Development Guidelines for a Biological Resources Database for Environment Southland's High Values Area Programme

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Summary

Project and Client

Environment Southland has contracted Landcare Research via an Envirolink Medium Advice Grant from the Foundation for Research, Science, and Technology to provide guidance on the development of a biological resources database to support Environment Southland's new High Values Area (HVA) programme. The HVA programme is a voluntary programme in which landowners nominate their sites for inclusion. Environment Southland will evaluate the sites, including conducting a field survey, and determine whether they contain significant ecological values as defined in the draft Regional Pest Management Strategy.

Currently, Environment Southland does not have a standardised, comprehensive, spatially linked database to collect and hold information on biological and biodiversity resources within the region. Having such a database would help Environment Southland implement, first, the HVA programme and, eventually, enhance their ability to meet a variety of several council functions including state of the environment reporting, policy and plannning development, consents and compliance administration, and pest management and monitoring.

Objectives

- Asses Environment Southland's information needs for HVA programme
- Recommend development guidelines for a regional biological resources database to meet, first, the needs of the HVA programme while considering, second, broader and longer term council needs related to policy development, resource management, and reporting.

Methods

- Landcare Research staff held two workshops with Environment Southland staff to discuss their information needs relative to the HVA programme and for biological resources within the region more broadly
- Based on a review of the information provided by Environment Southland and workshop discussions, Landcare Research prepared guidelines for developing a biological resources database to support the HVA programme centred on a high-level database design.

Information Needs Assessment

- Selection of sites for the HVA programme represents a common challenge in biodiversity and conservation management: namely how to assess the ecological values at a particular site and prioritise whether to direct limited resources to that site as opposed to other sites
    - The HVA site selection process consists of six steps and two decision points:
        - Initial Contact & Site Nomination
        - Desktop Survey
        - Decision Point #1: Proceed based on desktop survey
        - Pre-Survey Landowner Interview
        - Field Survey
        - Post-Survey Landowner Interview
        - Site Ranking
        - Decision Point #2: Include nominated site in HVA Programme
- Database design focused on information needed by the first five steps of the process. A site ranking system remains under development by Environment Southland.

Recommended Database Specifications

- The recommended database design has four major sections focused on the four major aspects of the HVA programme:
    - **Sites** store information about the location and basic attributes of specific *places*
    - **Surveys** store information about *conditions* of a particular place at a particular time based on either direct (i.e. field surveys) or indirect (i.e. desktop surveys or interviews) observations
    - **Assessments** store information on the *selection process*, i.e. status and workflow, for each site considered within the HVA programme
    - **Parties** store information about *people* and *organisations* involved in or affiliated with the HVA programme, such as council staff, surveyors, landowners, etc.
- Information on sites and surveys links to spatial databases, e.g., geographic information system layers, that can be combined with other spatial data such as cadastral layers as needed
- Sites remain a key focus of the database but the design allows for sites to change over time
- Surveys can include field surveys but also information from other sources
- Assessments record cases within the HVA programme; sites under consideration or part of the programme represent open cases and the same site can be the subject of multiple cases
- Parties provide a flexible approach to people and organisations which allow for different roles and relationships among people, organisations, and other information within the database.
- Several other issues were noted that go beyond the scope of the current project:
    - Data capture and input
    - Single versus multiple databases
    - Unique primary key record Ids in tables
    - Database architecture.

Next Steps

- We recommend Environment Southland (or another regional council) champion the next step in the process by advocating additional work to coordinate the development of biological/ecological resources databases within New Zealand to meet current and emerging council needs for biodiversity and biosecurity conservation and management
- Specifically, we recommend convening a workshop, perhaps funded by Envirolink or jointly funded by Envirolink and TFBIS, to bring together representatives from all councils to review and discuss their needs and aim to develop an Envirolink Tools project targeted at meeting common information needs that all councils have to support biodiversity management, prioritisation, and reporting at multiple scales within New Zealand.

1. Introduction

Environment Southland has contracted Landcare Research via an Envirolink Medium Advice Grant from the Foundation for Research, Science, and Technology to recommend specifications for a biological resources database to support the council's new High Values Area (HVA) programme. Currently Environment Southland does not have a standardised, comprehensive, spatially linked database to collect and hold information on biological and biodiversity resources within the region. Having such a database would help Environment Southland implement, first, the HVA programme and, eventually, enhance their ability to meet a variety of several council functions including state of the environment reporting, policy and plannning development, consents and compliance administration, and pest management and monitoring.

The HVA programme is under development as part of Environment Southland's draft Regional Pest Management Strategy. The programme is intended to identify and preserve areas of significant ecological value through focused pest management. Under the HVA programme, Environment Southland will work with interested land agencies and owners to:

- identify candidate sites for inclusion into the HVA programme
- survey the candidate sites and record their ecological conditions
- record the survey information into a comprehensive biological database
- review the collected information
- recommend whether to include a candidate site in the HVA programme.

A key consideration for inclusion in the HVA programme would be the willingness of the land owner or agency to undertake actions to maintain the significant ecological features at their respective sites. Sites recommended for inclusion into the HVA programme would then provide the impetus for the land owner or land agency to seek appropriate assistance to help maintain or enhance the biodiversity values at that site. The principle form of assistance would come through the provision of funds to maintain levels of pest control needed to maintain or even enhance the ecological conditions at the site.

Over the past year Environment Southland has been developing processes to implement the HVA programme, including protocols for interacting with land owners and methods for collecting and recording the appropriate ecological information to help them assess the value of candidate sites.

While developing those processes, Environment Southland recognised the need to have an integrated biodiversity information database where they could capture and utilise site-based biological information and monitoring data collected as part of the HVA programme. Council enquiries made throughout New Zealand indicated that no other regional council or other organisation has yet successfully developed a database to meet Environment Southland's needs.

2. Objectives

The objectives of the current project included

- Assessing the information needs of Environment Southland in relation to the HVA programme
- Recommending specifications for a regional biological resources database to meet, first, the needs of the HVA programme while considering, second, broader and longer term needs related to policy development, resource management, and reporting.

This project only addresses needs for collecting and storing the information required to evaluate candidate sites for possible inclussion in the HVA programme. Once included in the programme, HVA sites would require on-going monitoring to assess trends in their condition and therefore the effectiveness of any associated management regimes. The database and information will also require on-going investment and maintenance to insure that they continue to meet Council and HVA programme needs.

3. Information Needs Assessment

3.1. HVA Programme in Context

Environment Southland's HVA programme shares many challenges with similar conservation programmes both within and outside New Zealand: how best to allocate finite resources to help conserve and enhance native biodiversity for the long term? The task becomes one of prioritisation that requires knowing for any given area of interest (e.g., a site in terms of the HVA programme):

- What does the current site contribute to the overall state of indigenous biodiversity compared to other sites in terms of:
    - Representativeness – how typical or atypical is a particular location compared with what occurred naturally (i.e. pre-human) and currently?
    - Distinctiveness – how unique or common are the biological resources found at a particlular location including individual taxa, ecological communities, environments, soils, and other natural heritage values?
    - Condition – are the conditions at a particular site mostly native, mostly exotic, or somewhere in between? How prevalent or common are non-native species?
- What threats or pressures currently impact native biodiversity at the site?
- What will be the future state of biodiversity in the presence or absence of those threats and pressures?
- What management is or could be implemented to reduce or remove any threats or pressure?
- How do the gains made in managing one site compare with gains made from managing a different site?
- What criteria should be used to decide which sites to include in the HVA programme and which sites not to include?
- What processes were used to identify and assess the biological resources at a site including metadata, survey methods, surveryor qualifications, etc.?

- What provisions are there for on-going collection, curation, management and reporting of the biological resources information for a particular location?

The key challenge lies in determining what information to collect so the council can assess a site's conservation value relative to national, regional, and local goals and needs. To give some sense of the scale of the task, the Southland Region contains over 2500 remnants of indigenous vegetation greater than 5 ha and likely many more of smaller size (Garden & Wood 2003). The challenge of choosing which sites to include in the HVA programme and actively manage will therefore be formidable.

New Zealand Biodiversity Strategy

Within New Zealand, these questions are most often framed within the context of the Biodiversity Strategy (Department of Conservation & Ministry for the Environment 2000). The strategy outlined four goals and ten themes intended to help halt the decline of indigenous biodiversity. The HVA programme represents one attempt at the regional level to address three of the four broad goals:

- Goal 1: Community and individual action, responsibilty & benefits
- Goal 2: Treaty of Watangi
- Goal 3: Halt the decline in New Zealand's indigenous biodiversity.

Theme 1 of the Biodiversity Strategy: Biodiversity on Land identifies a number of desired outcomes to achieve by 2020, including a net gain in the extent and condition of natural habitats and ecosystems, an increase in the area and health of scarce and fragmented habitats, the sustainable management of surrounding areas, a more representative range of natural habitats and ecosystems in public ownership complemented by an increase in privately owned and managed protected natural areas, no further human-caused extinctions, and few threatened species that require active recovery programmes.

The HVA programme addresses Goals 1 and 2 by working directly with private landowners, including iwi, to enhance understanding of and increase protection of indigenous biodiversity. The programme addresses Goal 3 by helping conserve and possibly restore elements of indigenous biodiversity throughout the region. This includes both maintaining and restoring a full range of native ecosystems and habitats and maintaining and restoring viable populations of native species.

Resource Management Act

The HVA programme also helps meet Council responsibilities under the Resource Management Act (RMA). Under the RMA, councils are charged with the sustainable mangement of their resources (Section 3) including the need to protect outstanding natural features and landscapes and areas of significant vegetation and significant habitats of fauna (Section 6). The HVA programme would contribute to those objectives by helping identify where such natural features, significant vegetation, etc., occur and outlining measures to help conserve them.

Biosecurity Act

Under the Biosecurity Act 1993, regional councils are required to prepare Regional Management Strategies outlining how they will control pest species. The HVA programme will help meet council's needs under the Act by providing a process for evaluating and selecting sites that have adverse or intended effects related to

- economic well-being

- viability of treatened species, survival of indigneous plants or animals, or the sustainabilty of natural and developed ecosystems, ecological processes, and biological diversity
- soil resources or water quality
- human health or enjoyment of the recreational value of the natural environment
- relationship of Maori and their culture and traditions with their ancestral lands, waters, sites, waahi tapu, and taonga.

As part of their draft Regional Pest Management Strategy, Environment Southland has developed a set of ranking criteria against which to evaluate candidate HVA sites (Table 1). The ranking system is based on a system developed as part of the Department of Conservation's National Possum Control Plan 1993–2002 (Department of Conservation 1994). The DOC system outlined a two-step process that first ranked management units based on its conservation value and second ranked the units according to their vulnerability to possum damage.

National Guidelines for the Protection of Rare and Threatened Native Biodivesity on Private Land

Finally, the HVA programme would also align well with the recently released guidelines for national priorties for protecting rare and threatened indigenous biodiversity on private land (Ministry for the Environment & Department of Conservation 2007). Those guildelines have four priorities:

- National Priority 1: To protect indigenous vegetation associated with land environments, (defined by Land Environments of New Zealand at Level IV), that have 20 percent or less remaining in indigenous cover.
- National Priority 2: To protect indigenous vegetation associated with sand dunes and wetlands; ecosystem types that have become uncommon due to human activity.
- National Priority 3: To protect indigenous vegetation associated with 'originally rare' terrestrial ecosystem types not already covered by priorities 1 and 2.
- National Priority 4: To protect habitats of acutely and chronically threatened indigenous species.

Table 1 HVA site selection criteria from the Draft Regional Pest Management Strategy

National Importance	• contains a nationally endemic plant species or community • the ecological plant or community is better represented in the ecological district than in any other district in the country • contains an animal species endemic to the unit or ecological district or better represented in the ecological district than any other district in the country • contains nationally important soil or water or other physical properties • national culturally significant features or sites are contained within the unit • contains nationally significant economic features, i.e. found nowhere else and can only be undertaken in that particular environment • contains nationally important health, recreational or other social values
Of Outstanding Value	• highly endangered, rare or restricted endemic species breeds in the unit • the management unit is of international or national importance to migratory species for breeding and/or migration • largely unmodified ecosystems or examples of original habitat, not represented elsewhere; of large size and containing viable populations of all or most species typical of such ecosystems • containing plant communities of great scientific value, for example, nationally rare successional sequences or mosaics • sites where a plant community, or more than one species of plant, reaches a geographic limit • contains economic, cultural and social values important to the South Island
Highly Valuable	• site containing a native species which has declined significantly as a result of human influence • example of a largely unmodified site not represented to the same extent elsewhere in the ecological district and used by most species that are typical of the habitat within the ecological district • containing regionally rare plant communities in good condition and forming part of a larger tract of vegetation, for example, subalpine and alpine areas surrounded by a tract of forest • nationally rare plant communities that have been degraded in value, for example, containing problem weeds • regionally significant social (human health, recreational or other social) values are contained within the management unit, which contains regionally important economic values • sites of cultural significance to the region present in a management unit
Moderately to Highly Valuable	• management unit supports a species still widely distributed but whose habitat has been reduced • management unit with large numbers of breeding or moulting birds or where breeding or moulting areas are of inter-regional significance • large and fairly unmodified site, which is represented elsewhere in the ecological district and contains all or most species typical of that habitat for that ecological district
Moderate Value	• all sites supporting good numbers of species that are typical of that habitat within an ecological district and that have not been heavily modified by humans • management unit contains locally important social, economic and or cultural importance
Of Potential Value	• areas whose value to native animals is limited to small size, heavy modification, or other factors, but could be more benefit to animals if left to regenerate, or managed and developed to their benefit • management unit contains social, economic and cultural values important to the local community.

3.2. Council Workshops

We held two workshops with Environment Southland staff during the course of this project. The first workshop was held in March 2006 and was funded by an Envirolink Small Advice Grant. At this workshop council staff outlined the HVA programme and provided a preliminary set of information needs related to the programme. We in turn provided verbal recommendations and suggestions for staff to consider as they developed the HVA programme.

Based on the first workshop, Environment Southland and Landcare Research developed and submitted an Envirolink Medium Advice Grant application that resulted in the current project. In conjunction with developing the proposal, Environment Southland staff developed and trialed a draft survey methodology and form for collecting information that would be used later to evaluate and rank candidate HVA sites. Council staff subsequently provided their draft survey forms and related material to Landcare Research for evaluation and consideration while designing the database.

A second workshop was held between council staff and Landcare Research staff in March 2007. Council staff presented in detail their proposed HVA survey methods and information to Landcare Research staff. They also outlined their preliminary ideas about developing an evaluation method for generating relative rankings of sites upon which they would base their decision whether or not to include the site within the HVA programme. In addition, other council databases were discussed to explore the potential in the longer term to link the information in the biological resources database to those other databases. The relationship of the proposed database and its interoperatibility and exchange of information databases maintained by other organizations (e.g., DOC, MfE, MAF, local councils) were also discussed. It was agreed that the proposed database should as much as possible cater to but initially must serve council needs relative to the HVA programme.

In addition to the workshop, council staff and Landcare Research staff (DR) visited several field sites to discuss the various issues faced and conditions encountered when conducting on-site surveys. The visits provided valuable insights into the types of information the council may require.

3.3. HVA Site Selection Process

Based on information obtained through consultation with council staff, we evaluated the HVA site selection process and divided it into six steps that lead to the final decision whether or not to include a site within the HVA programme (Fig. 1).

Although the steps listed are specific to the HVA programme, overall they represent a relatively standard sequence of activities that an organisation would undertake to identify, evaluate, and recommend sites based on particular needs and criteria. In this case the programme aims to characterise the ecological conditions (i.e. ecological state) at a site and determine the relative ecological value provided by that site compared to other sites. Ecological value, as discussed above, can be assessed relative to a number of scales (national, regional, local) or desired outcomes, e.g., representativeness or distinctiveness of ecosystems or habitats, conservation and enhancement.

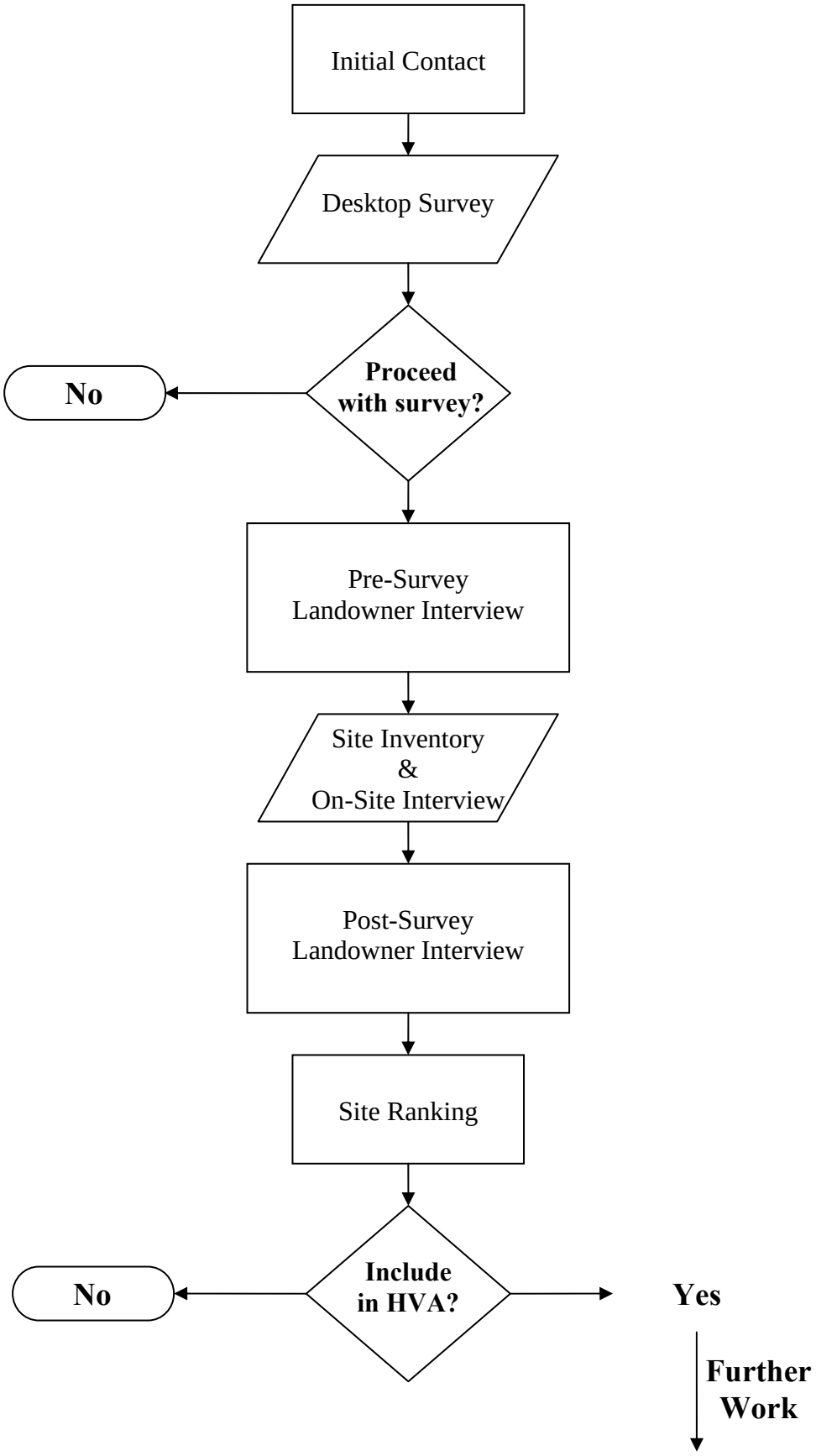

Fig. 1 Eight steps in the High Value Areas programme site selection process

Initial Contact

As a voluntary programme, the HVA programme will primarily rely on the enthusiasm and interest of a private landowner to contact the council and nominate a site for consideration in the programme. Initial contact will entail recording the basic landowner information and gaining basic information on site location and characteristics: who called, where is the site, how large, what information can they provide about the history and current condition and management (e.g., fenced, pest & weed control), etc.?

As this is a new programme, council staff currently do not know how many inquiries they may receive per year and how many of those inquiries would result in further evaluation. The database should therefore provide both the ability to capture this initial information easily and staff with the ability to report back to council on the level of interest generated by the programme based on the number of inquires received. The collection of even such basic information will, in the long term, help council staff build up a region-wide picture of sites offered for consideration and determine if any interesting patterns emerge, i.e. are there "hotspots" or conversely "dead zones" of community interest and participation?

Desktop Survey

Following an initial inquiry, council staff should conduct a desktop survey to compile as much information as possible about a candidate site and determine whether to proceed with a full survey and assessment. This is referred in the ecological literature as a "coarse filter" assessment that uses broad-scale information to make judgements on whether or not to proceed. The intent behind a desktop survey is to use readily available information sources to assess, often only in qualitative terms, whether it is worth proceeding and expending the resources needed to conduct a full site assessment and field survey. The primary benefit of a desktop survey is to avoid expending limited resources on too many similar sites with similar ecological values. The drawback is that sites that appear similar at a coarse scale may contain features or conditions not readily observed at broader scales common to such exercises, such as small pockets of wetlands or local populations of rare or threatened species (Walker et al. 2006). There is no hard-and-fast rule to apply; any desktop analysis should rely on as much information as can be feasibly collected and will invariably depend on a combination of that information and staff knowledge and experience.

In the initial phases of the HVA programme, the desktop survey will likely be minimal and not used to screen candidate sites. As the number of candidate sites increases, staff gain more experience, and the programme gains in popularity (i.e. more sites are nominated by landowners), the desktop survey could become an important step in the site selection process. Therefore we recommend council staff begin implementing a basic screening process immediately, even if they initially choose to survey all sites nominated for the HVA programme.

While the exact nature and types of data sources will vary from site-to-site, several published information sources and information held in-house by council will be available for any site. These information sources include (in alphabetical order)[1]:

- Aerial Photographs
- Biosecurity (Pest) Control Information
- Cadastral Information
- Ecological Regions & Districts Classification

[1] This list is by no means exhaustive.

- ECOSAT Land Cover and Native Forest Community Layers
- Freshwater Environments of New Zealand
- Freshwater Fish Database
- Land Cover Database
- Land Environments of New Zealand (LENZ) Classification
- Land Resource Inventory
- National Soils Database
- National Vegetation Survey
- Protected Natural Areas (PNAP) Surveys
- Protected Areas Network (PAN-NZ)
- Other Published Surveys
- River Environment Classification
- Staff, Expert, and Local Knowledge
- Topographic and Cartographic Information Sources
- Waters of National Importance (WONI) Wetland Mapping

Pre-survey Landowner Interview

After deciding whether or not to proceed with assessing a site following a desktop survey, council staff will interview the landowner(s) to gain as much information as possible about past and current site conditions and trends. Landowners often have the longest and in most cases only detailed knowledge of site conditions. Their observations of flora and fauna over time, although often only anecdotal, can yield valuable information about long-term trends that would otherwise be difficult or impossible to obtain. This includes observations about the presence or absence of flora and fauna, particularly mobile species such as birds, and past or on-going methods for controlling impacts to indigenous biodiversity such as excluding stock with fencing or mammalian predator control (i.e. baiting, shooting).

The landowner will also be able to provide information on site access, give any advice on what to expect, and clearly must give access permission to the surveyor.

Site Inventory and On-Site Interview

The site-survey represents both the most resource-intensive step in the HVA process and the one that will yield the most information about site conditions. The goal of the survey is to gather enough and appropriate information on site conditions, such as state, pressure (i.e. pests), management, and likely past and future trends, to make a proper judgement on whether to include the candidate site in the HVA programme.

The question of what to measure, how to measure it, and perhaps most importantly *why* to measure it in the first place represents in itself a challenging and on-going research and management question that easily goes beyond the scope of the current project. A recent review (Lee et al. 2004) provided a comprehensive review of ecological inventory and monitoring systems both internationally and within New Zealand. Their report offers a framework for measuring and assessing ecological values and discusses a number of possible indicators to inform those values.

In developing our recommendations, we relied primarily on the information identified in the draft HVA survey methods and associated data collection sheets that council staff developed in parallel with this project.

A copy of the draft HVA site survey form can be found in Appendix 1.

Post-survey Landowner Interview

Following a site survey, council staff may need to conduct a post-survey interview with the landowner to obtain any missing information or question any aspects of the site observed during the site survey.

Site Scoring

The scoring system for the HVA programme will be used to rank candidate sites and inform the final decision as to whether to include a candidate site in the HVA programme. The site scoring system remains under development by Environment Southland. In its current version it includes scores for four components of site condition:

- Spatial Integrity
- Structural Integrity
- Threats (Pests)
- Native Vegetation

4. Recommended Database Specifications

4.1. Overall Design

The biological resources database for the HVA site selection process would be organised into four main sections (Fig. 2). Each section would store information about the four main aspects of the HVA programme:

- **Sites** store information about the location and basic attributes of specific *places*
- **Surveys** store information about the *conditions* of a particular place at a particular point in time based on either direct (i.e. field surveys) or indirect (i.e. desktop surveys or interviews) *observations*
- **Assessments** store information on *cases* within the *selection process*, i.e. status and workflow for each site considered within the HVA programme
- **Parties** store information about *people* and *organisations* involved in or affiliated with the HVA programme, such as council staff, surveyors, landowners, etc.

Sites and **Surveys** would also link directly to **spatial databases**, e.g., geographic information systems layers to store geographic information and track site conditions as they change over time.

In developing this overall design, we avoided the tendency to create a database focused solely on sites and the conditions present at the time of the evaluation survey. Instead we aimed to develop a robust and extendable database that would supply not only good information on biological resources and how they change over time, but also one that records the decision-making process that Environment Southland has followed to support their evaluation of candidate HVA sites. Hence the high-level design is intended to create a basic database framework that recognises and caters to the dynamic nature of the HVA programme and tries to address the needs that council staff identified during two informal workshops.

In that regard, sites (or places) remain a key focus of the database, but the design recognises that conditions at a site can change over time by offering the capacity for multiple surveys of the same site or that information about the site can come from various sources, i.e. from interviews with various parties. By linking directly with spatial databases, we provide the ability to track changes in space and time. For example, the database design would accommodate the potential expansion of a site over time through targeted restoration. By tracking cases the same site can be evaluated more than once if, for example, it changes ownership and the new owners wish to have it re-evaluated. Finally, the database allows for a flexible approach to people and organisations through the use of a generalised parties data model. Under this model, people can have multiple positions and/or roles and can therefore link directly or indirectly to other sections of the database.

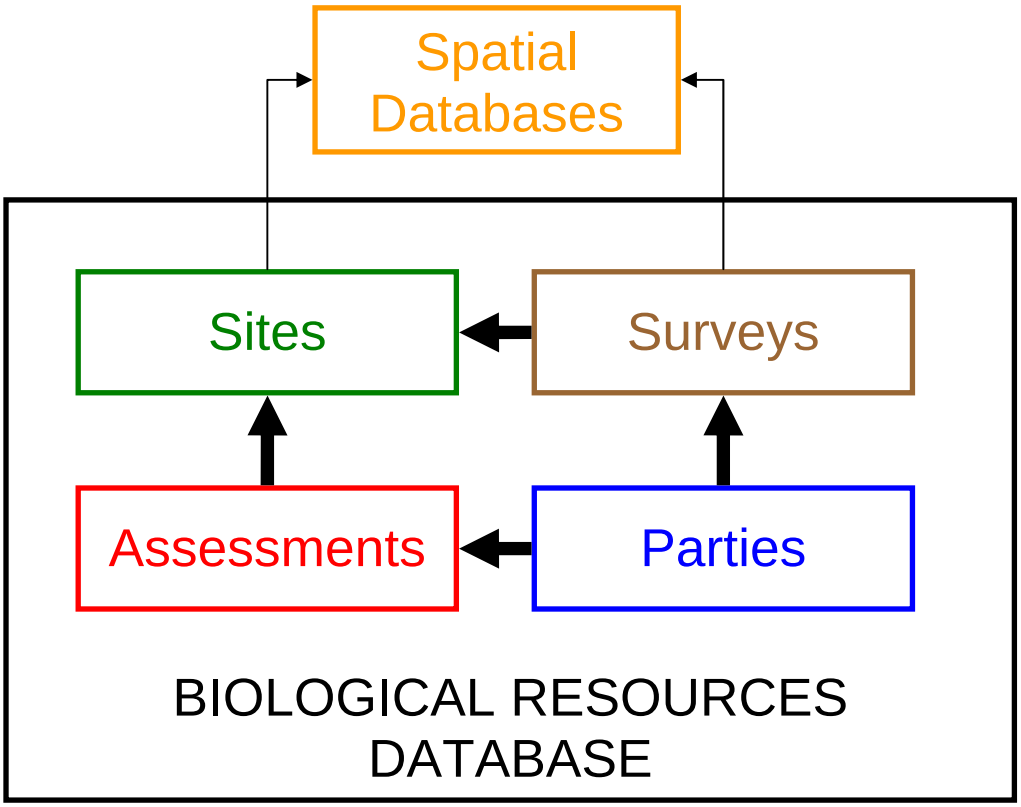

Fig. 2 High-level structure for the biological resources database showing the four main sections and primary links with related spatial databases. Arrows indicate the primary relationships and directions of information flow

While the current database focuses on capturing and storing information leading to a decision to include or not to include a site in the HVA programme, the database could be extended or enhanced to include on-going monitoring of current HVA sites. In this regard a "case" would remain open as long as the site remained part of the HVA programme. The database could also conceivably be extended to include non-HVA programme sites, such as Council reserves or private covenants undergoing pest management. The database could also link to other systems or databases within Environment Southland. More broadly, the database could also theoretically link to related databases such as DOC's Natural Heritage Management System that is currently under development or similar databases at other regional or district/city councils.

The overall design and organisation of the database would also theoretically be transferable to similar programmes focused on terrestrial biological resources being run by other organisations within New Zealand. However, issues of linkages, interoperability, or transferability are all beyond the scope of the current project and would require further investigation.

4.2. Sections and Components

Each section of the database has a number of specific tables that link to other tables within the same section and in some cases to tables in other sections of the database (Fig. 3). Some tables also link to spatial databases that store geographical information related to sites and surveys of site conditions.

The following sections outline the rationale behind each major section and overviews the basic table structure and relationships among tables. At the end of each section is a table that outlines the purpose and links of each table within each section.

Sites

Sites are the basic unit of evaluation within the HVA programme. A site could be represented in one of several ways. For example, sites based on location would represent a contiguous area of land bounded by a single boundary (i.e. legal, ecological, both), such as a single forest remnant in an agricultural landscape. Sites could also consist of related but spatially discontinuous places, such as multiple forest remnants on a single farm. Based on feedback received at the workshops and further discussions, we felt council staff would prefer to treat a site as geographically and ecologically distinct places. This makes sense in terms of the HVA programme focus on the ecological values of a given place and the fact that most HVA sites will likely be relatively distinctive compared to their surrounding landscape.

Following this data model, the Sites section of the database is comprised of six tables. Three tables (Sites, Site Coordinates, Place Names) capture basic information on site location and key attributes (Table 2) that should remain relatively constant over time. The other three tables (Consents, PestControl, and ControlMethod) record information on key activities related to a site that may affect its ecological value. Pest control, in this design, is considered an attribute of a site and not a condition of the site.

Information on a site's ecological condition will be stored in tables in the Survey section of the database which is discussed in more detail below. This will include information on the presence and in some cases abundance and distribution of pest species. Storage of information on site ownership will occur within the Parties section of the database, also discussed in more detail below.

Each site should link to a spatial database, represented as the SitesLayer table in Figure 3, where the site can be geographically represented. The associated spatial database should be flexible and accommodate potential changes to site boundaries over time. Because sites are defined based on ecological criteria, changes in site configuration/boundaries would most likely consist of the expansion or contraction of particular ecological features. Almost always this would consist of identifying expansions or contractions of the extent of native vegetation. However, other ecological features such as non-plant species, functions or processes may be more important to the significant ecological values that a site supports. For example, a predominantly non-native site may support a local population of a particular native species, such as a colony of native ants or a small population of a particularly rare or threatened native plant. In such cases the site definition should follow the expansion or contraction of the population of interest rather than simply delineating small fragments of native bush.

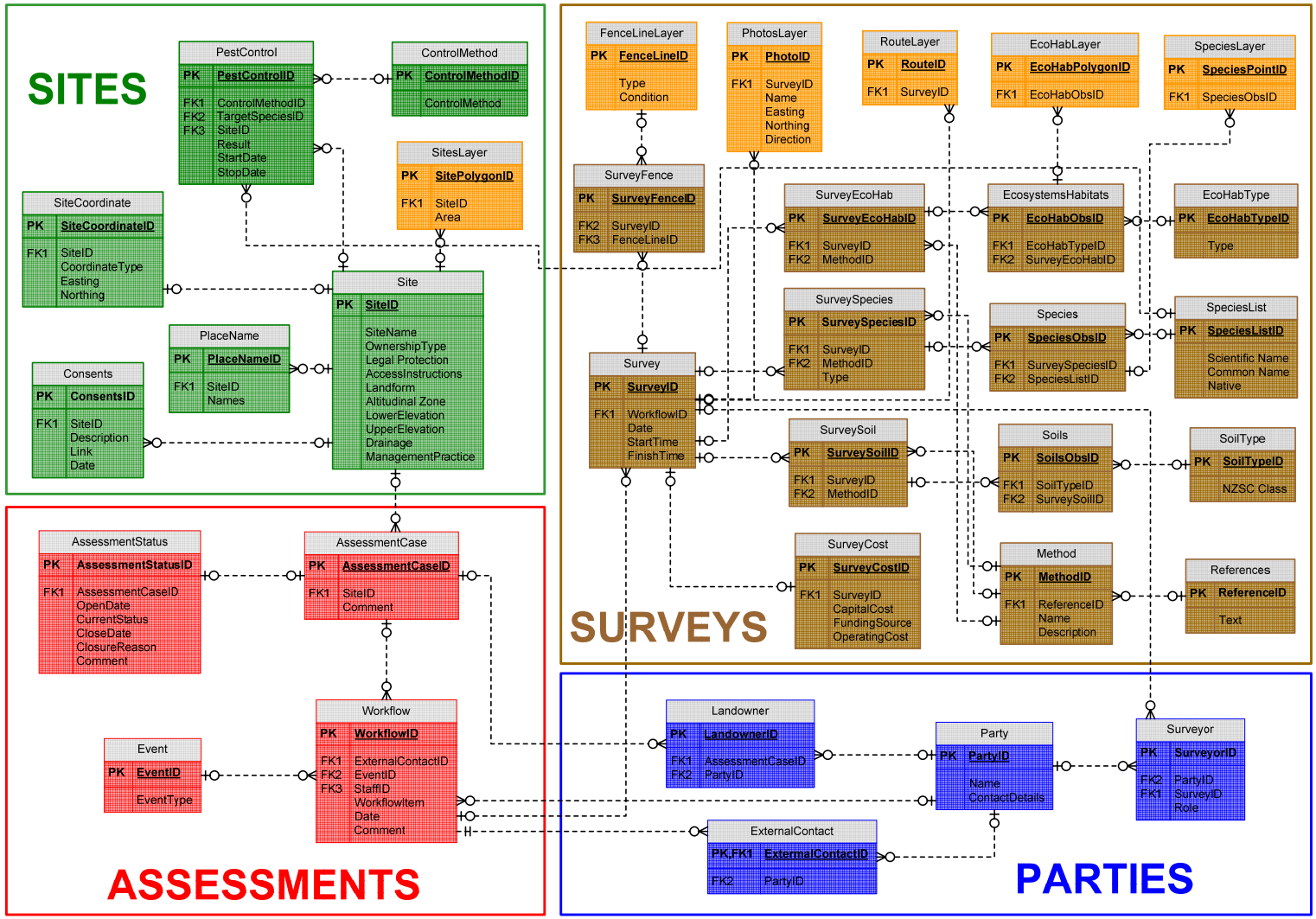

Fig. 3 Basic table and relationship structure of the biological resources database

Table 2 Purpose and links of the tables within the sites section of the database

Table	Purpose	Links
Site	Stores information on sites evaluated under the HVA programme	Place Name Site Coordinate Consents Pest Control Sites Layer (Spatial) Assessment Case
Site Coordinate	Stores a point location (easting, northing) associated with each site	Site
Place Name	Stores one or more place names associated with a site	Site
Consents	Stores links to any consents granted for a site	Site
Pest Control	Stores information on pest control history at a site. Each control has an associated method, target species, result, and start/stop date. Lack of a stop date would indicate that control is ongoing Could be linked to a spatial datatbase of control operations (e.g., possum control) but that is not shown	Site Control Method Species List
Control Method	Stores information on different pest control methods Note: This table could be combined with the Method table in the Surveys section to create a global Methods table common to the entire database	Pest Control
Sites Layer (Spatial)	Related table in a spatial database that records site boundaries. The one-to-many relationship between the Site table and the SiteLayer table allows the tracking of changes to site boundaries (e.g., expansion or contraction) over time	Site

Information on the spatial extent of site boundaries can be overlain with cadastral databases to help identify and associate information on ownership with a site. Because the HVA programme is voluntary, a change of ownership requires that the council re-evaluate the status of a site. The different ways in which ownership can change (ownership, parcel boundaries, interest, and combinations of all three) (Table 3) generates the potential for high levels of

spatial complexity in ownership patterns even though a site may remain relatively stable ecologically.

We recommend that any change of ownership, parcel boundaries, or interest should at a minimum trigger the creation of a new event that requires a review of an open case. Changes in ownership through sale or subdivision will most likely require the Council to 1) close the current case for a site, effectively removing it from the HVA programme, 2) open a new case for the site linked to the new owner(s), and 3) determine the disposition of those owners. If the new owners agree to continue having the site within the HVA programme, the site could be re-enrolled with little further work or perhaps a quick field survey conducted to insure that the relevant ecological conditions remain intact. If the new owner(s) do not wish to participate, then the case can be closed and the site removed from the HVA programme.

Change of parcel boundaries under the same ownership, which would most likely entail subdivision, should trigger an event requiring re-contacting the owners and ascertaining their intentions for the property and reaffirming their commitment to the HVA programme.

Changes in interest of existing owners will be most problematic and difficult to detect and track. We would expect that such changes would be flagged during on-going monitoring. Changes in relative level of interest would most likely affect on the ground conditions first, i.e. a new majority owner deciding to remove a fence and allow grazing in a forest fragment.

To avoid problems associated with these types of changes in the medium to long term, we recommend the database automatically trigger an event to re-contact owners periodically (annually or biennially, for example). Alternatively, as a condition of participation in the HVA programme, the council could require that owners alert them to any changes in legal boundaries or ownership arrangements that could affect the site.

Table 3 Examples of combinations of changes of associated ownership, parcel, and interest for an HVA site

Complexity	Example	Owners	Parcels	Interest (%)	Shape
Simple	Single home owner on lifestyle block	1	Single	100	
Simple	Farming couple	2	Single	50/50	
Moderate	Business Partnership	3	Single	50/25/25	
Moderate	Family Inheritance	5	Two	20/20/20/20/20	
High	Business Enterprise across multiple properties	5	Multiple	35/35/10/10/10 (does not correspond directly to parcels)	
High	Maori property owned in common	Many	Single or Multiple	1/Total # of owners	

Surveys

The Surveys section of the database contains the tables that store information on the observed ecological conditions at a site at the time of a field survey. It is the most complex and largest section of the database, containing a total of 14 tables and linking to 5 related spatial databases or GIS layers (Fig. 3). Although it appears quite complicated at first, the design and visual layout of the section are actually relatively straightforward.

The Survey table is the main table of the section and stores a unique record for each survey undertaken. It is important to note that surveys link *indirectly* to sites. This is because a survey represents one item (event type of "field survey") within the work flow of a particular assessment case. This design accommodates multiple surveys of the same site over time within one assessment case. At a minimum, a site would have one associated survey representing the original field visit used to evaluate the site for inclusion in the HVA programme. Although we only briefly discussed on-going monitoring, council staff could store information from subsequent surveys as part of on-going monitoring within the HVA programme.

Surveyor information, i.e. who actually conducts the survey, is stored via a link table in the Parties section of the database. This creates a many-to-many relationship between Surveys and Parties such that a survey can have 1 or more surveyors and a surveyor can participate in 1 or more surveys. The limitation of this current design is that it does not allow association between particular surveyors and particular ecological attributes (habitats, species, etc.) Based on our discussions with council staff, one or perhaps two surveyors will have responsibility for surveying all aspects of a site, at least initially. Over time the ability to link a particular surveyor with a particular attribute (e.g., birds, pests, etc.) may become necessary.

Directly associated with each survey is a survey cost table (bottom middle of the Surveys section in Fig. 3) that tracks the resources required to survey a site. Collecting this information over time will help Environment Southland staff make preliminary assessments of field survey costs during the desktop survey, which at some point in the future may be used to help prioritise field visits based on available resources.

Directly to the right of the Survey table is a set of 9 tables, arranged in three rows (read left to right) of three tables each focused on 1) soils, 2) ecosystems & habitats, and 3) species. Each row of three tables follows the same basic design. The first (leftmost) table links directly to the Survey table. This allows for multiple surveys or subsurveys of soils, ecosystems/habitats, or species during a single field survey of the site. The second (middle) table records the observations of a particular resource during that particular survey or subsurvey. The third (rightmost) table stores standard reference information for each resource to insure consistency among surveys and surveyors. Depending on how the database is technically implemented, it could link to standard reference datasets stored on-line to insure full compatibility and interoperability with other systems and databases. Finally, each survey or subsurvey table links to a Method table that stores all types of survey methods used currently or in the past. The Method table links further to a Reference table that stores authoritative references containing survey methods, where available. In summary, the linked set of three tables allows for multiple surveys with multiple observations of different soils, ecosystems, habitats, or species using multiple survey methods.

For species the design does not distinguish between native and non-native (i.e. pests) at the survey level but rather at the species level. For example, surveys for possums would be treated the same as surveys for native birds, although the survey methods would clearly differ between them. The species table should record observations in the appropriate units (density, count, basal area, etc) based on the method used. As their specific needs evolve over time, Environment Southland can develop specific tables catered to recording observations using

particular survey methods (e.g., 5-minute bird counts) and/or particular resources (e.g., habitats).

The surveys section includes links to five spatial databases (or GIS layers), shown in a row along the top of the section (Fig. 3). Although depicted as part of the database, in reality this information will reside in a separate spatial database, most likely initially as a series of GIS layers. In the longer term the council may choose to move this information to an organisational geodatabase running on an enterprise-wise database server. Table 4 outlines the purpose and links of each of the spatial database tables in more detail.

The design of the survey section would allow Environment Southland to expand the scope of the database to encompass additional information over time. We expect this will be the case as they gain more knowledge and experience with the HVA programme and identify new data requirements to support on-going biodiversity and biosecurity efforts.

Table 4 Purpose and links of the tables within the Surveys section of the database

Table	Purpose	Links to
Survey	Stores primary information for each unique survey	Survey Cost Survey EcoHab Survey Soil Survey Species Survey Fence Fence Line Layer (Spatial) Photos Layer (Spatial) Route Layer (Spatial) Workflow Surveyor
Survey Cost	Stores information on the resources expended to conduct a survey	Survey
SurveyEcoHab	Links surveys to observations of ecosystems and habitat conditions based on particular methods	Ecosystems Habitats Method Survey
Ecosystems Habitats	Stores observations on the ecosystems and habitats observed from a survey obtained using particular methods. Allows for multiple types of surveys, each having one or more observations, i.e. a many-to-many relationship	Survey EcoHab EcoHabType EcoHabLayer (Spatial)
Ecosystem Habitat Types	Stores a standard list of ecosystem and habitat types	Ecosystems Habitats

Eco Hab Layer (Spatial)	Spatial database or GIS layer that records the extent (polygon) of different ecosystem or habitats within a site at the time of a particular survey	SurveyEcoHab
Survey Species	Links surveys to observations of species based on particular methods	Survey Species Method
Species	Stores observations on species from a survey obtained using particular methods. Allows for multiple types of surveys, each having one or more observations, i.e. a many-to-many relationship	Survey Species Species List SpeciesLayer (Spatial)
Species List	Stores standardised species lists including both scientific and common names	Species
Species Layer (Spatial)	Spatial database or GIS layer that records the location of different species observed using particular methods during a survey	Species
Survey Soil	Links surveys to observations of soil conditions	Soils Methods Survey
Soils	Stores observations of soils from a particular survey obtained using particular methods. Allows for multiple types of surveys, each having one or more observations, i.e. a many-to-many relationship Note: similar to ecosystems & habitats and species, this table could also link to a spatial database or layer of existing soils information (i.e. NZ Land Resource Inventory) or a soils layer created solely for this purpose	Survey Soil Soil Type
Soil Type	Stores information on standard soil types based on the New Zealand Soil Classification system	Soils
Methods	Child table that stores information on the various survey methods used during a field survey such as 5-minute bird counts, RECCE plots, line transects, visual soil assessments, residual trap catch index, etc.	Survey Survey Ecosystems Habitat Survey Species Survey Soils

		References
References	Stores reference information related to survey methods of ecosystems & habitat, species, soils, etc. Could be treated as a separate global table within the database, rather than being identified within the Sites section	References
Survey Fence	Links surveys with observations on fence conditions	Survey Fence Line Layer (Spatial)
Fence Line Layer (Spatial)	Stores information on the geographic location, type, and condition of fences; allows recording of fences of different type and condition	Survey Fence
Photos Layer (Spatial)	Records the geographic location (e.g., easting, northing) where photos were taken Note: could also be linked directly to observation tables	Survey
Route Layer	Stores waypoint information on survey transects (if needed) or other routes traversed during the survey	Survey

Assessments

The Assessment section of the database stores information on the status of cases within the HVA programme. A case consists of a unique consideration of a site within the HVA decision making process. The concept behind cases is to track accurately and completely the decisions and events involved with evaluating a site for inclusion in the HVA programme (Fig. 1). Each case will have an open date corresponding to the initial inquiry from a landowner regarding a proposed site and a closing date at which point the site is no longer under consideration for inclusion in the HVA programme. In this sense, a case in the HVA programme database could be similar to a court case or perhaps a resource consent application under the Resource Management Act. The same site could have more than one case, e.g., could be considered more than once within the HVA programme over a period of time based on changing circumstances such as change of ownership as described above.

While we did not explicitly discuss on-going monitoring and re-evaluation of sites with Environment Southland staff as part of this project, we recommend that a case for a site remain open as long as a site remains part of the HVA programme. At any point in time an examination of open cases would yield a list of sites within the programme and sites under consideration/evaluation for the programme.

The Assessments section consists of 4 tables: assessment case, assessment status, workflow, and event (

Table **5**). The Assessment Case table is the main table that stores the unique identifier for each case and provides the main link to the three other sections of the database (Fig. 2).

Table 5 Purpose and links of the tables within the Assessments section of the database

Table	Purpose	Links to
Assessment Case	Stores information about all cases within the HVA programme. Each case will be a unique record in the table	Assessment Status Workflow Landowner Site
Assessment Status	Stores information on the state of a case, including open date, close date, current status, and reasons for closure	Assessment Case
Workflow	Stores the sequence of events that are undertaken to evaluate a candidate site for inclusion in the programme. StaffID links to PartyID and identifies the staff member responsible with the work flow item	Assessment Case Party Survey
Event	Stores a list of standard event types use in the evaluation process such as phone calls, interviews, surveys, decisions, etc.	Workflow

Parties

The Parties section of the database stores information on the people and organisations involved with the HVA programme. Parties is a generalised concept of contact information and is designed to allow for variable relationships among people, organisations, and their roles relative to the HVA programme.

The Parties section consists of four tables: Party, Assessment Contact, and Surveyor (Table 6). Party is the main table that stores information on all people and organisations involved in the HVA programme. Unlike the main tables in the other three sections, the Party table does not directly link with other sections except for the Workflow table in the Assessments Section. Instead, the Party table links through a set of intermediate tables to create several many-to-many relationships for land ownership, external contacts, and surveyors.

Table 6 Purpose and links of the tables within the Parties section of the database

Table	Purpose	Links to
Party	Stores information on people and organisations, either within or outside the Council, associated in some way with the HVA programme	External Contact Landowner Surveyor Workflow
External Contact	Provides the ability to link a workflow item to one or more external (i.e. non-Council) parties, such as an interview of a land manager before a site survey	Party Workflow
Landowner	Stores information indicating which parties own a particular site undergoing assessment within the HVA programme	Party Workflow
Surveyor	Links surveyor and site information	Party Survey

4.3. Additional Considerations

In addition to the ecological information a biological resources database must capture, we also discussed with council staff several other technical considerations that will influence the design and implementation of the proposed biological resources database. Full consideration of these issues is beyond the scope of the current project. Nonetheless, we felt it important to highlight these considerations briefly for council staff to consider as they move forward with database development. The issues are discussed below and generally follow a temporal sequence beginning with data capture and input to technical issues related to long-term information storage and retrieval.

Data Capture and Input

Council staff prepared a draft field survey sheet that they used during several field survey trials to develop and refine their ideas and methods for information capture. While they were generally pleased with the survey sheet design, staff recognised that recent technological advances, i.e. personal digital assistants (PDAs), offer several potential advantages to traditional paper survey forms for information capture. These advantages could include:

- simplifying data capture by removing the need to use several sheets of paper
- providing the opportunity to link observations to spatial locations directly via GPS technology
- creating and archiving photographic evidence through the use of built-in digital cameras
- promoting standardisation and consistency among surveyors by automatically limiting choices for data input where applicable
- facilitating efficient data upload including the potential for near immediate upload from the field using wireless technology.

Other advantages are also likely to exist, but again our discussion on these topics was limited.

A potential disadvantage of relying on a PDA for data capture would be the risk of data loss due to equipment failure and/or the obsolescence of PDA software. In short, paper survey forms do not "crash" (although they can burn), and paper files can remain viable and accessible for many decades, whereas the true long-term archival capacity of digital information remains in question.

We generally agreed with staff that an all-digital approach to data capture offers many benefits but recommended they continue to make paper copies of all survey information.

Single versus Multiple Databases

Part of our discussion therefore focused on whether the council should seek to develop and deploy a single database for all biological resources, in addition to the HVA programme database that is the focus of this report, versus multiple but interoperable databases focused on particular issues.

Environment Southland has a number of existing databases related to various aspects of their organisation including consents processing, wetlands, resource monitoring, etc. Currently those databases, as well as additional information on a variety of resources, are dispersed throughout the organisation. Some information exists within centralised or personal databases (i.e. Microsoft Access), whereas other information exists as collections of spreadsheets that may reside in a central file space or in the personal file space of a particular staff member.

From our experience this is a common situation that creates issues of integration and interoperability both within and among different organisations. Key datasets such as these should not be stored on personal drives, as this creates many issues of data security, integrity and access, both in terms of ability to locate information in the first place and to link to it once found. We recommend that the council:

- undertake a systematic inventory of their biological resources datasets
- record and document any files (e.g., spreadsheets, text files) and link them to existing or new databases, even if only as metadata, i.e. what, where, when, why.

With regards to database development and the question of single versus multiple databases, each organisation needs to follow an approach that best suits their needs and capabilities. With regard to a biological resources database, our experiences with DOC (Lee et al. 2004) suggest maintaining smaller and more readily managed databases, at least in the beginning, could prove more tractable, although there is a balance. As the number of systems increases, so does the difficulty in maintaining, updating, and retaining knowledge about them.

Regardless of the approach, the council should also seek to design databases that allow for interoperability and exchange with both internal and external databases, although we acknowledge that often times suitable guidelines in this regard either do not exist or are difficult to find and implement.

Unique Record IDs

A related question to the single vs. multiple databases issue was whether each table should have a field containing unique record identifications. Our recommended table structure for the biological resources database (Table 2) provides for unique primary key fields for each table but does not necessarily require unique values among all tables. For example, SurveyID in the Survey table and SiteID in the Site table, both primary keys, could share common values (i.e. 1 to *n*). Good database practice recommends that the primary key values in each table be unique, which would allow for easier integration among all tables.

Database Architecture

We briefly discussed possible database architecture choices, specifically whether the proposed biological resources database should exist as a stand-alone database within a stand-alone database application such as Microsoft Access or whether it should be housed centrally on a dedicated database server and associated software such as SQL Server but perhaps still with an Access front-end for data input and access.

In the short term a MS Access-based solution would likely be most feasible for initial design and prototype development and, in a few cases, serve some small standalone needs. In the long term, however, an MS Access-based solution poses several limitations for meeting broader council goals of integration, interoperability, expansion, robustness for multi-user systems and systems integration, and repurposing, i.e. web-based delivery of information to future stakeholders such as DOC, MfE, or other councils. There can be maintenance issues with MS Access such that updates change the way the programme works and breaks a custom application or database. We have experienced this firsthand within Landcare Research.

We therefore recommend the council develop or, if it already exists, revise a long-term knowledge management strategy that identifies their biological resources information needs and outlines a pathway for developing information systems to meet those needs.

5. Next Steps

This report provides guidelines and recommendations for a high-level structure, including tables and relationships, for a biological resources database to serve Environment Southland's immediate needs for their High Values Areas programme. While this report provides a solid foundation from which Environment Southland can proceed, it represents only an initial effort and only scratches the surface of what would be required in the long term. In addition, we are aware through other projects including other Envirolink grants that councils throughout New Zealand have identified and are facing similar needs to those of Environment Southland as they come to grips with their increasing responsibility for the long-term conservation and management of biodiversity within their jurisdictions. Different councils have implemented different solutions to different degrees of sophistication to meet their needs: some have quite advanced, enterprise-wide solutions, while others find themselves in a similar position to Environment Southland, i.e. trying to maintain a fragmented collection of files, spreadsheets, and stand-alone databases to meet a variety of needs. A recent review of the Biodiversity Strategy (Green & Clarkson 2006) recognised that, while progress has been made in understanding and taking action to halt the decline of indigenous biodiversity, much more could be done, including putting in place better systems for the coordinated collection, dissemination, and use of biodiversity information to help achieve the goals of the New Zealand Biodiversity strategy.

The time therefore seems ripe to bring together regional and district councils within New Zealand and tackle this issue together rather than continue to seek separate and independent solutions on an organisation-by-organisation basis. While we recognise that each council will have some specific information needs, we also know that most councils share similar needs with regard to understanding, collecting, and recording biodiversity information and using that information to outline and prioritise among a range of management options.

We would recommend that Environment Southland, or perhaps another regional council, champion the next step in the process by advocating for additional work to coordinate further

development of biological/ecological resources databases within New Zealand aimed at meeting council needs for biodiversity and biosecurity conservation and management. The next step would include analysis of:

- data requirements – what is common to all councils and what is specific or unique to particular councils
- database models and data business rules – what is needed to insure good interaction, sharing, and interoperability
- user functional requirements analysis - what would a proposed database system do and not do
- architectural design – how will the main system components interact, including external systems (e.g., GIS, external services like names lists etc)
- application and Interface design – what the application looks like and how it works at the user level.

Specifically, we recommend convening a workshop, perhaps funded by Envirolink or jointly funded by Envirolink and TFBIS, to bring together representatives from all councils to review and discuss the issues outlined above. The key outcome of the workshop would be to scope a work programme for an Envirolink Tools project targeted at meeting common information needs that all councils have to support biodiversity management, prioritisation, and reporting at multiple scales within New Zealand.

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Appendix 1 Proposed HVA Site Survey Forms

Appendix 1 contains the proposed HVA site survey form provided by Environment Southland.

HVA - Survey Form

1 General Information

1.1 Name	1.2 GPS Coordinates
Site Name:	**Accuracy:**
Site ID:	**Easting:**
Catchment:	**Northing:**

1.4 Ownership			1.5 Legal Protection	
☐ **Territorial Authority**			☐ **No legal protection**	☐ **Partial legal protection**
☐ **Private**	☐ **DOC**	☐ **Other**	☐ **Legal Covenant**	☐ **Reserve**

2 Contact Details

Name/Company/Authority		
Street		
Suburb/Town		
Phone:	**Extension:**	**Cell Phone:**
Email		

2.1 Landowner/manager – Environmental Awareness (EA) and Attitude (AT)		
☐ **Good EA/positive AT**	☐ **Good EA/cooperative AT**	☐ **Some EA/cooperative AT**
☐ **Some EA/indifferent AT**	☐ **no EA/confronting AT**	

3 Site Assessment / General information

Assessed by:	Recorded by:	Date:

3.1 Altitudinal Zone				
☐ **Coastal**	☐ **Lowland**	☐ **Montan**	☐ **Subalpine**	☐ **Alpine**
3.2 Landform				
☐ **Flood Plain**	☐ **Terrace**	☐ **Gully**	☐ **Ridge**	☐ **Face & Aspect:**

3.3 Ecosystem Category

☐ **Terrestrial Ecosystem** (If ticked, continue with step 3.4)

☐ **Wetland Ecosystem** (Use separate "Wetland Survey Form" for further site assessment)

3.4 Main Habitats and features					
Total Area Size (ha)					
Area*/Unit ID**	**Category Code*** **	**Habitat Code****	**Fence class*****	**Unit Size**	**Comments**
1					
2					
3					

*__Area__: Site contains only one habitat type **__Unit__: Site contains more than one habitat type
***Select "__Category__ code" (A–E) and "__Habitat__ code" (1–32) from list
****Fence class: **1**-virtually new **2**-stil fully stock proof **3**-minor maintenance **4**-major maintenance **5**-no longer functional **6**-no fence

4 Evaluation & Management

4.1 Area boundaries and/or route walked (File name - GPS track/waypoint list)

4.2 Site History

Unit ID 1 2 3 4	**Condition**	**Size** (% or ha)
☐ ☐ ☐ ☐	- Primary (original, mature native forest or other native area).	
☐ ☐ ☐ ☐	- Modified primary (area that has major changes, e.g., from logging)	
☐ ☐ ☐ ☐	- Secondary (area that has regenerated following clearing)	
☐ ☐ ☐ ☐	- Re-vegetated (vegetation actively re-established on bare land)	

Comments on history:

4.3 Adjacent Land Use (tick as many boxes as applicable)

☐ Farming (Crop/Livestock - record type)	
☐ Residential/urban	☐ Reserve (public or private reserve land)
☐ Water body	☐ Exotic Forest

4.4 Human Impacts

Activities/Signs	**Comments**

4.5 Social, Cultural and Aesthetic Values

Comments:

5 Pest animals

5.1 Past animal pest control - (last 5 yrs) ☐ Yes / ☐ No / ☐ Don't know.
Comments on control:

*Species: Tick as many boxes as applicable **Level of control: **H**-High, **M**-medium, **L**-low, **Nil**

Species*	Control measure	Level of control Achieved**	Comments
☐ Rabbits/Hares			
☐ Mustelids			
☐ Rats			
☐ Possums			
☐ Deer			
☐ Pigs			
☐ Goats			

5.2 Current animal pest control – ☐ Yes / ☐ No / ☐ Don't know
Comments on control:

*Species: Tick as many boxes as applicable **Level of control: **H**-High, **M**-medium, **L**-low, **Nil**
***Frequency: **SP**-sporadic, **S**-seasonally, **A**-annually

Species*	Control measure	Level of control achieved**	Frequency of Control***	Notes
☐ Rabbits/Hares				
☐ Mustelids				
☐ Rats				
☐ Possums				
☐ Deer				
☐ Pigs				
☐ Goats				

5.3 Threats identified/Pest animals
Comments on control:

Species	Signs Pellets Prints	Browse		Comments
Possum	☐	☐	☐	
Deer	☐	☐	☐	
Goat	☐	☐	☐	
Pig	☐	☐	☐	
Stock	☐	☐	☐	
	☐	☐	☐	

6 Weeds

6.1 Past weed control - (last 5 yrs) ☐ Yes / ☐ No / ☐ Don't know

Comments on control:

*Pattern: **U**-uniform, **R**-random, **C**-clumped, **I**-Individual plant **Level of control: **H**-high, **M**-medium, **L**-low, **Nil**

Species (controlled)	**Infestation pattern***	**Control measure**	**Level of control achieved****

6.2 Current weed control – ☐ Yes / ☐ No / ☐ Don't know

Comments on control:

*Tier: **G**-ground**, S**-subcanopy**, C**-canopy ** Infestation pattern: **U**-uniform, **R**-random, **C**-clumped, **I**-individual plant
*** Level of control: **H**-High, **M**-medium, **L**-low, **Nil**

Species (under control)	**Tier***	**Infestation Pattern****	**Control measure**	**Level of control achieved*****

6.3 Threats identified / Weeds

Comments on control:

*Species List: Based on Regional Pest Management Strategy
Pattern: **U-uniform, **R**-random, **C**-lumped, **I**-Individual plant
***Tier: **G**- groundcover, **S**-subcanopy, **C**-canopy / Vines in tier in tier in which they occur

Species* (identified)	**Pattern****	**GPS**	**Tier*****	**Cover** (%)	**Comments**
		E **N**			
		E **N**			
		E **N**			
		E **N**			
		E **N**			
		E **N**			
		E **N**			

7 Area or Unit Assessment / Checklist

7.1 Photo Points

Point ID	Unit ID 1 2 3 4	GPS	Magnetic Bearing	Focal length	Photo ID	Photo Description
	☐ ☐ ☐ ☐	E N				
	☐ ☐ ☐ ☐	E N				
	☐ ☐ ☐ ☐	E N				
	☐ ☐ ☐ ☐	E N				
	☐ ☐ ☐ ☐	E N				
	☐ ☐ ☐ ☐	E N				
	☐ ☐ ☐ ☐	E N				
	☐ ☐ ☐ ☐	E N				
	☐ ☐ ☐ ☐	E N				
	☐ ☐ ☐ ☐	E N				
	☐ ☐ ☐ ☐	E N				

7.2 General Features

Unit ID 1 2 3 4	Feature
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	**Shape** - Narrow long strip, sometimes can look through from one side to other may be 20 m or less in width - Some wider areas where cannot see through forest - Most of forest area in compact shape without extensive exposed strips, but occasional small fingers do occur - Extensive approximately round or square area
	Nearby native forest ☐ No forest areas over 10 ha in size within 5 km ☐ Closest areas of forest over 10 ha in size are 1–5 km away ☐ Areas of forest of at least 10 ha present within 50 m –1000 m (1km) ☐ Large continuous area of forest present within 50 m of area assessed
	Corridors ☐ Patch is completely isolated from other tall stature vegetation for over 1 km ☐ Vegetation corridors are present within 500 m–1 km of the patch ☐ Vegetation corridors are present within 500 m of the patch ☐ Extensive vegetation corridors including exotic forest, vegetated waterways are present up to boundary of the forest and extend to other areas of native forest over 10 ha in size
Comments:	

7.3 State of the habitat – (Edge Condition)

Unit ID 1 2 3 4	Canopy & Understorey (*record main species and endangered species (if present) in list – step 8 & 8.1)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	**Canopy** - Major dieback in canopy, dead standing trees - Areas of significant dieback, but all trees live - Small areas of localised dieback - Canopy without dieback
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	**Understorey** - Understorey completely absent - Some understorey present and occasional seedlings/saplings present close to the edge of canopy - Considerable understorey and many seedlings/saplings around the edge of the canopy - Vigorous, abundant understorey with a range of seedlings/saplings spreading well beyond the current extent of the canopy
Comments:	

7.4 State of the habitat – (Inside Condition)

Unit ID 1 2 3 4	Canopy, Regeneration & Browse (*record main species and endangered species (if present) in list – step 7 & 7.1)
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	**Canopy** - Foliage very sparse, many large holes, dieback covers more than 25% of tree crowns - Foliage sparse in some areas, canopy holes common. Some dieback - Foliage mostly dense, only occasional sparse areas, Canopy holes rare, very occasional dieback - Abundant dense foliage over whole canopy, no canopy holes or dieback
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	**Canopy Browse** - Heavy canopy browse: 75–100% of leaves browsed on possum-preferred species - Moderate canopy browse: 25–75% of leaves browsed on possum-preferred species - Light canopy browse: 1–25% of leaves browsed on possum-preferred species - No visible canopy browse **See list for indicator species (Southland)**
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	**Understorey Regeneration** - Understorey completely bare of all species - Very few plants preferred by deer/goats/stock are present in the knee to shoulder height range Scattered seedlings of other species - Moderate numbers of plants preferred by deer/goats/stock are present in the knee to shoulder-height range. Other species relatively abundant - Abundant plants preferred by deer/goats/stock and other species may also occur
☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	**Understorey Browsing** - Severe understorey browse. 75–100% of stems of deer/goat/stock preferred species are browsed - Understorey may be completely bare - Moderate – heavy understorey browse. 25–75% of stems of deer/goat/stock preferred species are browsed - Light understorey browse. 1–25% of stems of deer/goat/stock preferred species are browsed - No visible understorey browse **See list for indicator species (Southland)**
Comments:	

8 Summary Notes

9 Bird life

9.1 Climatic Conditions

Temperature	**Precipitation Type**	**Precipitation Level**	**Wind** (Beaufort)
☐ 1 – freezing / <0 C ☐ 2 – cold / 0–5 C ☐ 3 – cool / 5–11 C ☐ 4 – mild / 11–16 C ☐ 5 – warm / 16–22 C ☐ 6 – hot / > 22C	☐ - Mist ☐ - Rain ☐ - Hail ☐ - Snow	☐ 0 – None ☐ 1 – Dripping foliage ☐ 2 – Drizzle ☐ 3 – Light ☐ 4 – Moderate ☐ 5 – Heavy	☐ 0 – Leaves still or move without noise ☐ 1 – Leaves rustle ☐ 2 – Leaves & branches in constant motion ☐ 3 – Branches & trees sway

9.2 Abundance

***O**-occasional, **C**-common, **A**-abundant

Species	**Heard**			**Seen**			**Comments**
	O	**C**	**A ***	**O**	**C**	**A***	
Bellbird	☐	☐	☐	☐	☐	☐	
Blackbird	☐	☐	☐	☐	☐	☐	
Brown Creeper	☐	☐	☐	☐	☐	☐	
Chaffinch	☐	☐	☐	☐	☐	☐	
Dunnock	☐	☐	☐	☐	☐	☐	
Fantail	☐	☐	☐	☐	☐	☐	
Fernbird	☐	☐	☐	☐	☐	☐	
Goldfinch	☐	☐	☐	☐	☐	☐	
Greenfinch	☐	☐	☐	☐	☐	☐	
Grey Warbler	☐	☐	☐	☐	☐	☐	
Harrier hawk	☐	☐	☐	☐	☐	☐	
Kaka	☐	☐	☐	☐	☐	☐	
Kea	☐	☐	☐	☐	☐	☐	
Magpie	☐	☐	☐	☐	☐	☐	
Mallard	☐	☐	☐	☐	☐	☐	
NZ Falcon	☐	☐	☐	☐	☐	☐	
Paradise duck	☐	☐	☐	☐	☐	☐	
Pukeko	☐	☐	☐	☐	☐	☐	
Redpoll	☐	☐	☐	☐	☐	☐	
Rifleman	☐	☐	☐	☐	☐	☐	

Robin	☐ ☐ ☐	☐ ☐ ☐	
Shining cuckoo	☐ ☐ ☐	☐ ☐ ☐	
Silvereye	☐ ☐ ☐	☐ ☐ ☐	
Skylark	☐ ☐ ☐	☐ ☐ ☐	
Starling	☐ ☐ ☐	☐ ☐ ☐	
Thrush	☐ ☐ ☐	☐ ☐ ☐	
Tomtit	☐ ☐ ☐	☐ ☐ ☐	
Tui	☐ ☐ ☐	☐ ☐ ☐	
Woodpigeon	☐ ☐ ☐	☐ ☐ ☐	
Other			
	☐ ☐ ☐	☐ ☐ ☐	
	☐ ☐ ☐	☐ ☐ ☐	
	☐ ☐ ☐	☐ ☐ ☐	
	☐ ☐ ☐	☐ ☐ ☐	
	☐ ☐ ☐	☐ ☐ ☐	
	☐ ☐ ☐	☐ ☐ ☐	
	☐ ☐ ☐	☐ ☐ ☐	
	☐ ☐ ☐	☐ ☐ ☐	
	☐ ☐ ☐	☐ ☐ ☐	

10 Main Vegetation/Diversity & Cover

Identify the main species and the approximate percentage of the site they cover. Climber/vines and tree fern in tier in which they occur. ***Note:*** *Percentage cover in each tier must total to less than 100%* per unit.

Tier	Unit ID 1 2 3 4	Species Name	Cover (%)	Unit ID 1 2 3 4	Species Name	Cover (%)
T1 >25 m	☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐			☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐		
T2 12 m–25 m	☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐			☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐		
T3 5 m–12 m	☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐			☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐		
T4 2 m–5 m	☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐			☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐		
T5 0.3 m–2 m	☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐			☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐		
T6 Vascular Plants <0.3 m	☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐			☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐		
T7 Epiphytes	☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐			☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐		

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