



## Background

This strategy in a nutshell seeks to share the vision and work streams that are being actively explored by the University of Dundee (UoD) Botanic Garden and Grounds under the Curator Kevin Frediani.

The combined challenges of climate change, population growth and the unsustainable use of natural resources locally and globally is resulting in the unprecedented loss of biodiversity and essential ecosystem services that support life on earth.

The focus of the botanic garden in seeking to achieve the UoD mission is one informed by the spirit of Patrick Geddes, the first professor of Botany at the forerunner to the UoD “Think Globally, Act locally”.

**Vision** as shared and informed by the UoD:

*“to transform lives, locally and globally through the creation, sharing and application of knowledge”*

## Nested approach to direct and inform effort

The strategy is based upon five interconnected work streams, each framed within the four nested levels of organisation. This organisational framework provides focus while ensuring resource use efficiency through prototyping projects and gaining evidence through the experience of sharing with the visitors. Evidence and experience gained at the Botanic Garden level then is fed into realising the potential of the University Grounds. The outer layers are partnership and coproduced projects with communities of shared interest at the City and national (international) level as time and resource allows.

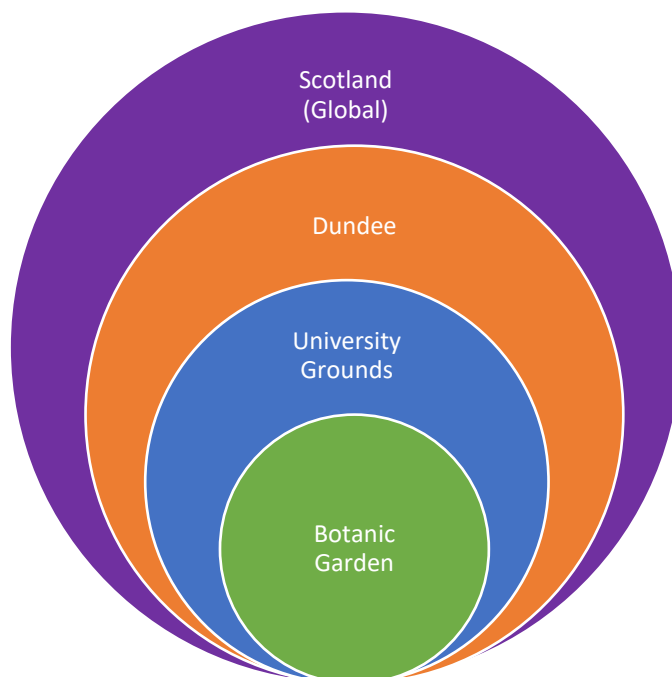


Figure1: The nested relationship of research and the development of work programmes that achieve the UoD strategic vision.

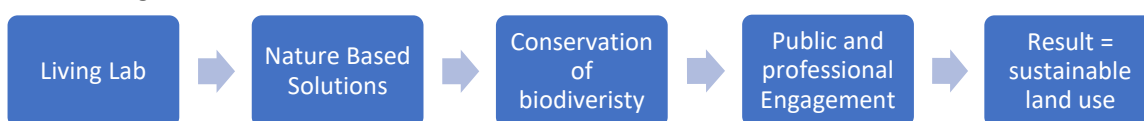


Figure 2: The five interconnected Botanic garden and Grounds workstreams that are described below.

## Strategy

The UoD landscapes provide multiple services that are not yet formerly recognised or optimised. As a steward of land, and a partner to Dundee's development, it is no longer expedient to maintain landscapes to provide amenity. Increasingly there is a need to plan and enable local solutions that provide resilient landscapes for the future and help address growing global challenges. Landscapes include vegetation, soil and moving or contained water (aka: green and blue infrastructure). Climate change requires new landscapes to be planned, designed and implemented to inform sustainable urban landscapes while conservation requires opportunity for plants to thrive in landscapes that will serve people's needs today, while benefiting the diversity as it grows. To achieve this new landscape requires novel research while providing opportunities to collaborate in local placemaking. While reducing risk through enabling a safe place to prototype land use interventions and grow an informed evidence to help inform change in Dundee and elsewhere. This is the Garden and Grounds equivalent of the university mission. "Transforming lives, locally and globally through the creation, sharing and application of knowledge". As a public visitor attraction and a local centre of applied research and education. Each UoD landscape provides different opportunities as follows:

### UoD spaces: land use aims and main objectives:

[Botanic garden](#) – as a leading visitor attraction and centre. Provided through the provision of space for research and education, investment in the site's amenity for recreation and enjoyment through [immersive and engaging place-based experiences](#). A university asset where Nature Based Solutions, Conservation of Biodiversity and Human Wellbeing are being explored using STEAM (STEM together with Art), gaining the evidence base for external interventions within the "Living Lab".

[University Main Campus](#) – an urban landscape of modern and historical built environment, where a landscape has evolved rather than been planned. The potential to unify the landscape through informed design of the interstitial spaces (between the buildings), while optimising ecosystem services and student and staff wellbeing through the application of appropriate Nature Based Solutions. The local vision of a [wellbeing campus](#) is the aim that inspires, attracts and retains to support the academic community.

[Riverside Sports Ground](#) – a transition space between River Tay and Urban Dundee. A landscape of high inputs that provides a robust and durable grass sports surface to support student and staff wellbeing and health. While also providing a corridor linking riverside nature reserve to the water front development where connectivity and design can enhance the main transport route into the city with four seasons of interest.

[Westpark conference centre](#) and events space - Residential houses, urban apartment & land banks- multiple sites across the central and west end of the city. From [University House](#) to [student apartments](#), with [research facilities](#) and land blocks all being maintained to provide local benefit. Although diverse origin and out with any planned development process currently, they provide opportunities to extend the benefits of Nature Based Solutions across the city contributing to the wider community, while offsetting some of the carbon used by the University in conducting its business.

Nested spaces where above work can help to inform and partner in [placemaking](#)

[Dundee – UNESCO city of design](#). The greenest city per head of population in Scotland, separated from its rural landscape through human imposed governance boundaries. A city with the potential to become the wellbeing capital of Scotland. Objectives to help inform investment through the design and implementation of [Nature Based Solutions](#) to help achieve [economic](#), [social](#) and wider [environmental](#) improvements as part of a [design led city](#).

Tay Cities region – collaborating with [St. Andrews Botanic Garden Trust](#), aims to compliment and not compete in the effort to help achieve the ambitions of the Tay Cities region. Championing green and blue 'infrastructure'. This collaboration focusses on the selection, design and application of Nature Based

Solutions to help improve the region. Achieved through supporting local authorities, developers and professional landscape consultants and contractors. Providing evidence based best practice tools, training and underpinning knowledge for trait-based plant selection and use.

[Bioregioning Tayside](#) – working at the catchment level to partner for success in informing a future resilient landscape defined by the geographical limits of human communities and ecological systems. This work explores historical drivers that define our current social and environmental systems. Aiming to build a regional collaborative approach towards a resilient region in the face of global change. Part of an international [network](#) of community based landscape scale projects.

## Work Streams

- 1) [The Living LAB](#): Research education and practice on own sites – under the umbrella of a new doctoral programme. Initial focus on forming a cross disciplinary collaboration of established researchers, new post docs and self-funded PhDs or MSc's that started in January 2021:
  - [Education for sustainable development](#) - This research focuses on sustainability as a means of avoiding the depletion of natural resources in order to maintain an ecological balance. An understanding of biodiversity and our impact on it, is at the heart of sustainability. To place this in context, this research adopts an ecosystem services approach to the environment, recognising the different services afforded in terms of productivity, ecological support, environmental regulation and cultural services, including human well-being. [Education and environmental awareness](#) clearly have a role to play in influencing and directing human activity. This work aims to explore the many facts of outdoor learning as a vehicle to development and engage a sense of nature connectiveness and understanding.
  - Ecosystem service evaluation of the Botanic Garden using [i-Tree Eco](#), began June 2020 with pilot project completed Sept 2020. A full inventory is now complete and following data analysis will provides the basis for better trait-based tree selection across the university sites to optimise the benefits. Including carbon capture and sequestration, water attenuation (diverting from drains), pollutant absorption, and using [CAVAT](#) to help inform trees as assets rather than landscape liabilities.
- 2) Prototyping [Nature Based Solutions](#) to develop our own sites. Defined by [IUCN](#) as “actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits”. This includes exploring methods, developing proposals and sharing knowledge about their efficacy in the Dundee and Tayside context.
- 3) [Conservation of plant diversity](#) (and native species such as red squirrel). 26% of the current 4000 taxa in the collection are of known wild origin. This living collection forms the basis of international work to conserve plants which are increasingly under threat of extinction. With [2 in 5 plants](#) now classed as under threat criteria globally of extinction. This essential international work that will benefit from future collaboration to research, and repatriate or translocate as human social and global environmental systems allow. It will also help inform the basis of a diverse and resilient future urban forest in Dundee.
- 4) [Public and Professional engagement](#) - extending the research and learning at the Botanic garden to the wider University and beyond to help regional and national informed change to a [resilient future land use and land cover change](#). This includes:
  - Education and public engagement that uses [STEAM](#) not STEM approaches where Art alongside Science, Technology, Engineering and Maths to make our world a better place.
  - Immersive experience-based visitor attraction that serves as a gateway to see the future today and learn what investments are being made to improve our cities as sustainable urban ecosystems tomorrow.

## Partnering for success:

A principle to compliment not compete with what is already being explored within a given space is a critical principle of this strategy. Where resources are scarce and opportunities to engage and be seen to act are growing, it is even more critical to plan the interventions and effort in a coordinated and transparent manner.

To that end the UoD Botanic garden and Grounds look to partner where possible with priority and knowledge gained from the nested framework outlined in figure 1 above.

Partners we are working with to explore potential currently include:

1. EarthWatch UK – exploring funding and opportunities for introducing [Tiny Forests®](#) or Miyawaki forests as planting interventions in community to help improve amenity, enhance wellbeing, serve as a corridor and home for wildlife while growing a [carbon store](#).
2. Sustainable Food Places – a cross organisational and individual consortium project initiated and being led by Vivien Collie. Working on six SFP key themes:
  - a. Food Governance and Strategy - taking a strategic and collaborative approach to good food governance and action
  - b. Good Food Movement - building public awareness, active food citizenship and a local good food movement
  - c. Healthy Food for All - tackling food poverty, diet related ill-health and access to affordable healthy food
  - d. Sustainable Food Economy - creating a vibrant, prosperous and diverse sustainable food economy
  - e. Catering and Procurement - transforming catering and procurement and revitalizing local supply chains
  - f. Food for the Planet - Tackling the climate and nature emergency through sustainable food and farming and an end to food waste.
3. Dundee City Council – ecosystem service evaluation using [i-Tree Eco](#). Building upon the [canopy survey](#) undertaken previously by DCC and engaging citizen science to evaluate the city of Dundee’s ecosystem services (including public, private and institutional land uses within the city boundaries. Partnering with Treeconomics and St Andrews Botanic Garden Trust to provide support and training as required to help inform future design of [green infrastructure interventions](#) and optimal use of [resource](#) use.
4. [Green Health partnership](#) – working with DCC and NHS partnership lead Dr Viola Marx to optimise the potential for greens spaces and human health and wellbeing through social prescription and informed interventions.
5. Urban arboretum. The joining up of a city landscape through the green and blue landscape is envisaged under the umbrella of the ‘Urban Arboretum’. A project that looks to use all of the knowledge and experience gained by the above work to help inform and then enable the [optimal planning](#) of Dundee’s landscape. Evaluation and selection of landscapes for future climate resilience and for wider social and environmental benefits without being a risk of pest and disease susceptibility, invasiveness to surrounding landscape or lack of fitness to emergent environmental conditions.
6. [Royal Society](#) & JHI/UoD Plant Scientists - A post-16 research project funded by the Royal Society’s Partnership Scheme. [Training the next generation of scientists](#), involving local schools across Dundee, whereby secondary school students sequence the chloroplast genomes from daffodils that they have collected from non-cultivated locations using Oxford Nanopore Technologies’ MinION. This project is in its infancy but has already attracted attention from universities across the UK with Southampton University, Cambridge and Cardiff expressing interest. Colleagues in the School of Education at Southampton University have specifically requested involvement in this and the Living Lab.

Kevin Frediani

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