Scoping Report on Digital Platforms Suitable for Developing Greater Inclusion of Diverse Biodiversity Narratives

Deliverable 2.2 for

People and Nature (JHI-D4-1)

30th November 2023.

Summary

This report presents a scoping report of technologies suitable to present videos of narratives relating to biodiversity, with a focus on marginalised views and experiences of biodiversity. The report describes the process followed to choose the software and underlying structure to share those narratives on the internet. It forms part of a research strand within the Scottish Government funded People and Nature (JHI-D4-1) which seeks to enable greater visibility, understanding, and ongoing exploration of a fuller diversity of narratives around biodiversity research and management. Using the Cairngorms National Park as a case study area, our use of video and map data within a digital platform will further this aim by increasing capacities to tell and listen to stories that have typically been marginalised, and allow their connections, disconnections, and remaining absences to be noticed, explored, and addressed.

Key Messages:

A range of suitable technologies or platforms is available. The platforms chosen to present the marginalised views and experiences must be accessible to and in use by diverse audiences. The platforms on which the development will focus will be mobile devices, (but not 'apps') and websites suitable for display on all device sizes. The effective use of a chosen platform to present an engaging and useful tool is more important than the underlying technology.

Advances in Technical and Conceptual Capabilities

The research team will be able to explore and collect narratives about biodiversity and present them in an engaging and accessible way. The team will explore how the platform can put lesser-heard voices at the centre of conversations around biodiversity management and research, and how it can be used for decision-making, deliberation, or conflict resolution. Particular value and capacity will come from the ability to explore stories in relation to contemporary and archival spatial and ecological data.

Contents

Citation:

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Introduction

The purpose of this report is to describe the process of evaluating various web-based means of improving the accessibility of biodiversity narratives. This report is a Deliverable for the Strategic Research Programme project 'Nature and People' (JHI-D4-1).

Further details and outputs from the project are available here: Enabling inclusivity in biodiversity narratives[1]

Concept and Approach

The underpinning approach of the People and Nature (D4-1) Work Package 2 (WP2) is to enable inclusivity in biodiversity narratives. The WP seeks to identify narratives and narrative approaches which are usually outside of biodiversity research and to develop and evaluate audio-visual and interactive narrative tools and techniques to better enable their productive engagement for transformative change.

The aim of Activity 2.2 is to develop a tool to present – and invite more inclusive exploration of - diverse biodiversity narratives in an accessible and non-exclusionary way. An additional aim is to improve the discoverability of these biodiversity narratives by helping the user access the narratives they would not otherwise encounter. The narratives are mainly recorded as videos, generally presented by an individual telling the story. The videos are stored on media sharing platforms including Vimeo and YouTube.

Earlier work within this WP (Brown et al., 2023) established a three axis framework of marginalisation of narratives relating to biodiversity to be used as the basis for the design of the tool. These axes are described as:

1. Marginalisation of people and social or cultural groups (e.g. age, gender, ethnicity, sexual orientation, disability)
2. Marginalisation of particular ecologies; ecological or biophysical entities, relations, and processes (e.g. particular species, species assemblages, habitats, ecotones)
3. Marginalisation of particular ways of knowing, notably:
    - knowing as embodied, sensory, and emotional as well as cognitive
    - knowing as not only done by humans
    - knowing as done through languages other than English-speaking and discursive domains - for example: minority languages, visual languages, as well as bio-sensory, biochemical or other more-than-human 'languages' or modes of articulation and response.

The design of the tool to present the biodiversity narratives should make visible and enable a fuller understanding of these types of marginalisation and invite these and remaining absences and marginalisation (of people, ecologies, and ways of knowing) to be highlighted and addressed. These objectives were iteratively developed by the interdisciplinary research team to ensure functionality informed by multiple disciplinary expertise and perspectives.

[1] https://www.hutton.ac.uk/research/projects/enabling-inclusivity-biodiversity-narratives

Technology Assessment

Platforms are the technology on which the research will be aggregated and shared with the public. The chosen platform will also be the means by which the public will interact with the diverse biodiversity narratives. Technologies as described in this report are the aspects of web design and development that control what is presented to the user and include the technological means such as websites or mobile device applications on which the content will be presented and the databases storing the data that are included on the websites.

Technologies

The primary technological choice is between a stand-alone website, social media, or an app (either native to iOS and Android or platform independent as a progressive web app), or alternatively a combination of two or more of these. Producing a stand-alone website would guarantee design independence and avoid any implied approval of corporate media such as Facebook, X/Twitter, or TikTok. However, not choosing one of these existing social media platforms risks the production of a site that is not as accessible to individuals or groups within the population who use social media sites and apps as their primary means of viewing and interacting with online content. Concern over privacy of internet use, the tracking of behaviour and the sharing of personal information led the research team to consider that the appropriate approach is to create a custom platform, independent of the established commercial providers and with no hidden tracking of users and their activity, other than what is unavoidable when using videos hosted on Vimeo and YouTube.

The design of a new website should follow the principles of responsive web design so that it will be usable on devices of a range of sizes including desktop and mobile devices. Consideration was given to using the Bootstrap[2] toolkit to create the website styling (i.e. the way in which text, buttons and other controls are displayed on the website in terms of colour, font type and size and other aspects of design) in a way that would ensure its usability and high quality across devices of a wide range of sizes. The design philosophy of Bootstrap is to engineer a webpage primarily for the smallest of devices (a small mobile phone held in portrait layout) and then to scale up components to suit larger devices and screens. Bootstrap calls this approach 'mobile first'. Younger people have been identified as a primary audience for the platform and they are known and can be observed to favour use of their mobile devices over larger screened desktop devices. Therefore, the mobile first design principle would seem to be an appropriate choice for our website and for this reason the story telling part of the website does use Bootstrap. In addition to the mobile first approach, Bootstrap also provides comprehensive tools and guidance for making websites more accessible to differently abled people, giving instructions for ensuring that screen reading tools are able to convey the page content to visually impaired users and also guidance for colour and contrast settings.

One of the principal benefits of apps (including progressive web apps) is to offer offline working so that the app may continue to work while not connected to the internet. However, the majority of the content being produced to share via the biodiversity narratives platform consists of videos or audio recordings and all of those will be stored in the cloud. It would not be suitable to download these many and large video files to the devices of users as on-demand streaming is available and efficient, and it gives the user control of how much data they download by which videos to view. Warning messages will be included on the mobile versions of the website that viewing videos can result in data charges.

[2] https://getbootstrap.com/

Audio-visual and Content Management Platforms

Two very popular video hosting websites are YouTube and Vimeo. The research team has several years of experience in producing and hosting video and evaluated several platforms before choosing to use Vimeo and obtaining a paid a licence to do so. This was done prior to this biodiversity narratives research project. By using a paid licence to host the video content in preference to the free to use licence, the research team has control over the presentation of the videos. This means that there is full control over which videos are displayed and also that commercial advertising may be blocked.

There are several web Content Management Systems (CMS) available which could be used as platforms for the web application. These include the Adobe ColdFusion[3] suite and Drupal[4]. ColdFusion is a cloud-based development software that can be used to produce impressive and effective web applications. However, the most inexpensive version costs £2,600 and is thus not affordable in the current research project. The James Hutton Institute uses Drupal as a content management system, and this platform may be used for free. However, while Drupal is effective for presenting relatively static content, it places constraints on developers working to produce more customised interactive content on their websites which makes the writing of code more laborious than would be the case in web applications developed without using a CMS.

ArcGIS StoryMaps[5] is an example of a platform that can be used to present both static and video content, and to integrate this content with maps. The research team has considerable experience in producing story maps, e.g. the UnderStories[6] project describing woodland use, management, and expansion in the Cairngorms National Park (CNP). The UnderStories project includes a map of location points which may be clicked to view links to videos telling stories of woodland in the CNP. This work helps the viewer understand the topic by clicking on the points to view videos or by selecting a video from the list of all videos. However, it does not allow the user of the site to follow a theme or story by viewing thematically related content, where the user may choose the theme.

The aim of the current research project is thus, in part, to build on UnderStories by creating a tool that will show connections and contrasts between the stories and the ways in which they are told, and in turn highlighting how marginalisation happens and can be addressed. It is hoped that this will engage the user more effectively, encouraging them to spend more time on the site, viewing more videos, gaining a wider and more nuanced understanding of the topics. The current project will also identify gaps in its database of stories and encourage users of the site to interact with the project by contributing stories to fill these gaps. This requirement for additional navigation through the story database renders the ArcGIS StoryMaps platform unsuitable for the current project.

The Stornaway[7] video story tool has been reviewed by the research team. It is a site for producing interactive videos similar to those in training suites: the user watches a video, then the user is asked a question, on the basis of the reply a second video is displayed, and so on. The tool includes clickable hotspots in the video so that the user may choose something of interest. The tool is relatively affordable and would be useful in complex video narratives, linking multiple videos in a pre-defined linear or branching process as required. Stornaway offers the user the ability to choose between options, but those options must be predefined by the creator of the content. If a

[3] https://www.adobe.com/uk/products/coldfusion-family.html
[4] https://www.drupal.org/
[5] https://storymaps.arcgis.com/
[6] https://storymaps.arcgis.com/stories/844f1375edf44091add002a6a9988a8f
[7] https://www.stornaway.io/

straightforward type of story using multiple videos was being produced in the current research project, then this could be readily accomplished with standard website authoring tools such as buttons and option widgets.

However, the research team believes that a more interesting website and sets of story narratives may be obtained in a more serendipitous or alternatively in a user driven way than by setting out pre-configured story pathways using a platform such as Stornaway. In the serendipitous approach, the user may request that a random video is presented, the code behind the web page will then retrieve a series of videos with thematic similarities from the database. These will be presented in the three axis framework of marginalisation of narratives relating to biodiversity as described above for the user to explore further. Alternatively, the user may fully control the choice of videos by specifying categories to which a presented video must belong. This process will also retrieve videos with thematic similarities from the database, but with the user more in control of what is displayed.

In addition to existing videos from the UnderStories project, the research team will acquire video stories over several field campaigns during the research programme so the database of stories will be occasionally updated over several years, and also potentially following the completion of the programme. A flexible website that can accommodate irregular additions to the content and to present the additions to its users is a more practical solution than a site with predefined and populated narrative pathways. A site with predefined branching pathways (such as Stornaway) would require continuing website development and support to present any new stories in the pathways, whereas the flexible serendipitous or user-driven approach requires only that a new story be added to the database and classified according to its thematic content for it to be made available with the previously shared media. For these reasons, it has been decided not to use Stornaway in this project and to create a custom, in-house platform using standard web authoring techniques including JavaScript (a ubiquitous client-side web software language used to create interactive websites) and Bootstrap (see above) to control the styling over a range of device sizes.

Earlier work on the project established that the videos would be presented in a framework of three axes of marginalisation (people, ecologies, and ways of knowing). A suitable website must present the videos in a way that permits the user to explore videos along these axes but also to discover videos with unexpected connections between the axes. Options were considered on how best to present videos along such axes and draft websites were produced in HTML/JavaScript and presented for research team discussions. These drafts included videos being presented in scrollable linear views (corresponding to the axes of marginalisation) but also as carousels of videos through which a user could click. The process of refining these drafts is described in the discussion below.

Map Platforms

Interactive web mapping pages can be produced for many purposes. These can range from a map indicating the location of a business to more complex maps that offer tools to calculate spatial analyses or queries of datasets (e.g. Hutton's Soil Finder[8]) or to allow the user to investigate and understand huge datasets that would be otherwise largely unintelligible (e.g. Hutton's Agrometeorological Website[9]). The requirements for the map platform in this project are limited to the presentation of a background map (or a range of different background maps or images) and a set of location points which, when clicked, display a video to the user in an interactive popup view. The page has three additional requirements: (i) to enable filtering of the display of the location points; (ii) for the page to be responsive to user input so that it can highlight associated points; and (iii) to

[8] https://soilfinder.hutton.ac.uk/SoilFinder.html
[9] https://agromet.hutton.ac.uk/

allow the user to choose between a standard contemporary topographic map and alternative layers of historic maps. The spatial data to be presented are also likely to include more complex spatial features as a video may refer to a landscape type (e.g. forest) rather than a particular point (e.g. the oak woodlands at Craigendarroch in Ballater), and the referent may also be diffuse in nature (e.g. a narrative on 'rolling hills' cannot have the area to which it refers exactly and precisely demarcated).

The functionality required from the project website is available in several map platforms including Leaflet[10], Esri's ArcGIS Maps SDK for JavaScript[11], Mapbox[12], Python Dashboards[13] Google Maps and others. For the purposes of this research project, these various platforms can be considered to be largely identical in their functionality (as they all provide the required functionality), thus the decision on which to use must be based on criteria other than those pertaining to the platforms. The project team has experience in web development using Leaflet, ArcGIS Maps and Python Dashboards so the decision was made between those platforms. This capitalised on prior existing competence thereby maximising limited team resources to focus on innovative application rather than learning to develop on a new platform.

Amongst the organisations in Scotland that publish interactive maps to share with the public there are several approaches. SEPA uses Esri ArcGIS Maps to produce their web mapping pages (e.g. Scotland's Soils website[14]) whereas NatureScot uses Leaflet (e.g. SiteLink[15]). Forestry and Land Scotland uses Esri mapping software for its in-house work (Forester Web) but uses Google maps[16] for its public-facing page to find a forest. Many local authorities such as Glasgow City, Highland Council, City of Edinburgh use Esri web mapping solutions. Leaflet maps are used mainly by private companies and government organisations. Examples of Leaflet maps include Airbnb[17], OpenStreetMap[18], The United States Geological Survey (Example 1[19], Example 2[20], Example 3[21]) and the UK Government interactive map for Covid-19 Cases[22].

The James Hutton Institute publishes webpages using ArcGIS Maps and Leaflet. The Institute has a significant number of staff who prefer to use free and open-source alternatives to Esri GIS software, in particular QGIS[23]. QGIS has a software plugin that enables a user to configure a map in the QGIS desktop software and to export this to a webpage that uses the Leaflet mapping package that may be used as a basis for the type of webpage being produced by this research project. This is an efficient means of creating a mapping website and, with a growing number of staff using the open-source QGIS, it is a solution that is economically sustainable and likely to benefit from a stable or expanding number of Institute staff capable of providing long term support and enhancement of the webpage created.

[10] https://leafletjs.com/
[11] https://developers.arcgis.com/javascript/latest/
[12] https://www.mapbox.com/
[13] https://plotly.com/examples/
[14] https://map.environment.gov.scot/Soil_maps/?layer=1
[15] https://sitelink.nature.scot/map
[16] https://forestryandland.gov.scot/?option=com_fcs&view=advancedsearchresults
[17] https://shorturl.at/wzTU6
[18] https://www.openstreetmap.org/#map=7/55.736/-4.153&layers=C
[19] https://ngmdb.usgs.gov/topoview/viewer/#5/39.758/-96.394
[20] https://eerscmap.usgs.gov/pwapp/
[21] https://cmgds.marine.usgs.gov/data_search.php
[22] https://coronavirus.data.gov.uk/details/interactive-map/cases
[23] https://www.qgis.org

Draft Leaflet and Python Dashboard maps were produced and shared with the research team for discussion and evaluation prior to a selection being made. It was observed that the Python Dashboard option did not work well with smaller and mobile devices whereas the Leaflet map automatically adjusts the controls and display to work well with all sizes of devices. It was noted that it would take a considerable amount of time to engineer code to ensure that the Python option would work with a range of devices. In addition, the Python option would require ongoing Hutton IT support whereas Leaflet maps can be enabled without this. Leaflet was also observed to be more flexible in its cartographic presentation and this is a critical consideration. In addition, Leaflet can use GeoJSON data (see Database section) as an information source.

As mentioned above, a draft template for the Leaflet web-map was produced using QGIS 3. In this draft the web-map the main layer is the "Testimonials" layer which uses the source data for the videos and the descriptions. Other layers include the National Forest Inventory of Scotland 2020 [24] provided by Forestry and Land Scotland. In addition, several historical base maps of Scotland were added that give a historic context to the web-map and can help the user identify historic place names mentioned in the videos and to view historical land and vegetation covers. These layers were provided by the National Library of Scotland Historic Maps API layers[25]. The main functionality of the web-map is to allow the user to explore the videos of the project by clicking on the markers in the web-map. Each time the user clicks on the marker on the map a container window appears (a pop-up) that contains the appropriate video. The user can watch the video in this pop-up or select to watch it full screen which transfers the user to a new tab on the web-browser allowing them to have a larger and better view of the video.

Screenshots of a draft example of the leaflet map that will be used are provided in Figure 1 and Figure 2. Some of the features in this map (e.g. Scotland Historic map layers) may change in the finalised version.

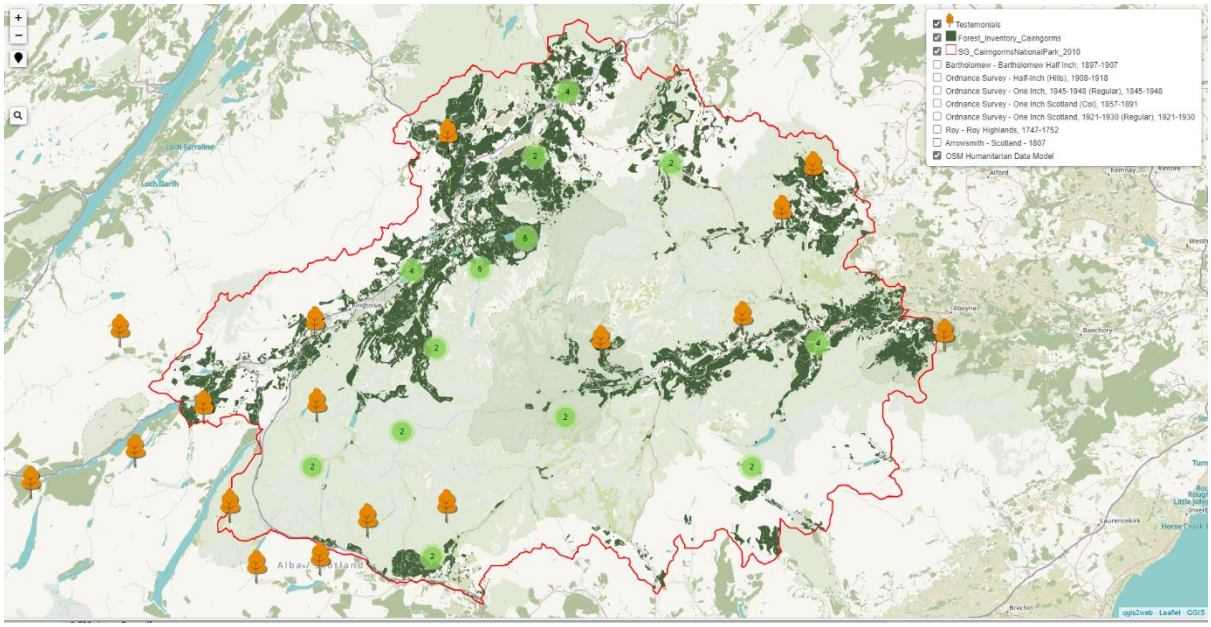

Figure 1 General view of the web map.

[24] https://data-forestry.opendata.arcgis.com/datasets/0681a879417b42dfb6d7825ef791cd5a_0/explore
[25] https://maps.nls.uk/projects/api/

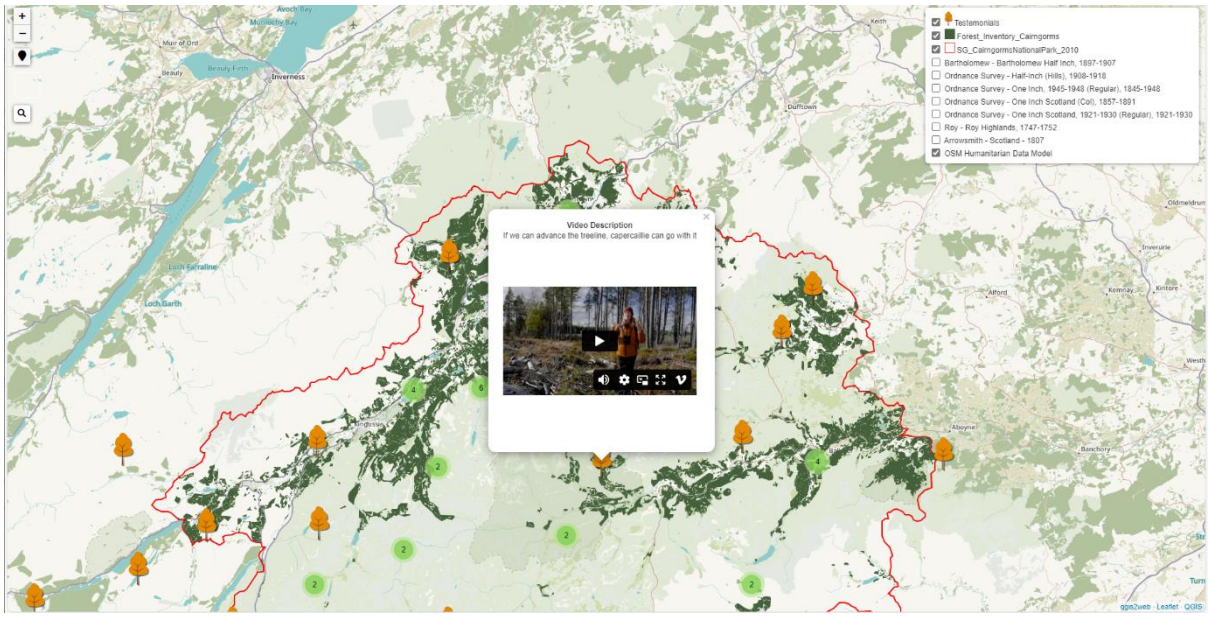

Figure 2 View of the web map with one of the video narratives selected.

Database

The carousels of videos and the interactive map display of videos both require a source of data. These data describe the videos by categorising their content using criteria composed of sub-classes of the three axes of marginalisation (i.e. people, ecologies, and ways of knowing). The data also include the names of the maker of the video, its coordinates (i.e. latitude, longitude) for placing on the map, and a title that captures the essence of the video's content. These criteria are used to identify videos in the carousels that both matched and were distinct and, as such, are a key component of the site.

The data must be stored in a location accessible to the website and to be capable of efficient updating when new data become available. To be accessible to the website the data must both be in a location accessible to the web server and stored in a format that a web application can efficiently process. The only appropriate solution for this is in a database. The James Hutton Institute uses Oracle, Postgres and MySQL databases. The database requirements for this project are very modest, extending to at most a few hundred records each of fewer than 20 values. For this reason, the Institute standard deployment of MySQL is adequate and suitable and has been implemented in this research project.

A secure interface between the public facing (and therefore publicly accessible) website and the database which must be protected against potentially malicious access must be provided. This can be done efficiently by creating a PHP (PHP Hypertext Preprocessing) API (Application Programming Interface). PHP scripts are programmes that run on servers to produce an output for consumption in a publicly accessible web page or app or similar. The internal code in the PHP script is not viewable by applications that call it so that passwords and database details may be included as part of the script without being revealed to applications or systems that call the script. In this project a PHP script has been written to connect to the database and to generate a data file containing the required information from the database. This information does not include the names or contact

details of the providers of the content so that they remain confidential and safely stored in the password protected database.

The data file is in a format suitable for use in the several project web pages created: GeoJSON. JSON (JavaScript Object Notation) is a very widely used data standard for machine readable data. GeoJSON is an extension to this format which adds geolocation information: coordinates and coordinate reference system information and data types including point, polygon, line and rings and can be used to represent more complex spatial features such as multi-part and diffuse objects. GeoJSON format data can be read by Leaflet and other mapping libraries and tools and can be used to generate (in this case) points or other spatial data marking the location of the video stories and is also suitable to be loaded as the source for the videos in the carousels.

Discussion

It is asserted above that the creation of a custom platform, independent of social media publishers is an appropriate strategy for the collation and presentation of biodiversity narratives. However, it must be acknowledged that the different social media outlets do appeal to many people, to some degree segmented by age (with older adults more likely to use Facebook and younger people more likely to use Snapchat, Instagram, and TikTok see e.g. market research by Pew[26]). A hybrid solution for the outputs could be to produce a main website hosting all the information and structure to accomplish the research project aims with additional social media outputs to promote the project and to attract other parts of the population, for example, videos on TikTok and Instagram and posts to Facebook and Tweets/X.

At present the tool to present the narratives is at the stage of draft design and is not publicly accessible. However, it has passed through many iterations and been reviewed by the research team and their inputs used to produce subsequent iterations. This follows the principle of agile software development[27]. The initial structure of the narrative tool (Figure 3) was to present the video stories along three axes corresponding to the three axes of marginalisation identified (i.e. people, ecologies, and ways of knowing) by other members of the research team.

[26] https://www.pewresearch.org/internet/2021/04/07/social-media-use-in-2021/
[27] https://en.wikipedia.org/wiki/Agile_software_development

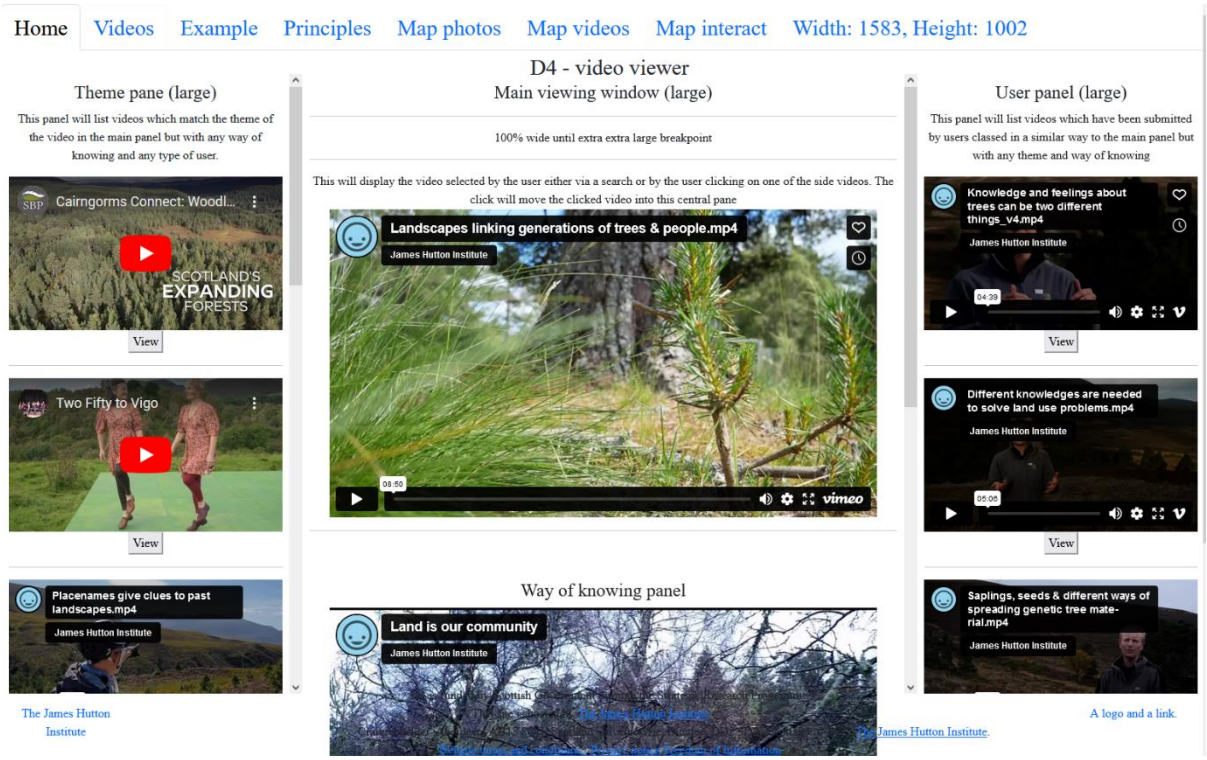

Figure 3 Initial layout - narrative website in three axis configuration.

During subsequent project meetings a preference was expressed for a different layout consisting of carousels of media through which a user may scroll to view content. A draft of this was produced and presented to the research team for further discussion (Figure 4).

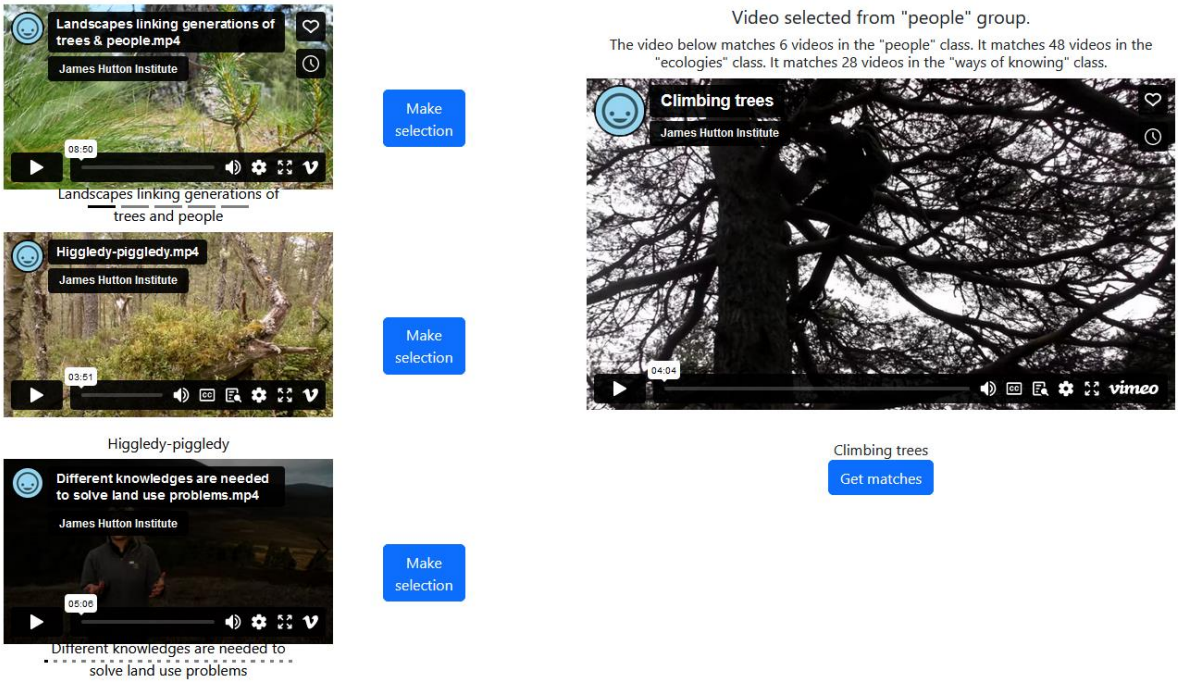

Figure 4 Carousel configuration for narrative website.

Carousels have been adopted as the research team's preferred means of display but this will also be evaluated in discussions with other stakeholders and by an informal project editorial group to be

convened in the third year of the project. A key benefit of using carousels rather than the three axes layout is the possibility of engineering a webpage that will work equally well on smartphones as on larger desktop or laptop screens. The significantly smaller screen on a mobile device requires a different layout and different design, necessitating different software technologies or the use of a responsive design library such as Bootstrap (described above). On a desktop screen all, or the majority, of the information can be displayed simultaneously. However, on a smartphone it will not be possible to show all the required content at the same time, so the website must include controls (buttons or menus) that will enable the user to interact with the page to change the display to show other content as required by the user, or in response to a user's action. This can be done by using so-called "pop-overs" to display and hide content in response to the user's actions. The use of the Bootstrap library and other responsive techniques means that the content may be presented clearly and effectively on a range of screen sizes as shown in Figure 5 to Figure 7. Please note that these figures are screenshots of functional prototypes but do not represent the intended finished appearance in terms of design, colour scheme and detailed design and layouts of buttons and other components.

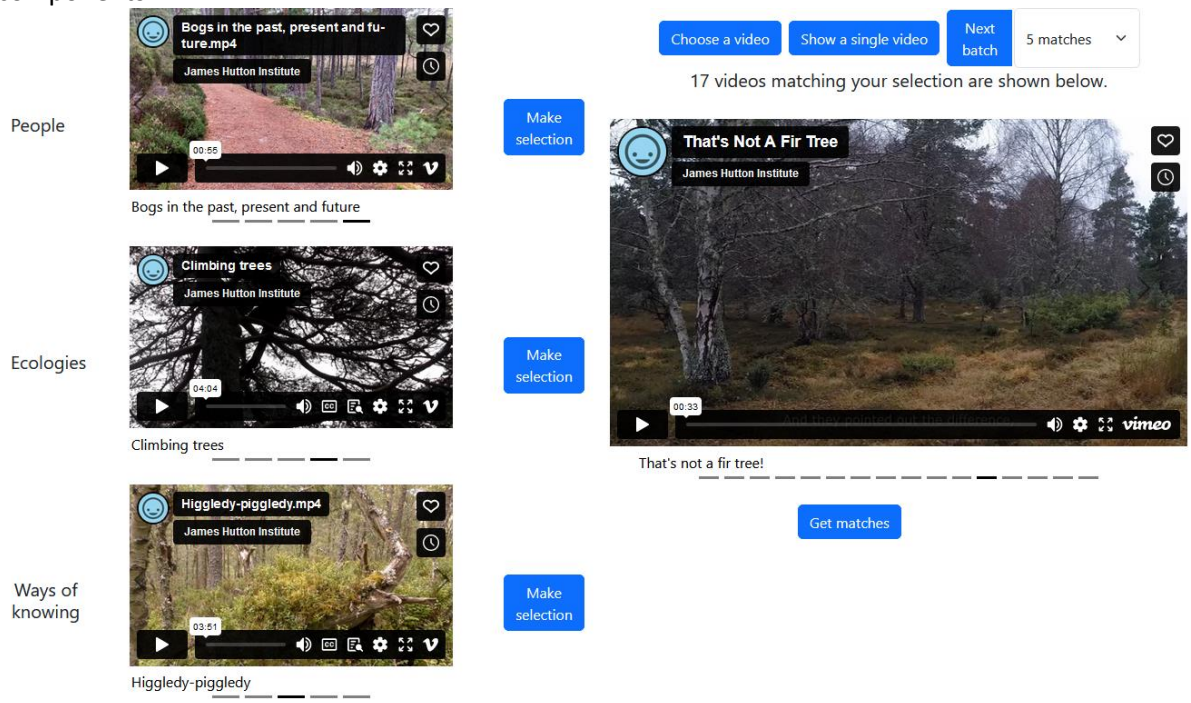

Figure 5 View of carousels layout on desktop PC screen.

In Figure 5, an illustration of the website as viewed on a PC screen in which all the carousels are always viewable and the user may readily switch their attention between the views.

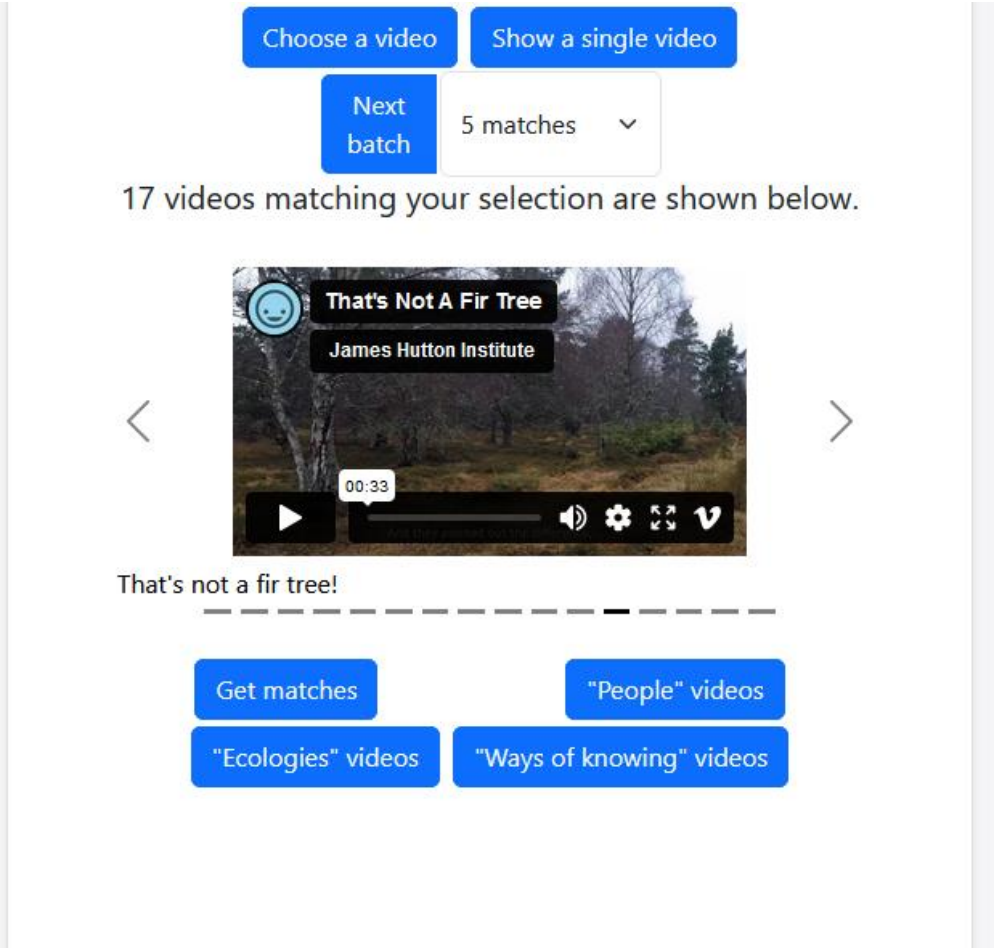

Figure 6 Tablet view in portrait orientation of main screen.

In Figure 6 is shown a view of the same content as displayed on a tablet or phone in portrait orientation. As there is insufficient screen space to display three carousels (corresponding to the three axes of marginalisation) and a fourth carousel or video corresponding to an “active” video being watched by the viewer, the screen is reconfigured by the JavaScript code and Bootstrap library. For these smaller screens, a single video or carousel is shown and a set of buttons for the user to press to reveal the three marginalisation carousels. Clicking one of these buttons causes a view to “pop-over” to reveal the relevant carousel as shown below in Figure 7.

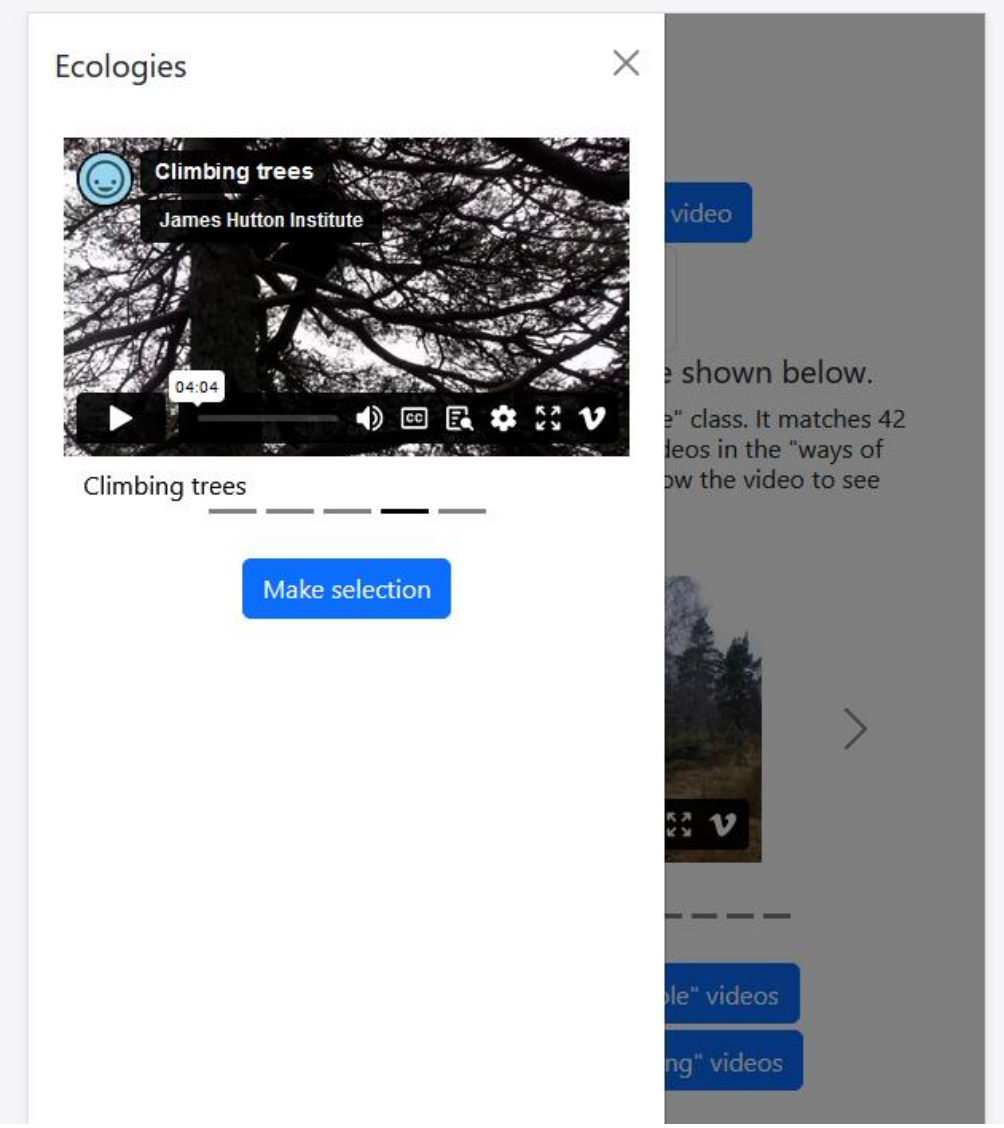

Figure 7 Tablet view in portrait orientation of matching videos in the Ecologies pop-over.

In addition to the above requirements for design to accommodate a range of device sizes, the number of videos in the project, and the initial inclusive options for discovering matches meant that the number of videos that required to be displayed was too large to practically include in multiple carousels on a website. It was found that including all the videos in the carousels resulted in excessively long page load times and page responsiveness was also significantly negatively impacted. To improve the performance and user experience the page was modified so that videos could be loaded in batches of a size chosen by the user.

Next Steps

A project editorial committee is to be formed to review, discuss, and guide the next stages in the development of the website. This group will make decisions during the remainder of the current year (2023-24) and in the next year on how the content will be presented to users. The findings from this report will be considered in conjunction with forthcoming first phase of collection and integration of new narrative data relating to marginalised biodiversity narratives, to allow an iteration of the platform to be developed that can be tested with stakeholders.

Development of the website will continue into years three and four of the project.

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Brown, K., Juarez-Bourke, A., Gray, R., & Nicholson, H. (2023). Scoping review of marginalised narratives in biodiversity research and management. Deliverable 2.1 'Scoping report on marginalised biodiversity narratives', within project D4.1 (People and Nature), Work Package 2 (Enabling inclusivity in biodiversity narratives). Available online: https://www.hutton.ac.uk/sites/default/files/files/D4_1%20WP2%20-%20Deliverable%202_1%20-%20Scoping%20review%20of%20marginalised%20narratives.pdf


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