Action Plan (vol 2) provide further contacts for local business, landowners, and other relevant stakeholder groups, and
- ESA, SSSIs, AONB, cSAC specifications within the area have encouraged the identification of existing landowners within the Avon catchment: contacts within the Environment Agency, English Nature and Wildlife Trusts should be able to supply and develop these.

3.3.4 Funding the strategy and its implementation

Funding can usefully be divided into the two phases of planning/strategy development and implementation. The former needs to consider the latter, ie planning the funding of the implementation, which is a critical part of the strategy. Experience has shown that organisations and agencies are prepared to give support to the development of a strategy without the receipt of any new or additional funding. This typically takes the form of a member of staff attending forum/task group meetings and providing input to, for example, documents, policy formulation and awareness raising and/or training sessions (Appendix 2). The champion organisation often takes on responsibility for writing up notes/minutes of meetings and generally servicing the group. The champion might provide a venue for meetings or this might be shared by the members.

Putting the strategy into practice will require either new/additional funding, the reallocation/redistribution/targeting of existing funding for weed control, or both. Organisations such as local authorities, the Environment Agency and Internal Drainage Boards spend considerable sums of money on weed control each year. The strategy should consider what control work is already being undertaken and how it might be possible to use some of these monies to target non-native invasive plants. This provides at least a starting point for implementing the strategy. It also reduces the amount of money wasted in some cases on futile control of these plants either because follow-up treatment is not undertaken or cannot be afforded, or because of re-infection taking place from neighbouring or upstream stands due the lack of a co-ordinated approach.

New funding or indirect funding can be achieved in a number of ways:

- use of policies aimed at controlling non-native invasive plants or improving the condition of designated sites to lever funding to achieve the objectives set;
- agreement of stakeholders to make special provision for funding to achieve focussed and concerted management, eg in a particularly badly infected part of the area;
- encouragement of private land owners, the general public and other groups of people, eg angling club and nature reserve committee, to control particular species on their patch;
- requirement under certain conditions that a land owner or develop must undertake management of a particular species on their land;
- application for grant(s) to achieve management across the area, in parts of the area or for particular species, and
- application for sponsorship for the same.

Examples in the UK where land owners and/or developers have been required to control a particular species include Japanese knotweed and giant hogweed. In the case of the former, the City and County of Swansea have a policy whereby planning permission will not be granted on a site contaminated by Japanese knotweed until it has been eradicated. In Edinburgh, giant hogweed was considered a health hazard and local bye-laws were used to require landowners to control the plant on their property.

3.3.5 Awareness raising

Careful consideration needs to be given to drawing attention to the overall project and/or relevant parts. This is typically seen in terms of the general public but should be thought of more broadly. Awareness raising could be aimed at:

- stakeholder organisations and agencies;
- key individuals within stakeholder organisation or agencies, eg budget holders and policy makers;
- politicians, eg elected councillors, and
- organisations and agencies inside and outside the area, eg horticulture trade and local authorities.

There are various means of raising awareness and these should be assessed in terms of effectiveness and efficiency. Examples include:

- meetings;
- workshops;
- leaflets;
- newspapers;
- notice boards;
- radio, and
- television.

The implications of awareness raising should be thought through, eg a campaign aimed at the general public in an attempt to gain action against a given species needs support in terms of appropriate information through to alerting herbicide suppliers of a likely increase in demand.

3.3.6 Potential sources of non-native introductions

An assessment should be undertaken of potential sources of non-native introductions. This is best compiled as a table/database including all the possible species, potential sources, conduits through which the source might pass, notes on the likelihood of source/conduit, and the means that are available to deal with the source and/or conduit.

Examples of sources that should be considered for aquatic plants include:

- natural sources and conduits, eg downstream movement, small mammals/birds carrying seeds or other propagules;
- horticulture trade (sales of invasive non-native species, sale of safe species contaminated with undesirable ones, disposal of unwanted plants);
- gardeners eg transport of unwanted garden pond plants to nearby water courses/bodies;
- angling and fishing activities (both intentional, eg planting up club waters with non-natives to provide cover for fish, and unintentional, eg transport of plant material caught up on tackle etc.;
- boating and water skiing, eg plant material caught on propeller blades and skis;
- haulage/cartage of soil containing propagules or plant fragments capable of sprouting, and
- transport of seeds, rhizome fragments and other propagules on wheels and other parts of machinery.

Conduits include:

- rivers and streams;
- canals;
- railways;
- roads and other highways, and
- migratory routes of birds and other animals.

For some species there could be information on the rate of spread that will help decision making (see Priorities for control or eradication section). Typically this is best considered at two scales: regional/whole area in which human intervention is usually the main vector enabling plants to make large “jumps”, and the local scale in which the plant is using natural means of spread, eg wind dispersal or movement down a watercourse.

Box 6 Potential sources of non-native introductions at the Hampshire Avon catchment

- A number of possible sources exist within the Avon catchment. Consideration should be paid to the number of garden centres (Appendix 3), the proximity of nearby rivers outside of the designated catchment areas (eg River Stour), major road routes into the area (eg M4, A31, A36, A338, A354, and A303) and a number of east – west railway lines, and
- local managers, surveyors and biological recorders are best situated to identify the most important corridors and conduits of movement: personal knowledge of local routes and the plants distribution over time provide are essential to this research.

3.3.7 Priorities for control or eradication

Setting priorities for management will involve decisions on the species to be targeted, the areas to be managed with consideration being given to priority habitats. A decision also needs to be taken as to what level of control is aimed at. This could be:

- eradication of a species throughout the area, eg swamp stonecrop known from a handful of sites;
- eradication of a species from a part of an area, eg Japanese knotweed from part of an area which is relatively free of the species;
- removal of a species from threatened habitats, nature reserves or other priority sites and/or habitats, and
- a phased control of a species across the area in an attempt to control its overall spread, eg Himalayan balsam which could be gradually controlled down a stream system. This approach could lead ultimately to eradication from the area.

It is essential to use the information provided by the distribution maps for the various species to determine priorities for control or eradication. Patterns to look for are:

- zones which are free or almost free of an invasive species;
- potential loci from which further invasion is likely to occur;
- locations rare species or key habitats that may be vulnerable to invasions;
- linear habitats along which a species appears to be moving (can also apply to shores of a lake or reservoir); and
- parts of an area in which there are relatively few locations of a particular species.

This information can then be combined with the risk assessment, which will have identified priority species and/or habitats/parts of the area most at risk.

Some species could be so widespread and well established that serious consideration should be given to the feasibility of control, and certainly of eradication, eg least duckweed and sycamore. Resources may be more effectively targeted at less well-established species where control or eradication is at least feasible.

Box 7 Priorities for control or eradication in the Hampshire Avon catchment

- Tributaries in the upper parts of the catchment acting as potential sources of propagules for downstream sites;
- Those non-native species that are at an early stage in the invasion of the focus area, and
- SSSIs and other nature conservation sites at risk from non-native species.

3.3.8 Horizon scanning

Prevention is a major component of any non-native species strategy and Section 4 provides some guidance on how preventative action should be structured. However even where the focus of a strategy is existing problems it is necessary to be vigilant and alert to possible future problems. Invasions can occur at different levels hence the "horizon" should be considered at appropriate scales. They include:

- international, ie a species moving from one country to another which from an English perspective is most likely to be mediated by human activity, eg importing aquatic plants for the horticulture trade;
- national, eg parrot's feather being moved from one part of the country to another, again human intervention is almost always responsible;
- regional/catchment, at which a range of factors could be important from human activity to natural processes. Knowledge of the latter at this type of scale, eg long distance movement down a river system, is poorly understood, and
- local, at which spread is normally via natural processes.

The factors mostly typically considered are those that facilitate or drive the invasion process. It is also important to be aware of factors which can act to change a species from its establishment phase, ie able to sustain itself in the "wild" without human assistance, to the invasive phase. Although of critical importance, we know little of these factors, eg plants such as giant hogweed and Japanese knotweed experienced a switch from the first mode into the second but we can only guess at a number of potentially important factors, eg increase in disturbance due to urban regeneration post the Second World War or increasing mobility of humans in lorries and other vehicles.

Box 8 Potential invasive species of the Hampshire Avon

Examples of potential invaders are:

- Curly waterweed (*Lagarosiphon major*)
- Water primroses (*Ludwigia* species)

Curly waterweed is known from the catchment but apparently from only a relatively few sites. It would be prudent to reassess its distribution, eg a pilot study in a selected area. The species can dominate the aquatic flora of ponds, reservoir and lakes and a risk assessment should be undertaken.

Water primrose species are causing problems on mainland Europe, eg the Bordeaux region of France and a species has been recorded in the London area. Awareness raising and recording for this species would enable action to be taken should a water primrose reach the catchment.

3.4 Preventing future invasions

The majority of the effort in the UK that is put into the management of non-native plant species has been in managing existing invasions. The catchment strategy must also consider what steps should be taken to prevent invasions occurring in the future. This is effort well directed as stopping invasive plants reaching infestation proportions would save significant environmental disruption and be substantially cheaper. In the sections that follow the area being protected from future invasions is termed the strategy area (in order to differentiate it from the focus area).

Inevitably some parts of this element of the strategy duplicate in some ways what was described for managing an existing invasion. Cross-reference should be made to those earlier sections. A simple concept of preventing an invasion is that of stopping a non-native plant entering into the strategy area. This is potentially naïve as a number of non-native invasive aquatic plants have probably already colonised the strategy area. They could be known about but not in an invasive mode, or may yet to be discovered. Prevention should therefore be extended to colonisation as well as invasion.

Information on potential non-native invaders or colonisers is valuable in making decisions on which species prevention should be aimed at. This could be obvious in that a species not yet known to occur in the strategy area has become a problem in other areas/regions. These could be relatively far afield, eg in France. Other species including a number stocked in garden centres are less well known in terms of their ecology but nevertheless have been known to establish themselves in the "wild".
There could be a significant part or parts of the strategy area which are free from invasive or potentially invasive non-native plants, in which case it might be desirable as part of the strategy to maintain them in this state. These could include:

- sub-unit(s) of a catchment;
- parts of a local authority area, eg a parish or parishes, and
- part of a canal system.

A particular site(s) within an area might merit individual attention, for example:

- the upper reaches of a river or canal system;
- a lake, reservoir or other water body;
- SSSI(s) and other sensitive sites; or
- potential development sites.

The following points should be considered as a step-by-step process for developing priorities and strategies for prevention or control of non-native species infestations.

1) **What are the non-native species presenting a threat to the area:**

- those already present in the area which might become invasive?
- those which could invade the area from sources immediately outside? or
- those which could colonise the area from distant sources via introduction vectors such as human-aided transport of plant fragments or imports of non-native species eg to a garden centre?

This same questions can be considered for any sub-units of the strategy area. Data from GIS-based systems as discussed in Section 2 above will play a significant part in determining which species pose immediate, medium-term or long-term threats. Regular feedback between stakeholders as mediated by a forum or action group will also facilitate the early identification of potential problem species (Appendix 2). The role of the Biological Records Centre providing early warnings on newly colonising and/or invading species will be critical.

2) **Undertake a risk assessment of each invasive non-native species identified in Step 1, ie assess the likelihood of each species colonising, spreading or becoming seriously invasive.**

This task should consider the known ecological habits of a species, ie is it known to be invasive elsewhere? Species can then be prioritised in terms of threat category, and high risk species should be targeted for control as soon as they are identified as occurring within the area. Medium risk species might be those that have potential to be invasive but are relatively more straightforward to control. Low risk species could be those which whilst undesirable are less likely to spread or where control is known to be straightforward.

An alternative approach is to undertake a risk assessment on a site level, ie assessing the susceptibility of an area to invasion and the seriousness of the consequences of an invasion. For example, a wetland site of high conservation importance which is connected to a river system and is downstream of a known infestation of a highly important species would be assessed as being of high risk, and therefore monitoring of non-native species would be targeted at this site to ensure early detection and removal of infestations. A risk assessment process such as this also helps to identify priorities for control, eg an upstream infestation which poses a risk to the site in question.

Factors that should be considered in a risk assessment of an individual non-native species include:

- direct environmental impact of the species, eg loss of native flora and/or fauna;
- indirect environmental impact, eg sediment erosion and/or effects of herbicide used for control on native species;
- direct economic implications, eg loss of value of property and land and/or cost of controlling the species;
- indirect costs, eg loss of tourism or other revenue, and
- other human impacts, eg health risks from toxic plants.

3) **What obligations are stakeholders under to prevent an invasion occurring?**

- are there any policies which empower organisations to prevent invasions, eg within local planning policies or policies adopted internally by individual organisations?
- does the county Biodiversity Action Plan include any relevant actions which deal with non-native invasive species or species which might be at risk due to non-native species invasions?
- are there any catchment related policies, eg from the Environment Agency that need to be conformed to? and
- have any agencies/organisations signed up to a code of conduct in relation to non-native species?

4) **What are the likely triggers and/or conduits that would enable a non-native species to pass into an invasive state either within or into an area?**

- human disturbance?
- natural disturbance?
- climatic change?
- flooding?
- non-human transmission, eg birds or smalls mammals? and
- human transmission (intentional and unintentional)?

5) **What specific conduits could enable an invasive non-native species to pass into an area?**

- water (linear habitats in particular)?
- communication routes, eg roads, railways and footpaths?
- migration routes?
- horticulture trade/garden centres?
- landscaping? and
- inter-water body movements, eg boating, angling, and water transfer schemes?

This process is poorly understood with much speculation as to the key routes. More effort is needed to understand not just what conduits are used but also to explore the rates of spread and the role of gaps and other impediments to free movement.

6) **What preventative measures could be taken based on the answers to the previous questions?**

- awareness raising amongst agencies involved;
- target key agencies, eg garden centres, angling/fishing clubs and boat owners;
- establish a code of conduct/best practice for appropriate organisations, and
- establish policies where appropriate.

There are indications that non-native species might be treated like a pollutant as in the case of Japanese Knotweed. Soil containing Japanese Knotweed rhizomes is described as contaminated and it comes under Duty of Care with associated restrictions, eg only licensed landfill sites can take such waste. Treating more non-native species as a pollutant would help ensure the implementation of preventative measures.

7) **Well established principles in achieving success include the need to:**

- work towards the emergence of a champion;
- set up a forum or action group;
- establish aims and clear objectives (preferably measurable);
- develop a strategy based on the outcomes of the above;
- implement management, and
- monitor success.

A number of the above points are elaborated upon in Section 3.3.

4 Conclusions

The proposed strategy is made up of two essential parts, the management of an existing invasion and the prevention of future invasions. In that the colonisation of an area is part of a process that could lead to a full-blown invasion, the two parts should be carefully integrated. Overall a good strategy needs to:

- be targeted at a carefully chosen focus or strategy area;
- be founded in a policy or policies;
- fit together and seek coherence, and
- be underpinned by a sound recording system.

Dealing with non-native plants is both environmental and economic in nature. Environmental scientists typically manage such invasions. However, it is important that the economic aspects are considered as carefully as those of the ecology and that economic targets are set if only to demonstrate the prudent use of money to overcome problems which have either become expensive to deal with or, if left unmanaged could cost considerable sums.

5 References

DEFRA. 2003. Review of non-native species policy. Report of the Working Group. London: Defra.

DEFRA. 2005. Helping to prevent the spread of invasive non-native species: Horticultural code of practice. London: Defra.

ECUS. 2005. *Control of Australian swamp stonecrop*. Final Report to English Nature. University of Sheffield

MCNEELEY, J.A., ed. 2001. *The great reshuffling: human dimensions of invasive alien species.* Gland, Switzerland and Cambridge, UK: IUCN.

WITTENBERG, R., & COCK, M.J.W., eds. 2001. *Invasive alien species: a tool kit of best prevention and management practices.* Wallingford: CAB International.

UKTAG. 2004. *Guidance on the assessment of alien species pressures* (Final). UK Technical Advisory Group on the Water Framework Directive

Appendices

Appendix 1. Note of invasive aquatic plants workshop

Invasive plants of freshwater habitats implications for nature conservation

22 November 2004
Northminster House, Peterborough

Introduction

Stewart Clarke, English Nature

The workshop was attended by representatives from English Nature national and area teams, colleagues from JNCC and experts in the field of invasive plant control and ecology. The purpose of the workshop was to (re-)consider the invasive species problem from a nature conservation perspective. Invasive species have recently been given a higher profile through greater recognition of the problem (IUCN 2001) and are recognised as a major threat to biodiversity.

A reappraisal of English Nature's position in relation to the problem of invasive plants was considered appropriate and timely for the following reasons:

- invasive plant species are a significant (but under recorded) reason for unfavourable condition on freshwater SSSIs;
- there is no clear English Nature policy on when and where to control invasive plant species;
- initiatives such as the Defra review work (Defra 2003) provide an opportunity to inform and influence national policy;
- the Atlas 2000 project (Preston, Pearman and Dines 2002) has given us a better though still incomplete, picture of the spread of problem species;
- recent changes in herbicide licensing have forced managers to begin to consider novel control techniques;
- experience with trying to control Australian swamp stonecrop *Crassula helmsii* at two SSSIs has highlighted the practical problems of management in open water situations and raised questions over the long term cost and efficacy of control (ECUS 2004);
- there is a need to consider the future risks from invasive species arising from climate change, advances in ornamental plant breeding;
- there have been criticisms over the conservation agencies' approach to invasive species (both of failing to take action and conversely of wasting resources on futile control efforts).

The workshop was convened to discuss the current and potential future scale of the invasive species problem, critically appraise various philosophies and rationales for control and identify control options and research needs.

Nature and scale of the problem

Aquatic invasive plants: classification, history and current distributions

Chris Preston, NERC Centre for Ecology and Hydrology

An introduction to the problem of aquatic and riparian invasive plants (real and perceived) was presented. The British aquatic flora is rich, of international importance and worth preserving. Species of southern England**,** particularly those of calcareous but relatively low nutrient habitats are most threatened. Species such as fen pondweed *Potamogeton coloratus* may be in decline throughout temperate Europe as a result of a range of pressures.

The perception that freshwater habitats are more susceptible to introductions is not supported by the evidence: of the British Isles flora 14% of aquatic plants are naturalised aliens, for other habitats the figure is 32%. The concept of 'archaeophyte' (pre 1500) as compared to 'neophyte' (post 1500) provides useful distinction between groups of "invaders". The majority of neophytes and particularly more recent wave of species are from outside Europe, aquatic species from the tropics tend to be fast growing and hence have the potential to become invasive. There is not a great reservoir sitting waiting to invade from the Continent and the predominant means of introduction is via human activity. The problem of invasive aquatics is focused in England (see Table 1) and particularly in the south where our native aquatic flora is most important internationally and under most threat.

Table 1 Major introduced aquatic species

	1st record	10-km squares (British Isles)	10-km squares (England)	% England
Elodea canadensis	1842	1696	1236	73
Elodea nuttallii	1966	808	715	88
Azolla filiculoides	1886	660	599	91
Crassula helmsii	1956	604	541	90
Lemna minuta	1977	540	515	95
Acorus calamus	1668	515	467	91
Lagarosiphon major	1944	443	397	90
Myriophyllum aquaticum	1960	268	251	94
Hydrocotyle ranunculoides	1990	43+	42+	98

An analysis of reproductive traits indicates that many of the 'problem' species do not produce seed or spores and few have specialised reproductive propagules. For example, both invasive *Elodea* species are only represented by females plants in Britain and of the species listed in Table 1 only *Azolla*, *Crassula*, *Hydrocotyle* and *Lemna minuta* either set seed/spores or have specialised propagules.

As many natives and aliens have similar 'life-forms' eg many of the small floating plants should we be concerned about impacts? For example, does it matter whether a ditch is

covered by the native *Lemna minor* or the alien *L. minuta* ? Other questions to consider when determining the (potential) impact of an introduced species include:

- To what extent do they invade newly created habitats as pioneer species, then die down?
- To what extent do they co-exist with other species? Which aliens, if any, really exclude native species?
- Are some species troublesome in some aquatic habitats but less troublesome in others?
- To what extent do their populations show annual fluctuations, allowing native species to exploit 'bust' phases of boom/bust cycles?
- What effect do they have on animal communities?

Chris Preston gave a subjective assessment of the impact of various introduced aquatic species asking whether in some cases the worst phase of impact was over (*Elodea canadensis*), the problems associated with some species were actually a symptom of other pressures (eutrophication and *Elodea nuttallii*) and whether some introduced species are more harmful than similar native species (*Lemna minuta*). A list of introduced species that have not become invasive was also presented (Table 2).

Table 2 Introduced aquatic species which have not become invasive

	1st record	10-km squares (British Isles)
Vallisneria spiralis	1868	15
Najas graminea	1883	1 (extinct)
Aponogeton distachyos	1906	63
Sagittaria rigida	1908	4
Myriophyllum heterophyllum	1941	1 (extinct)
Elodea callitrichoides	1948	18
Egeria densa	1953	17
Sagittaria subulata	1962	1
Cabomba caroliniana	1969	2

Climate change and human activity also bring some interesting dilemmas. For example, some native species have naturally expanded northwards in recent decades (eg *Butomus umbellatus, Glyceria maxima)* Additionally, some scarce native species (such as *Stratiotes aloides* and *Nymphoides peltata*) have become well-established outside their native range, often as a result of introductions from dumped garden stock. Furthermore, control policies may be handicapped by uncertainties in defining native range!

Discussion: nature and scale of the problem

Are invasive aquatic aliens a threat to biodiversity?

The general consensus was that yes, sometimes invasives are a threat to biodiversity and hence a major nature conservation issue. However, we need to be able to define harmful, eg To what extent does a species have a permanent impact on native species? Does it have a different function to the native species that it has replaced?

The example of *Azolla* on the river Lambourn was raised as an example of where we could not determine the exact mechanism but it was obvious that dense growths trapped in *Ranunculus* stands could have various impacts. A major issue is the biomass and dominance of these introduced species within a particular habitat. – a problem of scale. Others raised concerns about the 'microflora' which may be introduced with these problem species and may themselves promote problems, eg encouraging certain species or suppressing others. In most cases demonstrating a causal link between introductions and impacts is difficult because good 'before and after' information is lacking. There is a need for controlled before-after impact studies and some participants felt that research into the biological impacts of invasives was a priority. In contrast others argued that we might never be able to definitively identify the mechanisms for impact and the problem was already so pressing as to justify acting on the basis of anecdotal evidence and observation.

There is a clear need to consider the problem from the perspective of the ecological community and avoid too much focus on individual species as the impact may be at the larger scale. It is also important to recognise that impact can be measured at different levels, eg an alien plant at a particular site might not be harmful of itself but seen at a regional scale, it could be a source of propagules for other more sensitive sites, ie it is part of a wider invasion.

We may also need to consider the social dimension – people see plants in different ways, eg a non-native species might be good for fish fauna but displaces native flora, or *Myriophyllum brasiliense* is seen as attractive by some and as a drainage problem by others. This is particularly important in communication and education strategies and in preventing future problems.

Which species are of greatest concern and can we predict future problems?

There are problems in deciding which are the most problematic species due to the difficulty in determining impact. Again scale is a major consideration – a small localised patch of an introduced species in a large lake may be a problem if that patch is the only habitat suitable for a rare species and may serve as a colonisation source for other areas of the lake. Conversely, a similar sized patch of an introduced species which is stable may not be of concern. The question of *Elodea* is interesting because it is not clear whether it just replacing other (relatively widespread and potentially undesirable) native species that are responding to other pressures such as nutrient enrichment.?

Prediction of invasive potential has proved difficult. Studies of problem species in native country not generally very useful, for example some of our native species which are seldom problems in Britain are considered major problems in North America eg *Myriophyllum spicatum*. Exceptions may be where genetic studies are undertaken to determine the nature of the invasive population(s) and searches for potential bio-control agents. Systems have been developed to identify non-native species that could become problem species based on a multivariate approach and on expert systems but not widely applied. The UK has an excellent biological recording tradition, which can be used to identify potentially problem species, eg *Crassula* story.

Where should conservation agencies (and others) direct efforts?

It was widely agreed that raising awareness, particularly amongst public was very important in preventing future problems, eg don't take excess growth from pond into countryside. This was considered important because human mediated introductions are a major cause of problems. Plants typically have more than one mode of 'dispersal', eg from one garden to another at the national scale but down through a river network/catchment at a local scale. The potentially high cost of control was viewed as a major factor in determining where effort was best directed.

Control options

Options for the control of problem species

Jonathan Newman, Centre for Aquatic Plant Management

There are four general approaches to the control of invasive plant species: mechanical, environmental, chemical and biological.

Mechanical control involves the physical removal of invasive plants by hand (on a small scale) or through the use of excavators or weed-cutting machinery. As many species reproduce by fragmentation and tend to colonise disturbed or new habitats such control may actually exacerbate the problem. Eradication of a problem species may be possible but is likely to take expensive sustained efforts.

Environmental control of problem species may involve a wide range of activities from small scale shading or bank reprofiling to in-filling a water body. Nutrient stripping may be employed either through reducing nutrient inputs or harvesting biomass. Both types of physical control method (mechanical and environmental) depend on being able to spatially differentiate between the problem species and desirable native species and are therefore sometimes not appropriate for sites where rare species are present or where the invasive plant is growing within mixed stands.

The use of chemical control is increasingly likely to become limited due to the withdrawal of herbicides for use in water as a result of the EU pesticides review. Diquat, the most effective aquatic herbicide has already been withdrawn and other useful herbicides are likely to be withdrawn by 2010. This is particularly unfortunate because diquat appears to be the only effective control measure currently available for *Crassula*, our most pernicious aquatic weed. A range of other chemical and pseudo-chemical options have been proposed and trialled - steam, liquid nitrogen, but seem to have limited potential. There has been some success with controlling algal problems using ultrasound, barley straw and 'bacterial amendments' but these have no effect on vascular plants.

The greatest hope in the long term would seem to be through the use of biological control agents. Arguably given time most colonising plants would succumb to pathogens or attack from herbivores and thus be kept in check. However, the arrival of host specific control agents is likely to need a boost if they are to be effective before the invasive plants have had a major impact. Biological control is a hugely contentious issue as a result of some high profile mistakes in the past but there lessons have been learnt and there are now stringent screening procedures to ensure host-specificity. There has been considerable success controlling water

hyacinth in the tropics using *Neochetina* weevils and *Azolla* is already being controlled by the weevil *Stenopelmus rufinasus* in the UK. The *Azolla* weevil appears to be specific to the plant and dies in the absence of *Azolla* to feed on. Furthermore the weevil is considered ordinarily resident in the UK. A number of other biological control agents for key UK problem species are currently being investigated.

In conclusion, whilst the number of problem species appears to be increasing the range of methods available for control is reducing. Biological control is likely to be the most (cost) effective approach in the long term but will require considerable debate before it becomes acceptable.

Case study: Control of *Crassula helmsii* at two English SSSIs

Erica Kemp and Nick Birkinshaw, ECUS

Control of invasive plant species was undertaken at three SSSIs during 2003 and 2004 under the auspices of the English Nature Lakes Restoration project (ECUS 2003). The emphasis of the project was controlling *Crassula helmsii* which is widely acknowledged to be the most invasive of all introduced aquatics currently in the UK. However, at Hatchet Pond, in the New Forest it was decided early on that any control of *Crassula* was likely to affect other interesting plants, chemical control was not an option due to the open nature of the site and difficulty in restricting access to grazing animal, mechanical control was likely to spread *Crassula* further. At Hatchet Pond work was restricted to the mechanical removal of some exotic water lilies and pickerel weed. These were spreading slowly and not necessarily exerting a major impact on the overall ecology at the present time but were felt to be inappropriate considering the importance of the site as an example of a rare habitat type of European importance.

Swanholme Lakes, Lincoln have suffered from *Crassula* colonisation both in the water bodies and also in marginal wet heath areas. Chemical control using glyphosate and diquat on emergent and submerged *Crassula* respectively was undertaken on 3 separate occasions. At Brown Moss in Shropshire where the drawdown zone had more than 95% cover of *Crassula* a combination of mechanical control (followed by composting of material) and chemical control using glyphosate and diquat on emergent and submerged *Crassula* respectively was reasonably successful in reducing the overall cover of *Crassula* and cleared areas have been observed to have recolonised with native species. At both sites a survey prior to treatment and recovery of key rare species (for ex-situ conservation and reintroduction following treatment) was a vital step in the work as was follow up spot treatment of any *Crassula* re-growth using herbicide.

A combination of mechanical and chemical control seems to have worked well but it is clear that without ongoing management the *Crassula* could recolonise to previous levels. The plan now is to incorporate *Crassula* control into longer term (5-10 year) management plans for the sites with the hope that ongoing herbicide treatment, small scale manual removal and more extensive mechanical work where necessary can manage *Crassula* in the way that other conservation management takes place (eg bracken control, tree removal on heathland).

Discussion: control options

Feasibility of different control options

Inevitably cost is a major consideration, there was surprise as to how much money the works at Brown Moss etc had actually did cost. There was the view that we are not used to working with these sorts of costs in nature conservation and that to date the resources have not been available. It in order to secure funding it will be necessary to prioritise the sites that need invasive species control. It is key, whatever management option is pursued, that we look into the future and plan how management will be sustained. Control options may be determined by other factors such as scale, eg large sites such as Bassenthwaite Lake present very different logistical problems relative to smaller sites like Brown Moss.

Public relations aspects were acknowledged to be very important as control often involves major disturbance and the use of herbicides is not popular. In order to get public support for any control\it is necessary to unpick the various problems and demonstrate the need for control. For example, at Brown Moss *Crassula* was only one problem (other issues include successional processes, Canada geese and water level fluctuation) and others had different ideas about the role of *Crassula* in the decline of conservation interest at the site.

Is there an aesthetic issue? Should we be using herbicides in NNRs over protracted period of time?

Impact of herbicide withdrawals

There is a risk that a lack of data on the non-target effects of herbicides in water which has resulted in diquat being withdrawn for use in water throughout the EU, could force us to consider non-chemical approaches anyway. There are obviously risks associated with herbicide use but there are very effective and risks can be minimised through more detailed guidance on use and greater control over the availability of certain herbicides. English Nature, the Environment Agency and Centre for Aquatic Plant Management are working together to collect and collate the data to support the reintroduction of diquat for specific uses but there needs to be greater investment from the manufacturers to support the herbicides through the EU review process. There is the risk that all herbicide use in water will be prevented.

Potential for biological control and risks

Given the uncertainty associated with chemical control options a view was expressed that research efforts should be directed at biological control options. Importantly biological control does not achieve eradication but if successful a balance is achieved between agent and its food/prey. Hence this is likely to be the most sustainable long term option. Investing in chemical or mechanical control is going to be a problem to sustain long term and thus biological control and/or ecological measures hold a significant attraction. However, it was felt to be important not to be rely on biological control for the immediate future, solutions could take a long time to develop and may not be successful or acceptable. It may be difficult for English Nature to advocate the use of biological control agents, herbicide control is already controversial for some who believe that nature conservation organisations should not rely on chemical methods. A need for some long term strategic funding into biological control agents was identified.

Many felt that it was important to recognise that eradication is not a realistic objective for large areas. Any control programme is confounded by difficulties such as changes of personnel in key collaborating organisation and/or policy and any programme needs to be able to adapt and respond quickly. No one method is a panacea and it will be necessary to continue to use a range of approaches to achieve the level of control required to prevent adverse impacts.

Strategic approaches

Local and regional strategic approaches to addressing invasive plant problems

Max Wade, RPS Ecoscope

A strategic approach to dealing with invasive plant problems has a number of benefits and is more likely to be successful but is much more difficult to pursue not least because of the need to involve a wide range of partners. A site by site approach to tackling problem species is reactive and will slow the invasion but not prevent it; by contrast a strategic approach covering an area, river catchment or region can include preventative measures. The major components and steps of a strategy were described:

- knowledge of **species distributions** in the area of concern and also in neighbouring areas which may become sources;
- knowledge of **modes and routes of spread**, this requires an understanding of plant ecology but also of socio-economic factors that may be vectors;
- **raising awareness** amongst partners, stakeholders and the general public;
- coordinated management and stakeholder involvement;
- **relevant policies** giving a foundation to the project and setting targets;
- **funding** commensurate with management required and timescales;
- **decision making** with the ability to take action; this will require a concerted national approach and greater recognition that the problem belongs to everyone;
- targeted **training**, both in problem species identification and control approaches;
- strategies for **control**, **management and eradication**, with flexibility to adapt to changing priorities;
- pooling knowledge and experience of techniques;
- **monitoring and reporting** to feedback into and inform the strategy.

The strategy provides a framework within which existing action on invasive species can be targeted and coordinated and others can be encouraged to contribute. Within the strategy the same dilemmas about control options need to be addressed but the prevention of future problems can also be considered. Successful strategies will depend on the involvement of key partner organisations and stakeholders and will require funding and a focal point or 'champion'.

Discussion: strategic approaches

It was widely acknowledged that although many of the impacts were biodiversity issues, it was important that the nature conservation objectives were viewed in a broader sense and that we should seek partnerships with other interest groups who may be impacted by invasive species or who may have some control over the spread of problem species. It may be necessary to consider a wider range of taxa in order to engage other groups. However, this could only proceed with a level of coordination at the national level and a clear steer from national government.

Whilst legislative tools are recognised to play an important role in preventing spread and future problems it is clear that an emphasis on voluntary approaches is favoured by policy makers. This means that strategic approaches which engage all interested and affected sectors are likely to be increasingly important as will raising awareness of problems.

The government public service agreement (PSA) target for 95% of SSSI area to be in favourable or unfavourable recovering condition by 2010 is a clear driver for English Nature in tackling invasive species and the EU Water Framework Directive is likely to become a driver for invasive species management by the Environment Agency. These drivers will set their own priorities for action but we should not neglect the wider picture and need to consider what is happening outside of these designated area boundaries and attempt to get others involved. Beyond this it will be very important to recognise that the situation may change considerably as the result of climate change or the growth of activities with the potential to act as vectors for introduction of new species.

Concluding remarks

Key questions and actions for English Nature

Prioritise species of concern and sites for action

Introduced species can be categorised into those that are invasive and threatening native biodiversity and those which have been present for some time and have little or no impact. It is important that we are clear about this distinction as an organisation and that we acknowledge that many species have been introduced for horticulture without impact.

Amongst those species with invasive tendencies there are a few which experience suggests can be readily controlled or contained and which have not yet spread extensively. Preventing further spread of these species must be a priority. Other species such as *Crassula* are very invasive and spread rapidly, in many cases they appear to have reached a critical point at which they are so widespread that colonisation of new sites could potentially occur through natural vectors rather than human introductions. These species are of greatest concern and will need a coordinated approach. By prioritising species by potential impact there is less chance of being confronted with an overwhelming list and the issue becomes much more focused and hence more likely to be funded.

Developing a strategic approach to control

The scale and nature of the invasive plant problem in England means that effective control is unlikely to be realised without a concerted effort from a wide range of partners and stakeholders. English Nature has the remit and sufficient concerns to play a leading role in setting up strategic area, catchments or regional control projects but would require dedicated resources to achieve this.

Setting realistic targets

English Nature, together with partner organisations need to adopt a targeted approach to control, management and eradication (if ever possible) recognising that different species will require different approaches and we might have to adopt different short and long-term approaches. It might be necessary at individual sites to adopt a fire-fighting approach to prevent the establishment of a species with known invasive potential using whatever methods are available. At other sites where a species has been long established and the area colonised is large it might be necessary to accept that ongoing management of the impact (eg by keeping important areas of habitat free) is the only feasible approach. Longer term we might expect biological control to play a greater role but widespread adoption of biological control will require not only research into potential agents but also the development of clear guidelines concerning the use of such agents in areas of high wildlife value.

References

DEFRA. 2003. *Review of non-native species policy*. London: Defra Publications.

PRESTON C.D., PEARMAN D.A., & DINES T.D. 2002. *New Atlas of the British and Irish Flora*. Oxford: Oxford University Press.

ECUS. 2004. *Control of Australian swamp stonecrop*. Report to English Nature

Appendix 2. A summary of non-native invasive weed forums and groups

Tweed Forum – Tweed Invasives Project

Contact details and addresses:

Tweed Invasives Project: http://www.tweedforum.com/projects/inv

Tim Barratt
Tweed Invasives Officer
Tweed Forum
South Court
Drygrange Steading
Melrose, Roxburghshire
TD6 9DJ, Scotland
Tel: 01896 849723
Fax: 01896 849129

tim@tweedforum.com

Aims

The long-term, sustainable control of giant hogweed and Japanese knotweed within the Tweed catchment.

Objectives

Co-ordinate the treatment of the target species in partnership with local farmers, landowners, riparian interest groups and statutory authorities in the Tweed catchment.

Provide training, certification, and licensing as well as support and advice for the control of invasives.

When set up

2002

Geographical area covered

Tweed catchment approximately 5,180 km^2

Source of funding

Funded or received materials (herbicides etc) from:

Heritage Lottery Fund
LTCS – Landfill Tax Credit Scheme
Scottish Natural Heritage
Berwick Upon Tweed Borough Council
Scottish Water
Environment Agency
English Nature
Monsanto

Organisations and stakeholders

Heritage Lottery Fund
LTCS – Landfill Tax Credit Scheme
Scottish Natural heritage
Berwick Upon Tweed Borough Council
Scottish Water
Environment Agency
English Nature
Monsanto
Crop Services Scotland Limited
Local farmers, landowners, fisheries

Services

Offer advice to landowners
Arrange and cover costs of any certification or licensing required

Medway Valley Countryside Partnership

Contact details and addresses:

Medway Valley Countryside Partnership:
http://www.medwaycountry.abelgratis.co.uk/page5.html

3 Lock Cottages, Lock Lane
Sandling, Maidstone,
Kent ME14 3AU
Tel / Fax: 01622 683695

Objectives

Co-ordinating a control program of giant hogweed

When set up

2000

Geographical area covered

Along the banks of the Rivers Medway and Teise

Source of funding

Sponsored by the Environment Agency and local councils

Organisations and stakeholders

Environment Agency
Kent County Council
Maidstone Borough Council
Tonbridge and Malling County Council
Muraspec
Local landowners, local councils and river users

Services

Treat plants and raise awareness

Cornwall Knotweed Forum

Contact details and addresses:

Cornwall Japanese Knotweed Forum main website:
http://www.cornwall.gov.uk/environment/knotweed/japforum.htm

Cornwall Japanese Knotweed Forum Website at Exeter University:
www.ex.ac.uk/knotweed

Colin Hawke
Cornwall Knotweed Forum
Old County Hall
St. Clement Building
Truro
TR1 3AY
Tel 01872 222 000

Aim

Promoting a co-ordinated approach to the control and management of *Fallopia japonica* and its hybrids in Cornwall through partnership

When set up

1997

Geographical area covered

Cornwall County 3,559 km^2

Source of funding

Not known

Organisations and stakeholders

Comprises of representatives from a wide range of organisations including
Environment Agency
National Trust
County and District Councils of Cornwall
Camborne School of Mines
Railtrack
English Nature
IMERYS
Cornwall Wildlife Trust
University of Exeter in Cornwall
Duchy of Cornwall
South West Water

Services

Produces a number of publications and guidance notes, organised conferences and co-ordinated research projects.
Developing a GIS survey recording system in conjunction with the Botanical Society of the British Isles.
Co-ordinates guidance on good practice which is being developed continuously in the light of new research.
Is involved in research into best practice for control methods.
Maps the locations of knotweed populations countrywide - implemented by the Vegetation Advisor based at Cornwall County Council.
Raises public awareness.

Devon Knotweed Forum

Contact details and addresses:

Devon Japanese Knotweed Forum:
http://www.devon.gov.uk/environment/natural_environment/biodiversity/japanese_knotweed.htm

Aim

Raise awareness of the problems caused by Japanese Knotweed, share information about control and increase recording

Objectives

Assesses the scale of the problem, its costs and implications of Japanese Knotweed infestations in Devon and to disseminate this information widely.
Identifies centres of best practice for the control of Japanese Knotweed.
Develops, evaluates and disseminates information about innovative and successful approaches to the management of Japanese Knotweed.
Prevents the further spread of Japanese Knotweed through education, legislation and good practice.
Encourages the eradication of Japanese Knotweed through co-ordinated control.
Works in partnership with the Cornwall Knotweed Forum and other groups.

When set up

Unknown

Geographical area covered

County of Devon 6,700km^2

Source of funding

Organisations and stakeholders

Devon County Council
Environment Agency
District Councils
Dartmoor National Park Authority
Devon Wildlife Trust
Torbay Coast and Countryside Service

Services

Offer advice to landowners

City and county of Swansea

Contact details and addresses:

City and County of Swansea Nature Conservation Team:
http://www.swansea.gov.uk/index.cfm?articleid=7406

Sean Hathaway
Nature Conservation Team
Environment & Conservation Section
Planning Services, Environment Department
The Guildhall, Swansea SA1 4PH
01792 635749
nature.conservation@swansea.gov.uk

Aims

Prevent further spread of Japanese knotweed and protect vulnerable areas from infestation

Objectives

Control Japanese knotweed in the City and County of Swansea area in a co-ordinated manner.
Research into management of Japanese knotweed.
Implement a strategic management plan, overseen by the Japanese knotweed officer.

When set up

A Japanese knotweed working group was set up in 1992
A Japanese knotweed officer was appointed in 1998

Geographical area covered

County of Swansea 378 km^2

Source of funding

City and County of Swansea
Local housing associations
Police
Churches
Probation service
Community councils
Land owning estates

Organisations and stakeholders

Liaise with Environment Agency, Railtrack and other landowners

Services

Scrutinise planning applications. The Japanese knotweed officer is consulted on all planning applications within the area.
Prevent spread of Japanese knotweed on council land.
Treatment of Japanese knotweed.
Use GIS of surveyed knotweed to assist planning and city development decisions.
Advise on treatment of Japanese knotweed.
Raise awareness of Japanese knotweed through media, press releases and seminars.
Enforcement of legislation and guidelines regarding Japanese knotweed.

ENGLISH NATURE

Research Information Note

English Nature Research Reports, No. 686

Strategic control of non-native invasive aquatic plants

Report Authors: RPS Ecoscope Applied Ecologists Date: 2006

Keywords: non-natives, aquatic plants, strategy, catchment, River Avon

Introduction

There are a number of invasive non-native plant species associated with freshwater and wetland habitats. The invasive nature of the species means that they are liable to spread rapidly, occupying available habitat and excluding native flora. Their impact upon native fauna is largely unknown but it is widely acknowledged that dense stands of these species do not provide the diversity of habitat structure associated with the typical range of native plant species. Additionally there are a number of riparian species, in particular Japanese knotweed *Fallopia japonica* and Himalayan balsam *Impatiens glandulifera*, which colonise riverbanks and dieback during the winter exposing bank to erosion. This can result in loss of riparian habitat and siltation problems in stream.

Experience in controlling invasions of these problem species has indicated that eradication is difficult and that there is a risk of re-infestation from neighbouring sites or upstream sections if a strategic approach is not adopted. Coordinated control programmes which have the support of a wide range of partners and stakeholders have a much greater chance of success in the long term and there are a several pilot projects where such an approach has been adopted.

What was done

This report provides guidance on developing a strategy for managing and preventing invasive aquatic plant problems. The key steps in establishing a strategy are described with guidance on setting a focus area; identifying useful data sources, partners and stakeholders; prioritising and funding action. The report draws on experience in setting up invasive control strategies and best practice from a handful of established projects. The River Avon catchment (Wiltshire & Hampshire) is used to illustrate the various steps of strategy development. A brief report of a workshop held in Peterborough in November 2004 is included as an appendix to the report. The purpose of this workshop was to consider the non-native invasive problem from a nature conservation perspective.

Results and conclusions

The report describes the options for defining focus areas for a strategy with the conclusion that there is no one ideal scale and a range of factors will determine the focus area. It is proposed that whatever the focus area there should be strong links to local authority boundaries and aspects of hydrological connectivity (catchment boundaries). Once a focus area has been defined it is important to collate information on the current extent and distribution of known problem species in the catchment. A key component of any strategy must be to develop a risk assessment and prediction process for both

Continued……

potential non-native introductions and potential sources of such species ('horizon-scanning'). The importance of identifying and engaging the relevant partners and stakeholders is emphasised and the appointment of strategy 'champion(s)' is recommended. Additionally, the report proposes some factors to consider when prioritising action and establishing policies including organisational and planning processes to underpin any strategy.

English Nature's viewpoint

English Nature recognises the importance of working with a range of partners and stakeholders to address invasive non-native species problems. Establishing management programmes to tackle invasive plants will be an important part of restoring and maintaining favourable condition on SSSIs and European designated sites. Experience shows that coordinated control and management programmes can deliver significant improvements and raise the profile of invasive species problems such that future problems may be avoided.

There are now several strategic projects (Cornish Knotweed Forum, Tweed Invasives Project) which are developing best practice in relation to invasive plant management. We are seeking to develop similar projects across England to deal with invasive plant problems on and outside of designated sites. The report is intended to be used to guide the planning and implementation of such projects. Much of the content is intuitive but nevertheless should serve as a useful checklist to ensure that all aspects of strategy development have been addressed. It is hoped that the report will help partner organisations better understand our favoured approach to tackling this problem and act as an impetus for setting up new strategic projects.

The Defra review of non-native species policy (Defra 2003) resulted in eight key recommendations many of which could be achieved through strategic approaches of this type. Responses to this review highlighted the need for an organisation to take a lead on management and the potential to deal with aquatic invasive species through implementation of River Basin Management Plans (RBMPs) under the EU Water Framework Directive. It is proposed that the strategies described in the report could be adopted as a mechanism for coordinating action within these RBMPs.

Selected references

DEFRA. 2003. *Review of non-native species policy*. London: Defra Publications.

Further information

English Nature Research Reports and their *Research Information Notes* are available to download from our website: www.english-nature.org.uk

For a printed copy of the full report, or for information on other publications on this subject, please contact the Enquiry Service on 01733 455100/101/102 or e-mail enquiries@english-nature.org.uk

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Top left: Using a home-made moth trap.
Peter Wakely/English Nature 17,396
Middle left: Co_2 experiment at Roudsea Wood and Mosses NNR, Lancashire.
Peter Wakely/English Nature 21,792
Bottom left: Radio tracking a hare on Pawlett Hams, Somerset.
Paul Glendell/English Nature 23,020
Main: Identifying moths caught in a moth trap at Ham Wall NNR, Somerset.
Paul Glendell/English Nature 24,888