Using word clouds to present farmers' perceptions of advisory services on pollution mitigation measures.

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Abstract

Advice delivery is one mechanism that can be used to encourage the uptake of water pollution mitigation measures amongst the farming community, but determining who is best placed to effectively provide advice and increase adoption creates a challenge for policy makers. Through in-depth interviews, this research investigates the perspectives of both farmers and farm advisers on the delivery of water pollution mitigation advice in three agriculturally contrasting areas of England. A novel approach using word clouds as a visual comparative tool for qualitative data is presented to demonstrate a transferable method for disseminating research findings to a wider audience outside of academia. Results from the interviews indicate differences across the regions, and that contrasts exist between farmers and advisers' perceptions. This suggests it is important to assess both perspectives when designing effective advice delivery mechanisms and for policy makers to consider who is most appropriate to effectively deliver farm advice.

Keywords

Agriculture; Farmer attitudes; Diffuse water pollution; Farm advisers; Word cloud

1. Introduction

As governments strengthen and prioritise efforts to improve environmental land management, new policies result in farmers and land managers having to solve increasingly complex challenges and deliver multiple objectives beyond the production of food. The need for valued and trusted farm advisers has never been greater, as farmers look to a range of experts to help with such complex decision making (Phillipson et al. 2016).

One environmental issue high on government agendas is diffuse water pollution (DWP) from agriculture. Numerous farm practices exist which help to reduce pollution through changes in land use, farm infrastructure or management of soil, livestock, fertiliser and manure (Cuttle et al. 2016). In England, attempts to increase farmer uptake of such practices have included: financial incentives through government agri-environment schemes (AES); the provision of capital grants, free training and advice to farmers (CSF Evidence Team 2014); regulatory enforcement in Nitrate Vulnerable Zones (Defra 2017); and voluntary initiatives such as The Campaign for the Farmed Environment (Clothier and Pike 2013). Of the different mechanisms available to policy makers, advice provision has most recently received great attention due, in part, to financial cutbacks (Defra 2013) and the growing emphasis for governments to use non-regulatory mechanisms (UKWRIP 2011) and local scale approaches (Zasada et al. 2017).

This research investigated the agri-environmental advice sector of England to help further understand the relationships between farmers and their advisers and thus inform improvements in efficacy of advice uptake and behaviour change.

1.1 Provision of water pollution mitigation advice to farmers

Providing advice to farmers is a mechanism for the application of scientific research and new knowledge and innovations to help improve agricultural practices. Many different strategies for advice provision have been adopted by individual governments. Kania, Vinohradnik, and Knierim (2014) reported that each of the 27 EU countries had built its own strategy based on legislation, agricultural policy, ownership of research institutions and advisory organisations, structure of education, sources of finance and characteristics of farm holdings. Investigating which strategies are the most appropriate and effective has been the focus of several studies (e.g. Feder, Birner, and Anderson 2011; McDowell et al. 2016; Smith et al. 2015), with Berglund and Dworak (2010) highlighting that the issue of water was not always being

addressed to the same extent in farm advisory systems, with several Member States wanting deeper information exchange on how to best integrate additional water related issues into their advisory services.

Focussing on the example of England, the past 30 years have seen the farm advice sector transition from a publicly funded extension service to a more diverse range of privately funded providers (for more detail see Prager and Thomson 2014). The Government continues to provide advice on DWP mitigation through a variety of strategies, such as: the Catchment Sensitive Farming (CSF) initiative; AES - Countryside Stewardship; the Farm Advisory Service (mandatory under the EU Water Framework Directive) and through provision of funds to private and third sector organisations (e.g. Sherrington et al. 2015). However, there has been criticism that the advice sector is insufficient for meeting farmers' needs (Foresight 2011; Farming Regulation Task Force 2011; HM Government 2011; Defra 2013).

Table 1 provides examples of the different providers of DWP mitigation advice in England. With advisers now coming from a wide range of backgrounds and contexts such as government, non-profit environmental organisations and industry (Defra 2013), concerns have been raised over fragmentation, inconsistencies, conflicts and duplication of advice (AIC 2013). Nevertheless, some believe a pluralistic system can bring positive outcomes (e.g. Garforth et al. 2003; Phillipson et al. 2016), such as increased accountability, and therefore quality control (Kidd et al. 2000), as well as providing flexibility and creativity (Klerkx and Proctor 2013).

[Table 1 here]

Vrain and Lovett (2016) studied the roles of advisers providing DWP mitigation advice to farmers and discovered many organisations had distinct niches in terms of the recommendations made. Such niches were found to differ between several regions of England, indicating the complexity of the advisory system and highlighting the need for policy makers to consider which organisations and advisers are best placed to deliver on the ground advice to farmers in the different localities.

In order to understand how to increase the credibility of advice to improve uptake, it is important to not only ascertain who is best placed to deliver such advice, but also what advice is actually wanted by farmers. No previous research could be identified which investigated exactly what advice farmers wanted regarding farm practices which mitigate water pollution

(and provide further environmental and farm business benefits), and from whom, therefore the research presented within this paper aims to fulfil such gap.

1.2 Perceptions of advice

To help improve the design of advice delivery, previous research has investigated farmer perceptions of advice. A report from the Value of Advice project (AIC 2013) considered farm advice generally and categorised advisers into an outer and inner ring of confidence. The report concluded that farmers are more likely to trust and listen to advisers in the inner ring such as agronomists/crop advisers, accountants and vets due to the fact that these advisers focus on improving business performance. Government staff and third sector organisations were placed in the outer ring of confidence, being less influential on farmer decisions and seen as providing advice that may be restrictive to the farm business. Other research has interviewed farmers regarding their trust in sources of agri-environmental information and advice, the perceived reasons for any failures or barriers in respect of taking up the advice offered, and their knock-on effects (Sutherland et al. 2013). However, although this study was conducted in different locations across England, comparisons were restricted as participants were only interviewed regarding a particular local initiative. Our research therefore investigates perceptions of a wide variety of common sources of water pollution mitigation advice in three regions of England.

While the importance of trusted sources of advice for achieving behavioural change has been well established (Palmer, Fozdar, and Sully 2009; Sligo and Massey 2007; AIC 2013; Sutherland et al. 2013), Blackstock et al. (2010) state that gaps remain in understanding when a farmer judges whether a message is credible or not, and how different sources of advice on diffuse pollution are evaluated by farmers. Given the importance of advice to support voluntary uptake of mitigation measures, and the lack of knowledge regarding why specific advisers are listened to in different areas, this research interviewed farmers to discover not only who they would listen to, but also the reasons why, thus providing greater insight.

With much of the literature on advice perceptions focussing on farmers' views, a scarcer body of research has been conducted on advisers. Areas of investigation have included the extent and nature of adviser knowledge (Ingram and Morris 2007; Nettle, Crawford, and Brightling 2018), the quality of advice (Prager, Labarthe, and Caggiano 2016), adviser views on agri-environmental schemes (Hejnowicz, Rudd, and White 2016) and the working relations between advisers (Phillipson et al. 2016). However, knowledge gaps exist, with Hejnowicz,

Rudd, and White (2016) recommending more in-depth research is needed to understand the views of farmers and the role of advisers, as well as the relationships between farmers and their advisers to improve the effectiveness of environmental farm practices.

Greater insights into advice provision can be achieved when looking through the lens of both farmers and advisers (Hilkens et al. 2018; Ingram 2008; Proctor et al. 2012). This research was unable to find any previous work carried out which examined both perspectives (farmers and advisers) on the delivery of advice for water pollution mitigation and the reasons why farmers responded in certain ways regarding why they would listen to particular advisers. Therefore, results from interviews with both farm advisers and farmers were used to discover whether their perceptions corresponded with each other.

1.3 Disseminating qualitative research findings

As the findings from this research are relevant to policy makers and farm advisers, disseminating the research results outside of academia was crucial to ensure they informed and benefited the multiple actors involved. In general, researchers regularly face the challenges of: 1) knowing which channels of distribution are appropriate for dissemination; 2) engaging with the right stakeholders; and 3) conveying messages in a language understood by the audience (Welch-Ross and Fasig 2007). Too often than not, scientific research dissemination can be both confusing and uninterpretable for non-academics. The use of graphic representations of data can help overcome such issues (Weisgarber and Butler 2009). With their use for conveying qualitative research results providing benefits such as: assisting in the interpretation of data; telling a story that would otherwise be buried in vast amounts of text; communicating key aspects of data; grabbing attention; and increasing speed of comprehension and memorisation (Glenberg and Langston 1992; Brigham 2016; Tverksy 2001; Lipkus and Hollands 1999). Wattenberg and Viegas (2008) found that graphic visualisations of data generated a surprising volume of conversation, with viewers strongly engaging with the research results. Nevertheless, concerns and limitations regarding data visualisations also exist. More time, effort and cost can be required for production (Bryman 2015), whilst poorly designed visuals can create more confusion and clutter or lack of a storyline can detract from the key message of a visual (Brigham 2016).

Many different visualisation techniques for qualitative data exist, with Henderson and Segal (2013) outlining the strengths and weaknesses. Of the different techniques (Henderson and

Segal 2013; Bryman 2015), this research chose the method of word clouds to represent the qualitative data collected on perspectives towards different sources of advice. A word cloud gives greater prominence (text size) to words or phrases with a higher frequency of use and are best used for exploratory qualitative data analysis (Heimerl et al. 2014). In this research, the word clouds provided a clear, visually rich representation of key words from interview transcripts, enabling the reader to make quick comparisons between each of the word clouds created. "Phrase nets", "tree clouds", and "word trees" are examples of other visualisation techniques but were deemed inappropriate or unnecessary as they place emphasis on word connections and similarities (Kalmane 2012). "Spark clouds" (Lee et al. 2010) and "Parallel tag clouds" (Collins et al. 2009) do not provide a clear visual interpretation of data, appear visually complicated and therefore were also deemed inappropriate for this research.

Research on the effectiveness and perception of word clouds is discussed in Heimerl et al. (2014), who conclude that word clouds are a good visualisation technique to communicate an "overall picture" of text contents. Banas and Brown (2012) also argue that such techniques can facilitate the process of content analysis and expand reader comprehension, illustrating dominant ideas or themes for lay audiences.

Despite their positive uses, word clouds have their limitations. The following are examples of the main issues: 1) Word clouds emphasise word frequency and not necessarily importance; 2) They do not accurately reflect the content of the text if slightly different words are used with the same meaning; and 3) Viewers interpret images by focussing on the middle centre (discarding peripheral items) and reading left to right (in western cultures), undoubtedly causing particular words/phrases to stand out more (Weinschenk 2011). To mitigate against such issues, this research purposefully used word clouds to highlight frequently used words/phrases and not word importance. To address the second limitation, key descriptive words were extracted and standardised from interview transcripts to ensure different words of the same meaning were grouped. And finally, as multiple word clouds were created to be viewed together, the same method of visual interpretation would occur with each word cloud, thus alleviating such issue.

1.4 Research objectives

The literature above highlights the importance of advice delivery as a mechanism for encouraging the adoption of DWP mitigation measures on farms, along with the limitations of

existing studies and the necessity to disseminate research outside of academia. Together, they provide the rational for this research to 1) utilise a visually engaging technique to present results to a non-academic audience and 2) gain a greater insight into the perceptions of the agricultural community regarding advice through addressing the following empirical research questions:

- What advice do farmers want regarding DWP mitigation methods and from whom?
- How are different advisers perceived by farmers?
- Are the perspectives of farmers and advisers on DWP advice delivery consistent?

The remainder of this paper outlines the methodology used for interviewing farmers and farm advisers, and explains the process for word cloud creation for the qualitative data collected. This is followed by the key findings and discussion. The final section provides recommendations and an overall conclusion which considers the implications of the findings, not only for policy makers and practitioners regarding the provision of water pollution mitigation advice, but also researchers wanting to disseminate qualitative data in an effective and engaging manner.

2. Data collection and method of analysis

2.1 Farm adviser interviews

As part of a previous study conducted by Vrain and Lovett (2016), results from the semi-structured interviews with 81 farm advisers were used to enhance the analysis of the research presented in this paper. A detailed account of the methodology and framework can be found in Vrain and Lovett (2016), where additional results are discussed. This paper particularly focuses on adviser responses to the question "What do you think most influences whether a farmer implements your advice?"

To analyse the results, In Vivo coding from the verbatim responses was used to keep the data rooted in the participant's own language (Saldana 2015). The second and final cycle of coding resulted in 22 categories, with any In Vivo codes with similar meaning being consolidated, e.g. *"provide grant", "offer grant", "have grants"* were coded to create the one category *"grant"*. Summary tabulations were then created in Microsoft Excel using the 22 categories to identify what advisers from each organisation believed were the main characteristics which influenced farmer uptake of their advice.

To enable generalisations to be made from the interview findings, a comparative framework was designed. Advisers were categorised dependent upon their geographical location (East Anglia; North West; and South West) and employer: the public-sector government departments and agencies; non-profit environmental organisations; or private agriculture business sector (Table 2).

2.2 Farmer interviews

Semi-structured farmer interviews were conducted with the objective of understanding decision processes and experiences of adopting or not adopting a variety of DWP mitigation measures[1]. Questions were asked regarding what advice they wanted and from whom. To gain insight into participants' attitudes regarding advisers, an engaging method of questioning was used, building rapport between the interviewer and participants. The 22 categories of words and phrases previously stated by farm advisers during their interviews, when asked "What do you think most influences whether a farmer implements your advice?" (Section 2.1) were printed on to individual cards and laid out on a table to act as prompts. The farmer was then asked to carefully read all of the word cards before the interviewer held up a sheet presenting an organisation's logo. Farmers were asked "Would you listen to this organisation for advice on water pollution mitigation and act upon it?" Followed by an additional question of "why?" or "why not?". Such a method provoked rich conversation.

The face-to-face interviews were conducted with 58 farmers from three catchments corresponding to the regions where advisers were interviewed from (Table 2) and took place during 2014 at times when farmers were least busy with their day-to-day operations. Interviews were conducted in catchments being studied as part of a government funded project – the Demonstration Test Catchments (DTC) (McGonigle et al. 2014): Eden (North West) during January and February; Wensum (East Anglia) during June and October; and Tamar (South West) during November and December. Pilot interviews with six farmers were conducted during January 2014 in the Derwent catchment adjacent to the Eden catchment in Cumbria, with interview length and phrasing of questions altered as a result of feedback from the pilot.

Several strategies were used to help recruit farmers. Various contacts established from previous DTC work helped identify farmers in the area. A snow ball effect was also used by asking

[1] Mitigation measures were split into three categories: land use change (land out of production, tree planting, sediment trap); management change (subsoiling, reduced cultivation systems, tramline management, cover crops); infrastructure change (track re-surfacing, roofing over yards, biobed, re-siting gateways).

participants for further contacts of neighbours. Other methods of recruitment involved actively attending local agricultural events, as well as simply spending time in village pubs, community sports centres, and local shops, speaking to people and informing them of the research. After identifying potential participants, farmers were contacted directly by telephone, explaining the research, its benefits and to arrange a convenient day and time for the interviewer to visit their farm to conduct the interview. A success rate from initial contact to interview of 97% was achieved. Being friendly and keeping to the point helped build immediate rapport over the phone and resulted in farmers agreeing to participate. Often mentioning the name of someone in the community who had participated helped get a foot in the door. The duration of interviews lasted on average one hour with hand written notes taken, and dictaphone recordings when permitted. Transcripts were typed the same day, ensuring any extra thoughts from the discussion could be added. The same method of coding from the farm adviser interviews was applied to the responses provided by farmers. To maintain consistency, all interviews with farmers; data management; and data interpretation were conducted by the same researcher.

2.3 Word cloud creation

In order to compare the wealth of qualitative data collected from interviews, including the vocabulary used by farmers when asked about the reasons for listening or not listening to advice from specific advisers, word clouds were chosen as an innovative method to display the coded categories.

A variety of word cloud generators are available for free on the internet, however one which allowed formatting of individual phrases was required to enable positive and negative words from the farmer transcripts to be distinguishable. Tagul (www.tagul.com) was the word cloud generator chosen as it provided such a function along with various other desirable features, such as, formatting word cloud shape, frequency of word repetition, font type, style and word angle. Tagul provides a simple self-explanatory user interface, whereby one imports text into the box displayed, selects the formatting options desired and clicks the “visualise” button. Clouds can then be saved and exported as PDFs. Figure 1 displays annotated examples of word clouds for three adviser organisations to explain various features.

[Figure 1 here]

It was important to ensure consistency across word clouds for comparability, therefore the same font, style and overall shape were used, with only two variables changing: font size to depict word frequency and font colour to represent negative and positive words. For this paper, the colour black was selected to portray negative words (responses as to why they wouldn't listen to advice) and light grey for positive words (responses as to why they would listen to advice) . In original displays used for presentations, posters and reports, the colours red (for negative) and blue (for positive) were used for visual impact.

3. Results and discussion

3.1 What advice do farmers want and from whom?

In-depth discussions during interviews highlighted farmer preferences regarding advice that they would find of use for considering adoption of particular mitigation measures. Responses highlighted the variety of information farmers believed would be beneficial.

Advice regarding finance, such as grant availability and cost-effectiveness was cited frequently by farmers for many measures, however it was apparent that financial facts and figures were not the only pieces of information farmers wanted from advisers. Another highly valued form of advice was a personalised farm map or infrastructure plan showing suitable locations for implementing measures e.g. planting trees, re-siting gateways, creating sediment traps, tracks to resurface.

Variations in farmer responses existed between mitigation measures and catchments. For some measures farmers requested lots of different advice, noticeably for management and infrastructure measures considered as new or less mainstream (e.g. cover crops, sediment traps, biobeds and subsoiling). However, it emerged that for tree planting, which is neither new nor uncommon, farmers in the livestock-dominated catchments required a lot of advice to encourage adoption.

Having discovered what advice farmers would find useful, it was important to learn who farmers wanted the advice from, as immediate barriers and wasted efforts occur if the information is delivered by an adviser they would not listen to or know to approach. For particular measures, certain advisers were specified such as CSF Officers (CSFOs) for subsoiler lending schemes, independent specialists for biobeds or Forestry Commission for tree

planting, whereas for other measures e.g. re-siting gateways, anyone would be listened to (besides contractors who were considered biased).

3.2 Who farmers listen to overall

After discussions on specific measures, the farmer interviews investigated the broader topic of perceptions towards advisers from different organisations. Figure 2 shows the percentage of farmers in each catchment who would listen to and act upon advice from different advisers regarding DWP mitigation.

Across all three catchments, the advisers who farmers said they would most often listen to and implement their advice included government staff who work for CSF and the Environment Agency, representatives from the Rivers Trusts, as well as independent specialists. Advisers who were least likely to be listened to included salespeople and those from water companies, the RSPB and Wildlife Trusts. Differences in farmer responses between catchments can be seen in Figure 2. To highlight two examples, the Rivers Trusts had larger percentages of farmers that would listen to them in the Eden and Tamar catchments than in the Wensum catchment, while large agricultural companies (such as Frontier, a crop inputs and grain marketing business), had a greater percentage of farmers in the Wensum catchment that would listen to them than in the other two catchments.

[Figure 2 here]

3.3 Word cloud application: why do farmers listen to particular advisers?

Follow-up questions were used to examine why particular advisers elicited positive or negative reactions, with Figure 3 displaying the word clouds created for each organisation or type of adviser. Those most dominated by positive words (light grey) include independent advisers, CSFOs and Rivers Trusts, though there were different reasons for the positive appreciation. *Grant* was most frequently used for CSFOs and Rivers Trusts, whereas *knowledge* and *trust* dominate the word cloud for independent advisers. The word clouds for the RSPB, water companies and salespeople had the most negative perceptions (black text), with *lack of trust* and *bias* being dominant phrases (Figure3).

The perspectives of farmers were most similar (i.e. represented by a less diverse vocabulary) for the Forestry Commission, Woodland Trust and salespeople, whereas attitudes varied greatly for many of the other organisations. Some word clouds showed one dominant attribute e.g. CSFOs with *grant*, whilst others had several dominant attributes e.g. large agricultural companies with *trust, knowledge, clear advice* and *local evidence* (Figure 3).

3.3.1 Regional differences in attitudes towards advisers

Comparing the responses of farmers from the three catchments, different reasons were given as to why they would listen to particular advisers. As an example, Figure 4 shows the different vocabulary used by farmers in the three catchments for CSFOs and the Farming and Wildlife Advisory Group (FWAG).

It is apparent from Figure 4 that farmers in the Wensum provided more negative reasons why they would not listen to CSFOs e.g. *unknown, lack of continuity and nothing new. Grants* on the other-hand were a key factor, along with *trust*, for Eden and Tamar farmers to listen to advice. The contrasting perspectives regarding advice from FWAG reflect regional differences in prominence within the farming communities, varying from being *unknown* in the Eden, to providing local *evidence, clear advice* and being *trustworthy* in the Tamar.

Water companies also appeared to play a different role in each area, reflecting different degrees of farmer engagement. Some farmers were very negative in their views, with statements such as "*no way", "not a chance", "I would never listen to them"* and so on. Farmers in the Eden particularly referred to the water company as having a bad reputation, *thieves*, *commercial* agenda, and having employees that are *not local*. In the Wensum there were fewer negative responses with *knowledge* and *local evidence* being mentioned, while in the Tamar the water company had established a good reputation through the provision of *grants*. The general consensus amongst Tamar farmers was that it was a good idea for the water company to disseminate grants through other organisations such as the local Rivers Trust.

The different views of farmers across the three catchments confirm the findings of previous research (Vrain and Lovett 2016) that particular organisations had contrasting roles in delivering advice within various catchments.

[Figure 3 here]

[Figure 4 here]

3.3.2 Comparing farmer and adviser perceptions

Farm advisers were asked what they regarded as important factors or characteristics which influenced why a farmer would take up their advice. Comparisons between adviser responses from the different regions were not possible for individual organisations due to the sample sizes and so overall responses can be compared with those of the farmers previously discussed (Figure 3) to evaluate whether views align and thus whether advisers are promoting and emphasising the most important characteristics of themselves to farmers.

Advisers from the government agencies Environment Agency, Natural England and Forestry Commission mentioned factors such as *government* and *AES annual payments,* and these matched the perspectives of farmers.

CSFOs identified *grant* as a key factor (Figure 5), as did farmers, but advisers also stated *cost saving* and *credibility* as important characteristics, whereas farmers did not. Several other organisations also stated *cost saving* as a strong reason why farmers listened to them, however farmers refrained from mentioning this.

[Figure 5 here]

Responses provided by advisers from non-profit environmental organisations (Wildlife Trusts, Rivers Trusts, Woodland Trusts and RSPB) also placed emphasis on *grants* as a key factor (Figure 5), but failed to appreciate the importance of *local evidence* and *knowledge* that farmers perceived in such organisations (Figure 3). Discovering such differences in perceptions indicates improvements that could be achieved in advice delivery, with Section 4 highlighting the implications this research has for enhancing advisory systems.

3.4 Benefits and limitations of word cloud application

The empirical data displayed as water droplet word clouds were found to be highly informative and particularly well received by a wide range of organisations and audiences. During meetings, conferences and workshops, the word clouds were shown in presentations and posters to staff from different government departments, water companies, non-profit

environmental organisations and within the agricultural industry. Organisations who were involved in delivering farm advice or attempting to change farmer behaviour were provided with real insight as to farmer attitudes towards advisers. This research was not initially designed to conduct a systematic evaluation of word cloud use, however, a secondary outcome of using such visualisation method was the positive response from audiences. For example the Head of Water Quality and Agriculture at Defra stated "This research has contributed value…helping to convey messages using an innovative visualisation method, which clearly illustrates results and allows comparisons between word clouds to be effortlessly made." (personal communication, December 11, 2015).

Results have helped contribute to the CSF strategy and training programme, enabling the initiative to better understand what effort and resources might be needed to further increase the uptake of particular water pollution mitigation measures. The word clouds also assisted policy design through an understanding of the value farmers place on advice from a variety of sources, thus helping policy makers with engaging representatives from industry to target messages through appropriate channels.

The main limitation of using word clouds for this research was their scientific analytical value. Statistical differences between vocabulary displayed in each word cloud could not be calculated, therefore they are not a tool for analytical rigour. Despite the analytical limitation of word clouds, this research demonstrates the benefits of using such graphics for presenting results and engaging stakeholders which could be repeated in other catchments and applied across different types of advisory services.

4. Conclusion

The aim of this study was to enhance understanding of farmer perspectives on advice provision, ultimately to improve dissemination of knowledge for reducing water pollution. Interviews with farmers across three different catchments in England provided insights into what advice farmers wanted regarding particular mitigation measures and from whom. Information was then collected on the reasons why farmers would or would not listen to advice from different advisers. This enabled comparisons to be made not only between perspectives of the different sources of advice but also with data previously collected from adviser interviews on perceptions of how they think farmers view them.

The results indicated that farmers wanted advice for new or less common management and infrastructure change measures, such as, cover crops, subsoiling, sediment traps and biobeds. Farmers requested advice on costs, farm maps and infrastructure plans, stating they would be beneficial for decision making. It is clear more advice is necessary to encourage mitigation measure uptake, but from whom? Overall, CSF, Environment Agency, Rivers Trusts and independent specialists were highlighted as the most listened to for advice on DWP mitigation measures.

Through the use of word clouds, this research demonstrates an effective visualisation technique to compare qualitative data. Positive feedback from the creation of policy briefings and posters including the word clouds, suggests such a method is beneficial in capturing the attention of policy makers and advisers alike. The word clouds presented in this paper show that farmers' reasons for listening to various advisers vary appreciably. Important characteristics as to why farmers listened to such advisers included: grants, knowledge, trust, continuity, clear advice and local evidence. It is imperative to understand who farmers listen to in each area for disseminating advice effectively and why, as farmer attitudes towards advisers varied across catchments.

By investigating the bi-directional perspectives of advisers and farmers on advice delivery, this research identified similarities, as well as differences between the two. Advisers believed farmers listened to them for their advice on cost saving practices, however famers did not highlight such a factor. Furthermore, advisers from non-profit environmental organisations failed to appreciate the importance farmers placed on their knowledge and local evidence. Such results suggest that the link between water pollution mitigation advice and cost saving need to be made more explicit, and that environmental organisations need to promote themselves to farmers by emphasising their local knowledge and evidence to encourage uptake of advice.

This paper illustrates the benefits of interviewing both farmers and advisers on perceptions, gaining a greater insight into the farm advisory system. Future research could build upon such findings, to better understand the relationship dynamics and history leading to particular perceptions between farmers and advisors. An additional avenue of research could also be to conduct an analysis of how advisers and other stakeholders respond to the word cloud visualisations and the way in which their views are reflected back to farmers. Using word clouds as an empirical research tool in such a way, could be of potential interest to a wider range of researchers working outside the immediate context presented.

The methodology used has applicability and transferability to a wide range of agri-environmental issues and could help to disseminate knowledge and inform future extension strategies.

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Table 1. Main sources and types of diffuse water pollution mitigation advice in England (Source: Vrain and Lovett 2016).

	Source of advice	Main types of advice provision
Government departments and organisations	Catchment Sensitive Farming (CSF)	Targeted DWP advice and capital grants
	Environment Agency (EA)	Regulatory advice on farm practices
	Natural England (NE)	Agri-environment scheme options
	Forestry Commission	Tree planting and forestry legislation
Non-profit environmental organisations	The Wildlife Trust	Species and habitat management advice/grants
	Royal Society for the Protection of Birds (RSPB)	Farmland bird conservation and habitat management
	The Rivers Trust	Catchment scale projects delivering DWP advice/grants
	The Woodland Trust	Tree planting and woodland maintenance advice/grants
Agricultural business sector	Independent specialists e.g. agronomists/veterinarians	Particular areas of expertise such as crop improvements or animal health and welfare.
	Large agricultural consultancies	Whole farm business advice
	Water companies	Diverse approaches including CSF partnerships, capital grants, voluntary agreements and reverse auctions.
	Salespeople e.g. Feed/seed/ chemical/machinery	Farm practices for best use of product
	The Farming and Wildlife Advisory Group (FWAG)[2]	Whole farm conservation

Table 2. The number of farmers and farm advisers interviewed in the three regions/catchments.

		Arable	Livestock	Dairy/mixed
Region		East Anglia	North West	South West
Farm advisers	Government departments and agencies	14	12	14
	Non-profit environmental organisations	5	9	11
	Agricultural business sector	6	4	6
	Total	25	25	31
Catchment		Wensum	Eden	Tamar
Farmers		17	21	20

[2] Local FWAG organisations differ in status after the national FWAG (a not-for-profit organisation) went into administration in 2011. FWAG organisations have either formed as a new not-for-profit organisation or an advisory business, the majority being the latter.

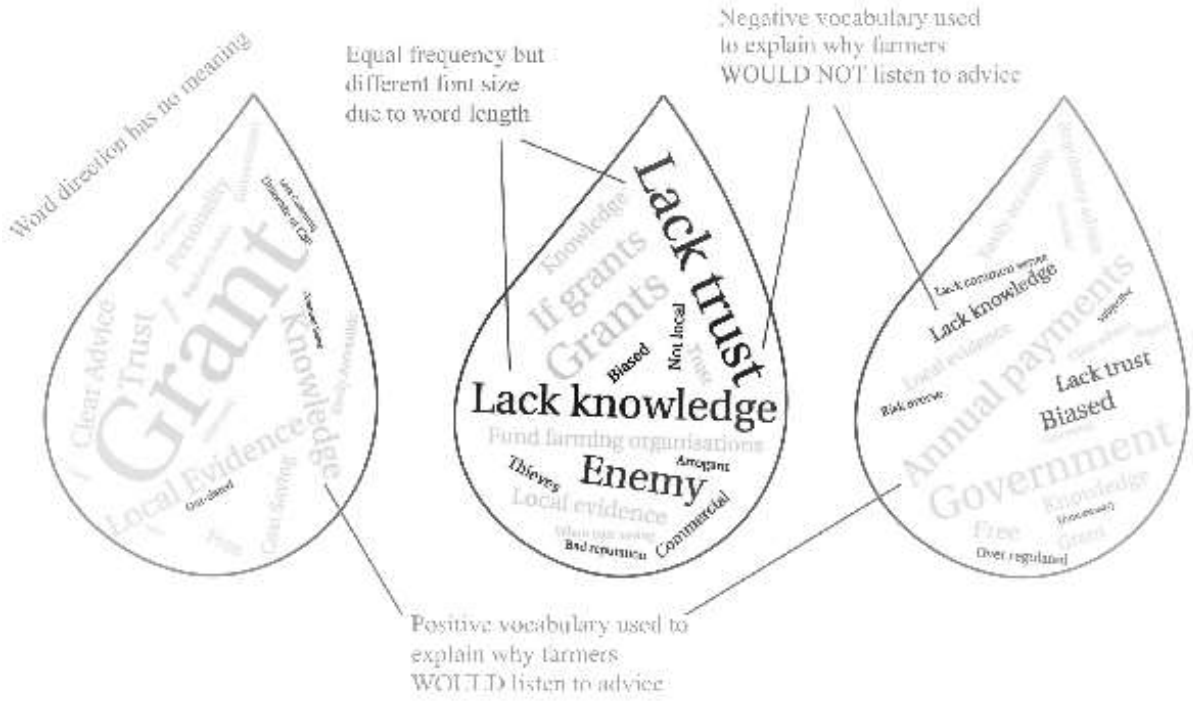

Figure 1. Annotated word clouds of vocabulary used by farmers as to why they would or would not listen to advisers for DWP mitigation advice.

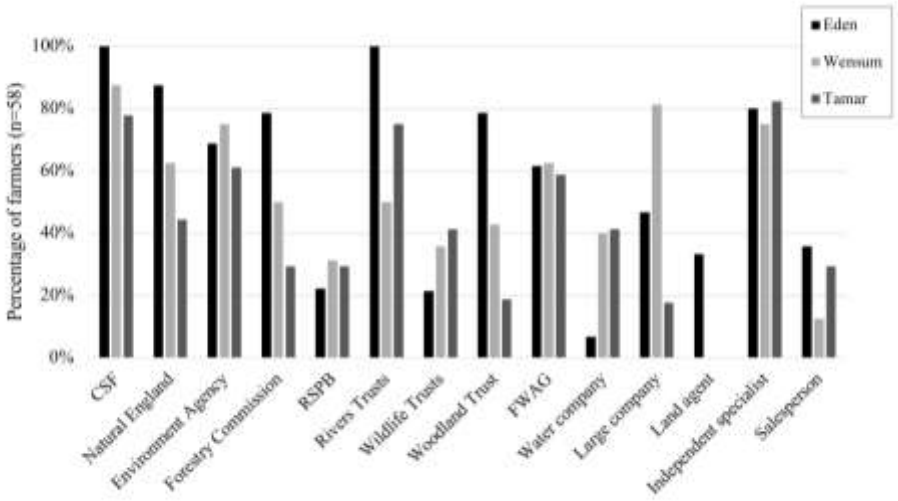

Figure 2. Percentage of farmers who would listen to advice on DWP mitigation measures from different advisers.

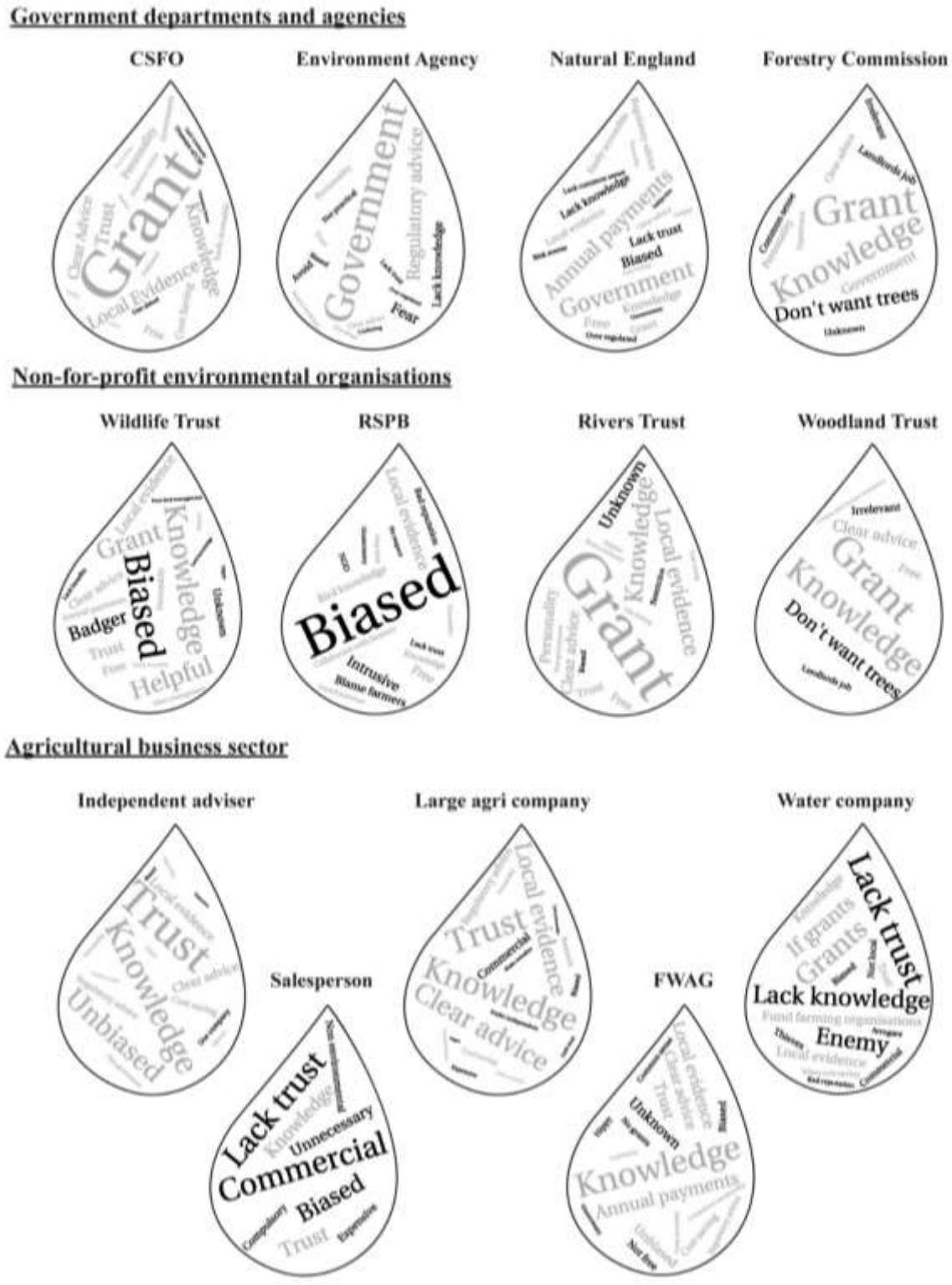

Figure 3. Word clouds for thirteen organisations showing farmers' comments which describe why they would (light grey text) or would not (black text) listen to advice from particular advisers.

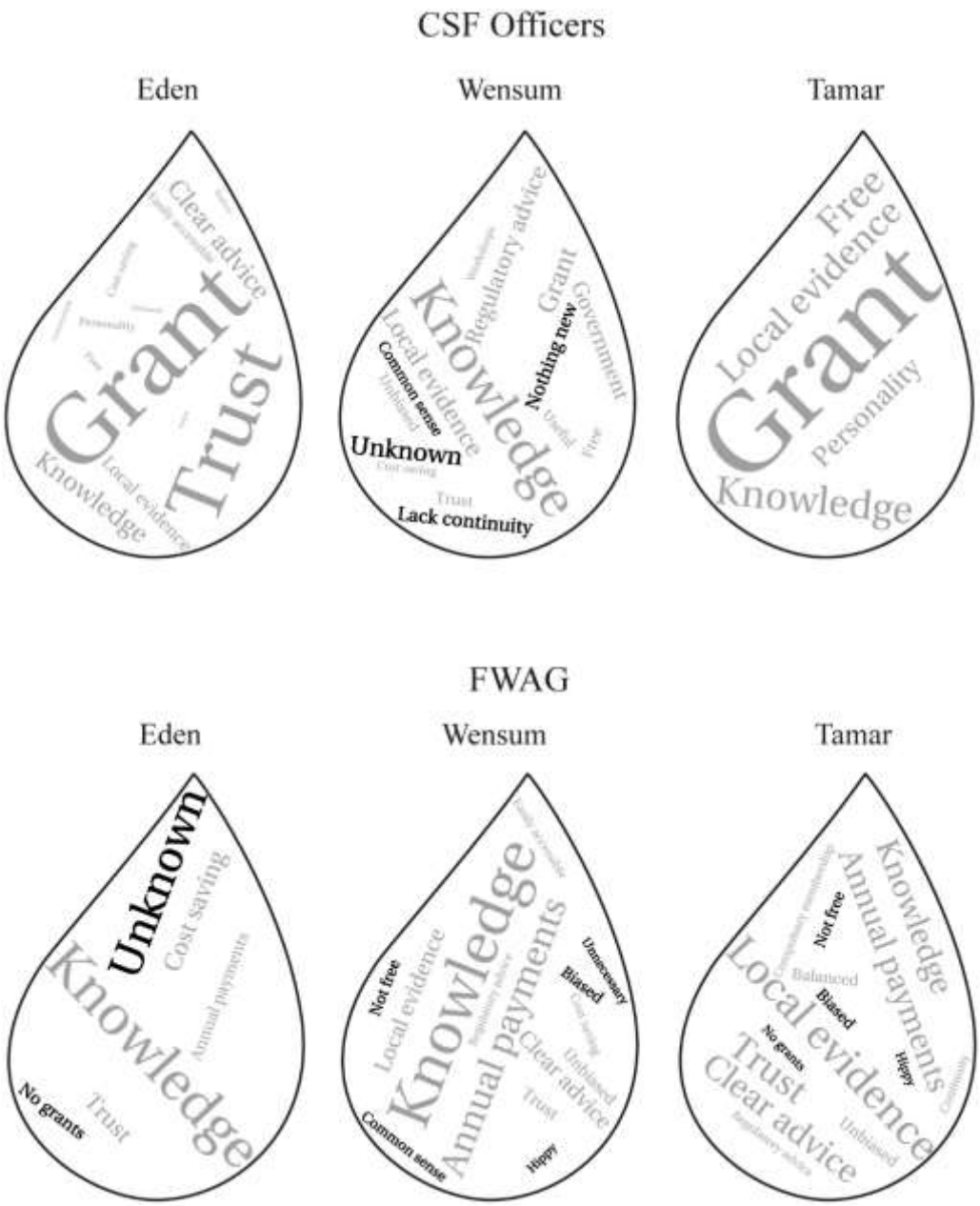

Figure 4. Word clouds representing the vocabulary used to describe CSF Officers and FWAG advisers by farmers in the three catchments.

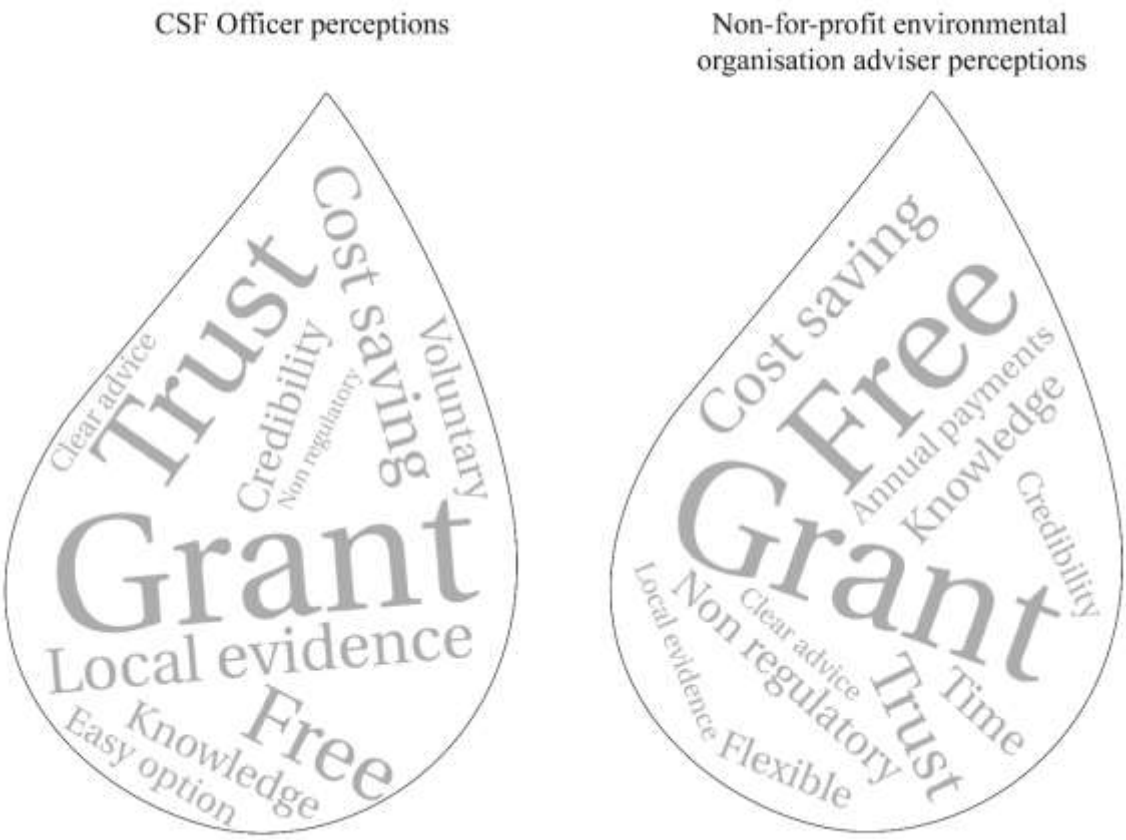

Figure 5. Vocabulary used by CSF Officers and Non-profit environmental organisation advisers when describing why they think farmers listen to their advice.