What do environmental charities look like in the UK, how are they structured, and how do they interact with other areas in the voluntary sector?

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Abstract

Understanding networks of organisations and individuals is paramount to comprehend how resources, funds, and information may flow between actors. This is particularly important in climate change discourse in the entanglement of politics, economics, science and society. The voluntary sector in the UK gains little attention in this conversation, but this study begins to investigate the capacity of environmental charities and their trustees as key actors in the movement through computational network analysis. Most charities were isolated with self-contained trustees, but some regional and social communities were identified amongst those with relations. The public and private sectors also proved to be salient as trustees in the forms of local government district councils and limited companies. This consolidates the inter-connectedness of modern societal structures, and invites further research into their ties.

1 Introduction

Climate change is one of the most pressing and pervasive issues humankind has ever faced. It is an intrinsically complex problem that is sending reverberations through many structures of our globalised world [1]. Due to the increasing inter-connectivity of these systems, it is difficult to dis-entangle the fields that sit within these webs, which include science, society, politics, and economics, as they all affect one another.

Networks of organisations and individuals from these overlapping domains create channels between actors that can allow for the flow of resources and funds, and the dissemination of information [2] [3]. As a result, connectivity may be considered synonymous with the power held by these bodies. Within the political and economic spheres, such actors have the capacity to influence public perceptions of climate change by means of promulgating their agendas through their ties to society [2] [3]. This is important to understand in terms of the mobilisation of individuals to take action either in favour of, or against, adaptation and mitigation policies, especially in social media conversations [4] and in electoral voting [5].

When it comes to the UK's effort in tackling the climate crisis, the discourse tends to be focused on the public and private sectors; the roles they play and the changes they can make. However, in a time where people are looking for ways to do their part and help out, more and more are turning towards philanthropy [6]. This ranges from billionaires setting up or funding large-scale charities, to village community groups participating in local, small-scale conservation projects.

Previous work has been produced looking at the interaction of US corporate businesses with think tanks, public relations firms, trade associations and *ad hoc* groups, in order to investigate the spread of contrarian views on climate change [2] [3]. In the UK, a study was performed in Greater Manchester investigating the communications and collaborations between stakeholders in the public, private, and third sector [7]. Inspired by these, this research shifts the conversation in the UK to the voluntary sector, and begins a discussion on the capacity of environmental charities and their trustees as key actors in promoting positive change.

A general overview of the UK charitable domain is constructed with computational network analysis, and the lens of this research then focuses on how environmental charities fit within this sector, and interact with other 'purposes'. Subsequently, ties between how environmental charities are operating and who they are trying to help are quantified, before finally, an attempt is made to identify any social and regional communities in the networks.

2 Methods and Materials

All data used throughout this study was procured from the UK Charity Commission data download service, which provides files of various information about charities both registered and removed from the Central Register of Charities. The variables utilised from four of the files were: registered charity number, charity name, linked charity number, registration status, trustee ID, and trustee name. Classification codes were also used to discern what the charities do, how they operate, and who they aim to help.

Registered charity number was the only constant variable in all of the files, and was therefore used as the thread to tie all of the data together across sets. From the register, 338,246 unique charity numbers were identified; 170,763 of which were existing at the time of extraction, and 167,483 had been removed and thus not considered for this study. Out of all existing charities, 170,419 had a description of what they did, and 19,081 of those claimed their purpose as 'environment/conservation/heritage'. 19,060 of these had available data on their trustees.

The final table collated from the wrangled data included the charity number and name, the charity's trustees' names and their IDs, and the what, how, and who of the charity aims. In the instances where charities had multiple subsidiaries, all with the same registration number, only the main parent charity name was used through utilising linked charity number.

To perform network analysis, Gephi 0.9.2 was used. This is an open source software for exploring and manipulating networks. The required inputs were a nodes and an edges list; the latter defined all connections between pairs of nodes, ascribed by a commonality. Connections investigated include shared causes of charities; pairs of who-how codes; ties between charities based on common trustees; and ties between trustees based on common charities. In each of these cases, the networks were undirected.

Layouts operationalised included the Circular Layout plugin (authored by Matt Groeninger), Yifan Hu, and ForceAtlas2 [8] [9]. The latter two are force-directed, approximating node repulsion with Barnes-Hut calculations. Many variables were extracted from the networks, including the modularity to detect communities of charities and trustees [10]. Average degree was computed to gauge the average number of edges connected to nodes across the entire population. This informed an idea of how connected the network was when considered with the ratio of nodes to edges, and when the number of connected components was calculated [11]. Various centrality metrics were also calculated to discern the relative influence of actors within the network. Betweenness was found to measure how often a node appeared on shortest paths between nodes. Eigenvector centrality was used to greater value as it quantified the importance of nodes from connections and on high-score, low-score basis [12].

3 Results

3.1 Charity overview

In the register of existing charities, 17 purposes had been defined. The charitable cause of 'environment/conservation/heritage' ranked as the 10th most common, with the label assigned to just over 11% of charities. The average number of causes claimed by a charity was 2.5. This inferred the presence of collections of purposes, confirmed by the network seen in Figure 1. Of 19,081 environmental charities, 2,377 were registered as exclusively for the 'environment/conservation/heritage'. Meanwhile, the rest experienced varying levels of overlap with the other 16 charitable purposes. In terms of weighted degree, it ranked as the 10th

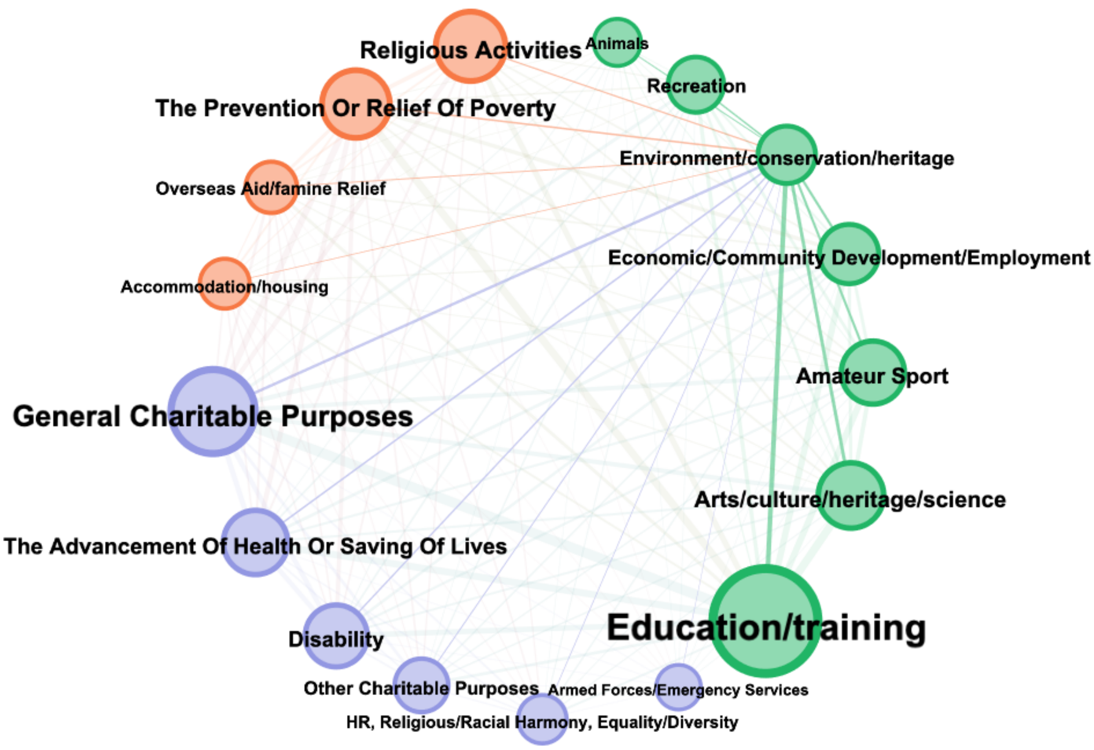

Figure 1: A network of the 17 charitable purposes defined by the UK Charity Commission. Organisations can claim more than one purpose for operation, therefore, ties between nodes are representative of overlaps, and the weight of the edges are the sum of charities with the shared pair of motives. The size of the nodes correspond to the respective size of each cause, and the three colours are produced from community detection.

most connected cause, suggesting that its connectivity was reasonably aligned with its size. The greatest connections to environmental charities were seen with education/training, arts/culture/heritage/science, and general charitable purposes; each with 12,244, 8,281, and 6,737 ties, respectively. The weakest overlaps were with the armed forces/emergency services, human rights/racial or religious harmony/equality, and accommodation/housing; with 301, 1,093, and 1,166 ties.

This gave a strong indication of the inter-connectedness of the voluntary sector, as the network of charitable purposes was saturated with all possible edges between nodes. It situated environmental charities in the middle of the domain, and the following work centres the narrative to look at networks within this specific area of aid.

3.2 The 'who' and 'how' of environmental charities

From investigating groups of interest and forms of relief, the most targeted groups that environmental charities intended to help were the general public, children/young people, and other charities or voluntary bodies. Meanwhile, the most common three actions taken in support were the provision of buildings/facilities/open space, advocacy/advice/information, and services. In the 'who-how' network, Figure 2, all groups of people and all forms of aid were connected to each other directly, demonstrating complete overlap.

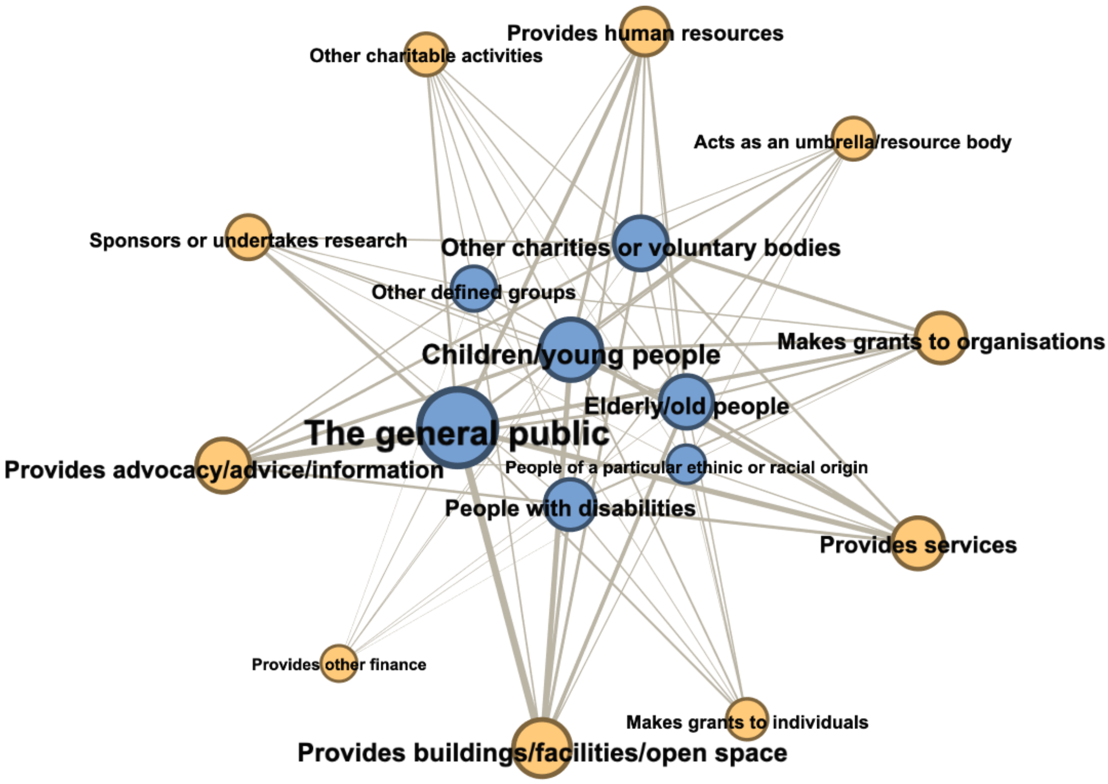

Figure 2: A who-how network for environmental charities, which identifies links between the target audiences for charitable actions, and the type of actions being performed. The size of each node indicates the number of charities ascribed to that aid/group.

The five strongest ties overall in the network were between the general public and children/young people, and the top three forms of aid. For all other groups of people, these actions were also the most significant, with the exception of other charities and organisations which received most of their help, naturally, through grants made to organisations. In general, the public dominated the attention of every form of aid. However, other notable connections that arose were the links between children/young people, and human resources and organisational grants, and the elderly, with human resources and services.

3.3 Identifying structures in the voluntary sector

The first attempt at identifying structures of environmental charities was done by looking at a network of their trustees, and seeing if they were affiliated with more than one organisation. This produced 110,533 nodes, each a trustee, and 430,736 edges, giving an average degree of 7.79 and 15,938 total connected components. Figure 3 shows the top 13 largest of these, the greatest of which contained only 1.43% of total trustees, but demonstrated some clear signs of groups and structure. Eigenvector centrality was calculated in order to discern

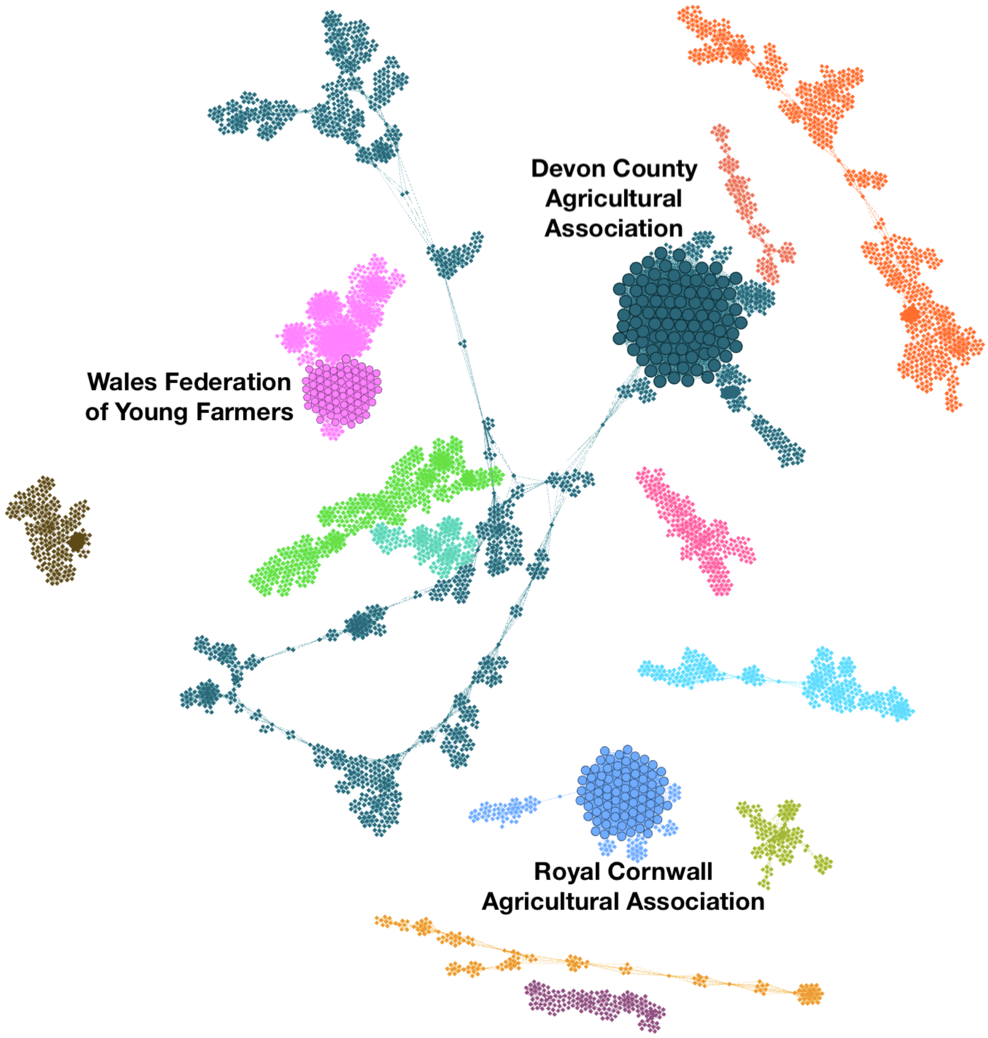

Figure 3: The top 13 largest connected components, differentiated by colour, in the network of trustees of environmental charities, showing 4.6% of trustees in this study. The node sizes are ranked by eigenvector centrality, a metric used to determine their importance.

the most important actors, and those coming out on top were all members of agricultural associations: Devon County Agricultural Association (DCAA), Royal Cornwall Agricultural Association, and Wales Federation of Young Farmers, respectively. These were charities with relatively big numbers of trustees; DCAA had the most with 88.

Community detection was performed and an example of regional structure was found in a cluster that contained DCAA. This community was made of 237 trustees to 17 different charities, 10 of which were based in the South West dedicated to causes such as sheep breeding, historic building preservation, agriculture, landscape conservation, and local parish needs.

The next network constructed used charities as nodes instead of edges, and made connections from shared trustees between them, shown in Figure 4. A significantly smaller ratio of nodes to edges was formed from this data. This network had an overall average degree of 0.415. Only 24.07% of charities showed at least one link with another, and this

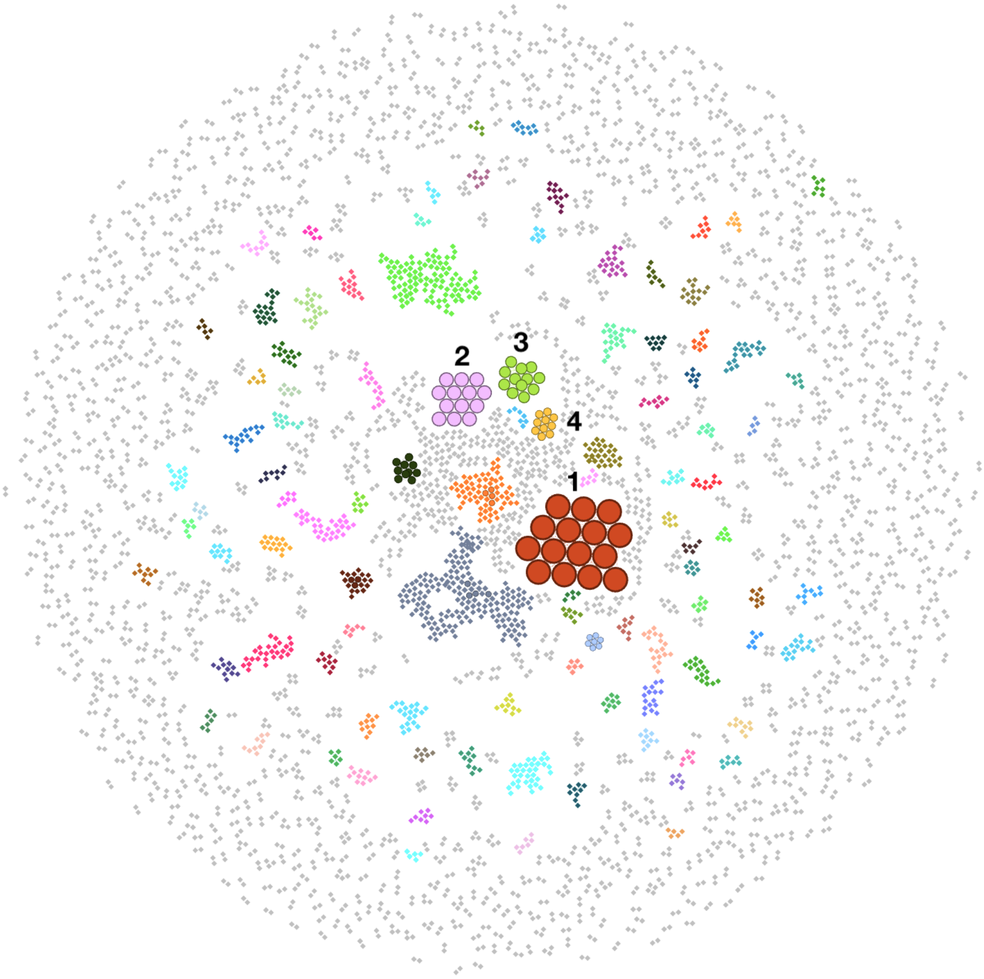

Figure 4: A network wherein environmental charities are represented by nodes, and ties are drawn between them where they share a common trustee. The top 4 clusters, with the greatest eigenvector centralities, are linked together by the trustees 1) Ludlow Trust Company Ltd, 2) Tandridge District Council, 3) Reigate & Banstead Borough Council, and 4) (The) Cowdray Trust Ltd, respectively.

population gave a slightly higher average degree of 1.726. As aforementioned, metrics of actor importance were calculated with eigenvector centrality. The top 15 existed in the same component and were bound by the common trustee of Ludlow Trust Company Ltd, though exhibited no regional connection. However, the clusters with the second and third highest eigencentrality values were tied by local government district councils, both in east Surrey.

To further this network and reflect the inter-connectedness of the sector, as revealed in Section 3.1, a once-removed dataset was created. Non-environmental charities were included if they had a trustee involved in environmental causes. This created a network of 33,679 nodes (56.59% environmental charities, 43.41% non-environmental) and 48,788 edges. An average degree of 2.897 was calculated amongst all nodes, which is 7 times greater than previously. The greatest component in this example contained 18.63% of the charities, shown in Figure 5. In general, this network was much more connected, but still only captured around 20% of all charities.

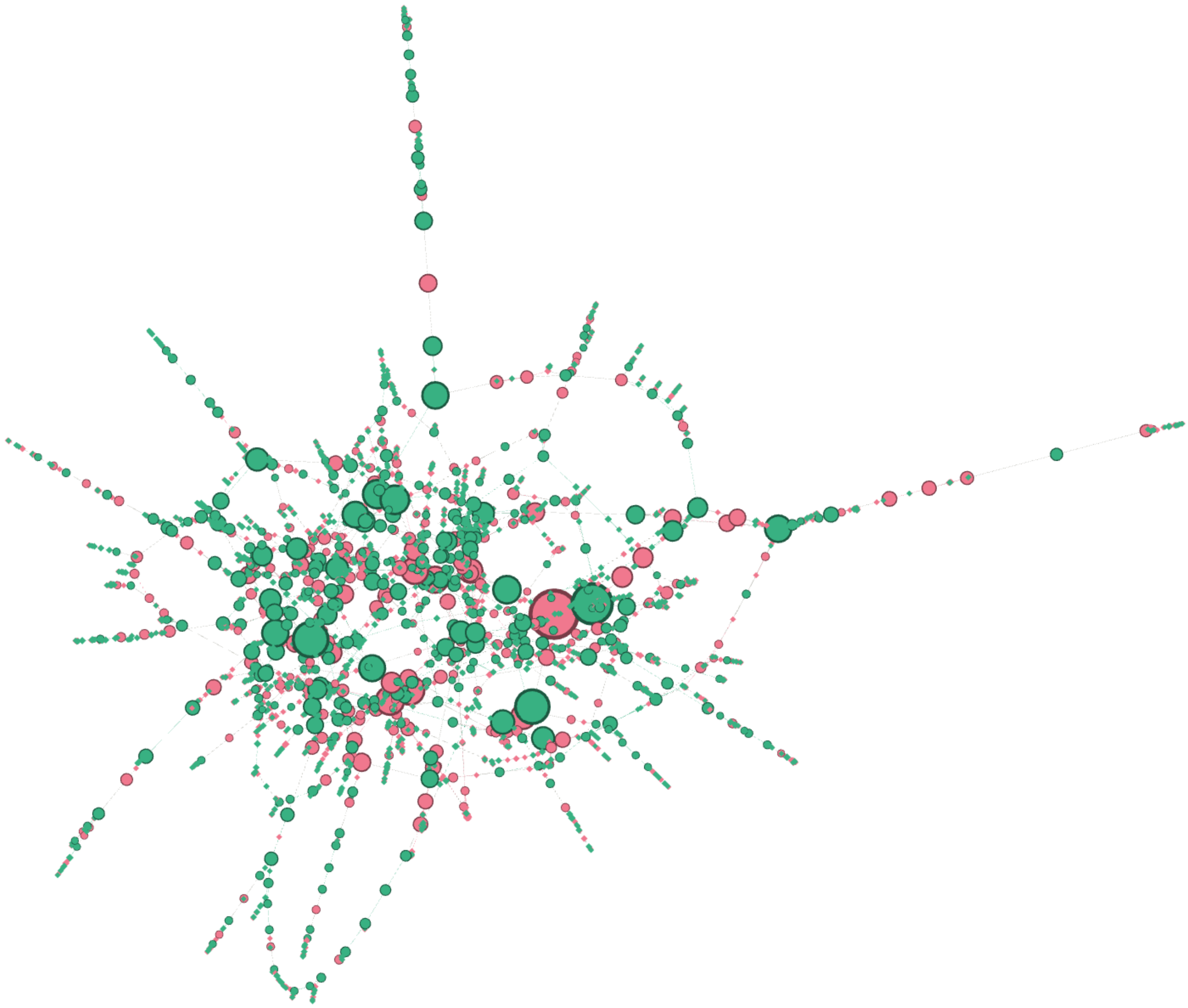

Figure 5: A network of environmental charities (green) and non-environmental charities (red), connected by shared trustees with involvement in environmental aid. This was the largest component of the data set and contains 6,274 nodes. Betweenness centrality was calculated for the nodes in an effort to identify key bridges between environmental and non-environmental foundations.

4 Discussion

In the UK voluntary sector, looking at a self-contained view of environmental charities, the majority (75.93%) of them were self-contained with a unique collection of trustees. Of the trustees that did show connections, the extent of overlap was relatively small as only 15, 983 components were identified compared to 19,060 charities present in the data set. However, examples of social structures were identified throughout as salience was attributed to charities with lots of trustees (particularly agricultural associations), local government district councils, and private limited companies. The first two naturally produced some regional clusters, with Devon County Agricultural Association being a part of a larger connection of South West charities, and local government district councils being particularly prevalent in their neighbourhood areas' voluntary sector. These findings alluded to relatively few groups of people with a disproportionate capacity to influence charitable actions on the small-scale.

The presence of governmental bodies and private limited companies was significantly noteworthy when considered in conjunction with the final network of first-order non-enviro -nmental relations in Figure 5. This network increased average degree centrality for the charities, and decreased the number of components by lengthening the size of connections made. Conclusively, this conveyed the limitations of studying environmental charities in isolation; it is harder to understand an entire system when focusing on a small cog in a much larger mechanism. In association with the network of charitable purposes in Section 3.1, this consolidated the need to extend this work further, both within the voluntary sector and beyond.

This project has produced fertile ground for a lot of work in this field of study. As mentioned, a greater network could be produced to involve the public and private sectors to better reflect their intertwined nature. From this, the network flow could be studied, and the promulgation of organisational or individual agendas. In particular, the movement of funds throughout the network could be enlightening given the government's entanglement with charities through grants and contracts. Within this, other centrality metrics might need to be considered instead of eigencentrality, such as betweenness, to investigate 'bridge actors' between sectors. This work could be motivated by public perceptions of climate change through utilising the who-how network in Figure 2 and charities providing advocacy/advice/information, or it could look at the efficiency of climate change policy making and enforcement.

There is also an opportunity to introduce natural language processing to create a more accurate taxonomy of charities, as the cause of 'environment/conservation/heritage' is broad and includes lots of organisations not directly concerned with climate change. This could employ the written governing documents that are available from the Charity Commission, and which all charities have to produce.

In addition, the efforts to identify social and regional structures could be extended and done more rigorously. The Charity Commission data download service does provide regional information, so this could allow for investigations into the geographical operations of charities in relation to areas significantly at risk to the effects of climate change; focusing on vulnerable communities and those likely to experience exacerbated inequalities on the basis of race, gender, sexual orientation, and socio-economic status [13] [14] [15].

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