



UK Centre for  
Ecology & Hydrology

# UK-SCAPE WP2.2: Water Futures

## Stakeholder Questionnaire Results

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# Executive Summary

The overall aim of UK-SCAPE WP2.2: Water Futures is to deliver data and analyses showing how future climate change could influence water quantity and quality. We have a reasonable understanding of what stakeholders need from this work, from past experience working with various stakeholders and from previous workshops. However, it was decided to carry out an online survey, to get responses from as broad a range of existing and potential stakeholders as possible on a wide range of questions related to WP2.2.

A set of twelve questions was compiled, divided into three broad classes: **general questions** about the job role and level of experience of the respondents; **questions on data of interest** in categories such as water quantity, water quality, and potential evaporation, as well as alternative sources of climate projections and different future time-horizons; **questions on data format/access**, for which respondents were asked to rank the given options by their 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> preference. There was also a final question allowing respondents to provide any other comments or suggestions. The introduction page of the questionnaire provided context for the questions, including information about recent work both within UK-SCAPE WP2.2 and other projects.

The questionnaire was setup as a JISC Online Survey, and the responses were completely anonymous. The questionnaire was online from early September 2021 to the end of November 2021. An email invitation to complete the survey was sent to a distribution list of 38 contacts who we knew (or expected) had an interest in the impacts of climate change on rivers in the UK. A reminder email was sent a few weeks later. UKCEH also advertised the survey internally (Grapevine) and externally (Twitter). In addition, the UKRI-funded UK Climate Resilience (UKCR) Programme promoted the survey in their November newsletter and during some of their webinars.

The questionnaire results were downloaded on 2<sup>nd</sup> December 2021. There were a total of 41 respondents, although not all answered every question. There was a high initial response (after the email and tweet), a small number of responses after the reminder email, and more responses after the survey was promoted by the UK Climate Resilience programme. The median time taken to complete the survey was about 7 minutes.

The responses to the **general questions** showed a roughly even split in the job role of respondents, between Academic, Government/Regulator, and Practitioner/Consultant. The majority have previously worked a lot with data relating to river flows under climate change.

The responses to the **questions on data of interest** showed that there is a lot of interest in water quantity, including both river flows and soil moisture, with slightly less interest in water quality. There is a lot in interest in potential future changes in river flows, although slightly less so in changes in soil moisture or water quality, and there is a lot of interest in data from further flow projections, especially alternative UKCP18 products and alternative RCPs. There is more interest in near- rather than far-future time-horizons, although high interest in all horizons as well as in transient projections and projections relative to Global Mean Surface Temperature changes from pre-industrial. There is interest in potential evaporation data for a range of land covers, although less than for river flows. A number of respondents made extra data requests under several of these questions.

In terms of **data format**, more respondents overall expressed a preference for data for specific locations of their choosing, although more expressed a 1<sup>st</sup> preference for grids covering sub-regions or the whole country. However, the 1<sup>st</sup> preference varied by job role: 'Academic' respondents tended to have a 1<sup>st</sup> preference for grids covering the whole country, while 'Practitioner/Consultant' respondents tended to have a 1<sup>st</sup> preference for grids covering sub-regions, and 'Government/Regulator' respondents tended to have a 1<sup>st</sup> preference for data for specific locations of their choosing. In terms of **data access**, most respondents expressed a preference for a web-tool, with a large proportion also being happy downloading the full dataset as netcdf files from the Environmental Information Data Centre (EIDC). A web-tool tended to be the 1<sup>st</sup> preference regardless of the job role of the respondent.

The survey results will be used to guide the datasets produced in the remainder of UK-SCAPE WP2.2 (due to finish in March 2023), as well as by other projects and in potential follow-on work. In terms of data format, we would like to try to allow for the differing preferences of respondents with different job roles. In terms of data access, a large proportion of respondents were happy to download full datasets from the EIDC; there are already six such datasets from UK-SCAPE WP2.2 freely available for download. However, most respondents expressed a preference for a web-tool; the possibilities for this will be explored.

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# 1 Introduction

The overall aim of UK-SCAPE WP2.2: Water Futures is to deliver data and analyses showing how future climate change could influence water quantity and quality. We have a reasonable understanding of what stakeholders need from this work, from past experience working with various stakeholders and from previous workshops. However, it was decided to carry out an online survey, to try to get responses from a broader range of (existing and potential) stakeholders on a wide range of questions related to WP2.2.

## 2 The questionnaire

### 2.1 Questions

A set of twelve questions was compiled, divided into three broad classes:

- **General questions:** The first two questions aimed to get an idea of the background of the respondents, and their level of experience in the use of data on river flows under climate change.
- **Questions on data of interest:** The next six questions aimed to get an idea of the level of interest in various potential datasets, in categories such as water quantity, water quality, and potential evaporation, as well as the level of interest in various alternative sources of climate projections and different future time-horizons. These questions asked respondents to select between the following options; very interested, interested, not interested, not sure. Each question in this section also allowed respondents to add information about further datasets of interest to them (in a free text box).
- **Questions on data format/access:** The next two questions aimed to get an idea about preferences for data formats, and ways to access the data. These questions asked respondents to rank the given options by their 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> preference (they had to select three). A final question in this section allowed respondents to add information about any other preferences for data format/access (in a free text box).

There was also a final question allowing respondents to provide any other comments or suggestions (in a free text box).

The introduction page of questionnaire provided context for the questions, including information about recent work both within UK-SCAPE WP2.2 and other projects (see [Box 1](#)).

### 2.2 Distribution

The questionnaire was setup as a JISC Online Survey ([onlinesurveys.ac.uk/](https://onlinesurveys.ac.uk/)). This is an easy-to-use web-based tool for creating, distributing and analysing surveys. It was primarily designed for Academic Research, Education and Public Sector organisations, and has been used by over 300 different organisations in the UK and internationally. It is GDPR compliant and is certified to ISO 27001 standards. The responses to the survey were completely anonymous. The questionnaire was online from early September 2021 to the end of November 2021.

### **Box 1: The introduction page of the questionnaire**

UKCEH have a long history of investigating the **potential impacts of climate change on river flows** across Britain.

Within our NERC-funded National Capability programme UK-SCAPE ([ukscape.ceh.ac.uk](http://ukscape.ceh.ac.uk)), we have recently used the **UKCP18 Regional** projections [8] and a grid-based hydrological model to investigate potential future changes in **seasonal mean river flows** and **extreme high and low river flows** across **Great Britain** [2,7]. Similar analyses of river flows for **Northern Ireland** are currently under review. The simulated river flow data used for these analyses will be available from the EIDC [5,6]. Ongoing work is developing corresponding projections for variables related to **water quality**.

**Potential evapotranspiration** data derived from the UKCP18 Regional ensemble, for a short grass land-cover, have also been made available via EIDC [9], funded by the Hydro-JULES National Capability programme ([ceh.ac.uk/hydrojules](http://ceh.ac.uk/hydrojules)).

Other recent projects have used the **UKCP18 Global and Regional** projections to look at a range of indicators of flow change [1,3], and used the **UKCP18 Probabilistic** projections to look at changes in peak river flows for a range of future time-slices and emissions pathways [4].

We would like to assess the level of interest in these and other potential datasets, along with preferences for data formats and access, to enable us to add value for a wide range of stakeholders.

We would thus very much appreciate it if you could answer the following 12 questions, which should take at most 5 minutes to complete.

**Please feel free to forward this questionnaire to anyone who you feel may like to contribute.**

#### References:

[1] Arnell et al. (2021). Changing climate risk in the UK: a multi-sectoral analysis using policy relevant indicators. [doi:10.1016/j.crm.2020.100265](https://doi.org/10.1016/j.crm.2020.100265).

[2] Kay (2021). Simulation of river flow in Britain under climate change: baseline performance and future seasonal changes. [doi:10.1002/hyp.14137](https://doi.org/10.1002/hyp.14137).

[3] Kay et al. (2021a). Climate change effects on indicators of high and low river flow across Great Britain. [doi:10.1016/j.advwatres.2021.103909](https://doi.org/10.1016/j.advwatres.2021.103909).

[4] Kay et al. (2021b). Climate change impacts on peak river flows: combining national-scale hydrological modelling and probabilistic projections. [doi:10.1016/j.crm.2020.100263](https://doi.org/10.1016/j.crm.2020.100263).

[5] Kay et al. (2021c). Grid-to-Grid model estimates of river flow for Great Britain driven by UK Climate Projections 2018 (UKCP18) Regional (12km) data (1980 to 2080). NERC EIDC, [doi:10.5285/b7a98440-8742-40d5-a518-46dc6420416e](https://doi.org/10.5285/b7a98440-8742-40d5-a518-46dc6420416e).

[6] Kay et al. (2021d). Grid-to-Grid model estimates of river flow for Northern Ireland driven by UK Climate Projections 2018 (UKCP18) Regional (12km) data (1980 to 2080). NERC EIDC, [doi:10.5285/7079d6e8-6184-4f80-89b4-4db924ec8b05](https://doi.org/10.5285/7079d6e8-6184-4f80-89b4-4db924ec8b05).

[7] Lane & Kay (2021). Climate change impact on the magnitude and timing of hydrological extremes across Great Britain. [doi:10.3389/frwa.2021.684982](https://doi.org/10.3389/frwa.2021.684982).

[8] Murphy et al. (2018). UKCP18 Land Projections: Science Report. Met Office Hadley Centre, Exeter, UK.

[9] Robinson et al. (2021). Potential evapotranspiration derived from the UK Climate Projections 2018 Regional Climate Model ensemble 1980-2080 (Hydro-PE UKCP18 RCM). NERC EIDC, [doi:10.5285/eb5d9dc4-13bb-44c7-9bf8-c5980fcf52a4](https://doi.org/10.5285/eb5d9dc4-13bb-44c7-9bf8-c5980fcf52a4).

An email invitation to complete the survey was sent (on 7<sup>th</sup> September) to a distribution list of 38 contacts who we knew (or expected) had an interest in the impacts of climate change on rivers in the UK (see [Box 2](#)). A reminder email was sent a few weeks later (27<sup>th</sup> September), thanking those who had already responded and asking those who had not yet done so to respond if they could.

***Box 2: The email request***

**Email Title:** The impacts of climate change on rivers in the UK

**Email Text:**

Dear Sir/Madam,

We are contacting you as someone with an interest in the impacts of climate change on rivers in the UK.

We are asking for 5 minutes of your time to complete a survey, which will allow us to assess the level of interest in a range of possible related datasets, along with preferences for data formats and access. We would very much appreciate it if you could answer the survey questions via the link below, which is completely anonymous.

Many thanks in advance for your help, and please feel free to forward this request to anyone else who you feel may like to contribute.

Survey Link - [ceh-online-surveys.onlinesurveys.ac.uk/uk-scape-water-futures-stakeholder-questionnaire](https://ceh-online-surveys.onlinesurveys.ac.uk/uk-scape-water-futures-stakeholder-questionnaire)

Regards,

Marcia Spencer (on behalf on Alison Kay and Vicky Bell, UKCEH)

UKCEH also advertised the survey internally in Grapevine and externally on Twitter (8<sup>th</sup> September, see [Box 3](#)). In addition, the UKRI-funded UK Climate Resilience (UKCR) Programme promoted the survey in their [November newsletter](#) (23<sup>rd</sup> November) and during some of their webinars, including one on 24<sup>th</sup> November (see [Box 4](#)). The UKCR newsletter was originally due in mid-October but was delayed until November, so the end date of the survey was extended.



**Box 3: The tweet**



**UK Centre for Ecology & Hydrology @UK\_CEH** · Sep 8



Are you interested in impacts of climate change on UK hydrology? We'd like to assess interest in hydrological projections for future climates and associated datasets. Please take part in our short survey:

[ceh-online-surveys.onlinesurveys.ac.uk/uk-scape-water...](https://ceh-online-surveys.onlinesurveys.ac.uk/uk-scape-water-futures-stakeholder-questionnaire)


#UKSCAPE @NERCscience



**Box 4: The advert during a UKCR webinar**

FUTURE-DRAINAGE workshop on new climate uplifts and implications for surface water flooding



Wider News



**UKCEH Survey**

**The impacts of climate change on rivers in the UK**

As part of the UK Centre for Ecology & Hydrology's wider work on the impacts of climate change on river flows in the UK, an online questionnaire has been created to assess the level of interest in a range of possible related datasets, along with preferences for data formats and access. The survey should only take 5 minutes, and is completely anonymous.

**\*The survey closes on 30 November\***

Survey Link: <https://ceh-online-surveys.onlinesurveys.ac.uk/uk-scape-water-futures-stakeholder-questionnaire>

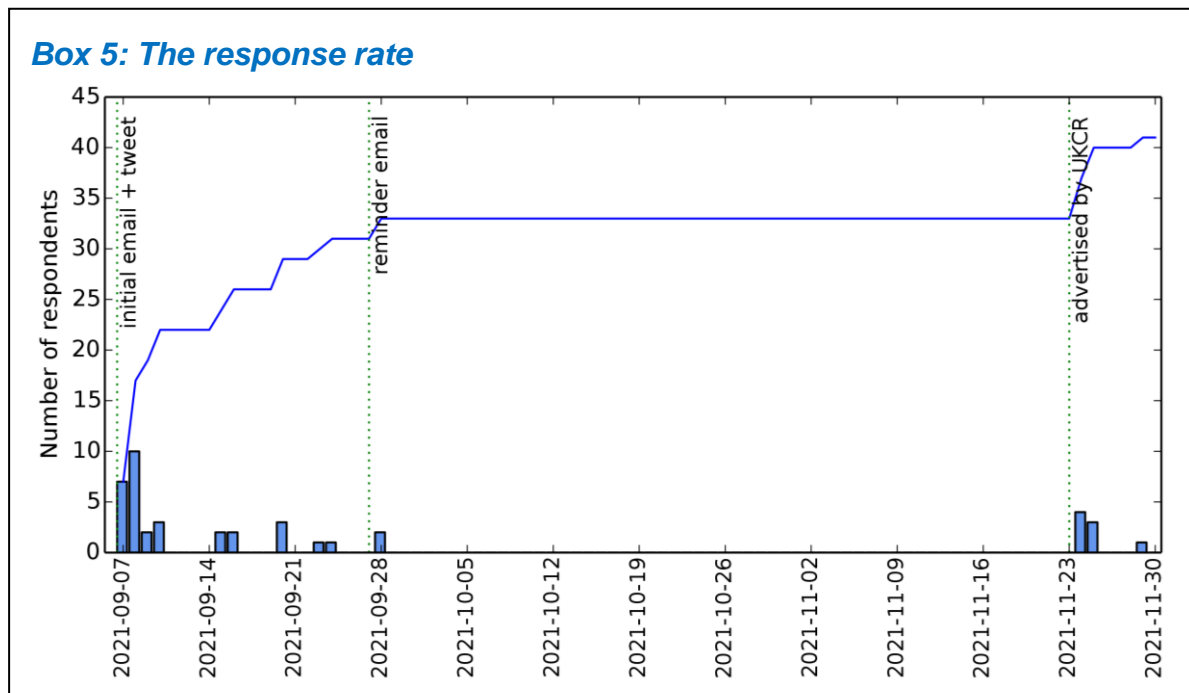
Powered by SurveyMonkey

### 3 The results

The questionnaire results were downloaded on 2<sup>nd</sup> December 2021. There were a total of 41 respondents, although not all answered every question.

The plot in [Box 5](#) shows the response rate, highlighting the high initial response (after the email and tweet), a small number of responses after the reminder email, and more responses after the survey was promoted by the UK Climate Resilience (UKCR) programme.

The median time taken to complete the survey was about 7 minutes.



The results for each question are summarised below.

**Q1. Which of the following best describes your job role?**

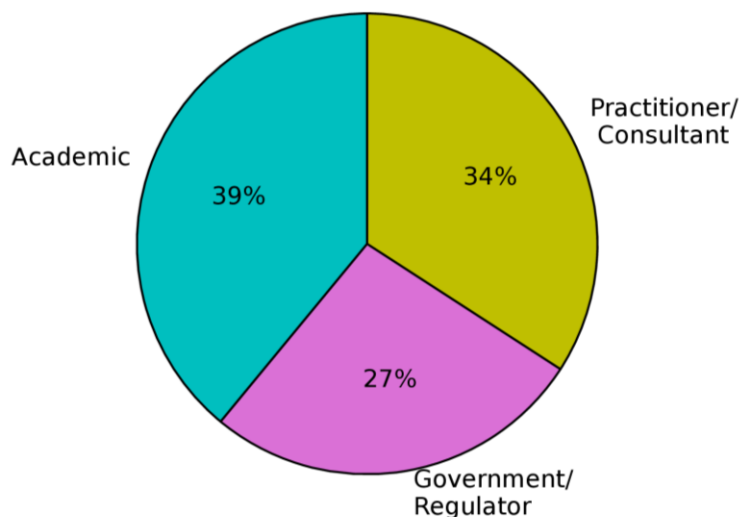
There was a roughly even split in the job role of respondents, between Academic, Government/Regulator, and Practitioner/Consultant (see [Box 6](#)). Note that four respondents provided text descriptions of their role, rather than selecting a pre-defined option. To simplify subsequent analyses, based on the descriptions provided, two were reclassified as 'Academic' and two as 'Government/Regulator'.

**Q2. Have you previously worked with data related to river flows under climate change?**

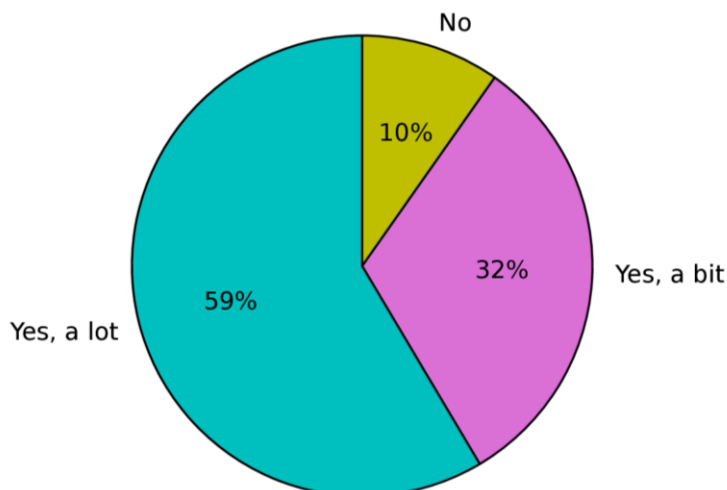
The majority of the 41 respondents have previously worked a lot with data relating to river flows under climate change (59%), with only 10% saying they have never worked with such data (see [Box 6](#)).

**Box 6: The results for Questions 1 and 2**

1. Which of the following best describes your job role?



2. Have you previously worked with data related to river flows under climate change?



**Q3. Which of the following variables related to water quantity are you interested in?**

There is a lot of interest in data on water quantity, including both river flows and soil moisture (see [Box 7](#)). Respondents to this question also asked for:

- *PET*
- *Rainfall, PET, soil moisture content daily time series*
- *Annual maximum flow (i.e. not mean), high frequency time series, POT series*
- *Summary statistics (i.e., Q5, Q10, Q95, median)*
- *15 min flows would be great*
- *Provided in relation to equivalent precipitation and abstraction data*
- *Time series of 15min data.*

**Q4. Which of the following variables related to river water quality are you interested in?**

There is slightly less interest in data on water quality (see [Box 7](#)), although respondents to this question also asked for:

- *Plastics, pharmaceuticals, legacy contaminants*
- *Chlorophyll (algae)*
- *Metaldehyde*
- *Pesticides*
- *Toxics.*

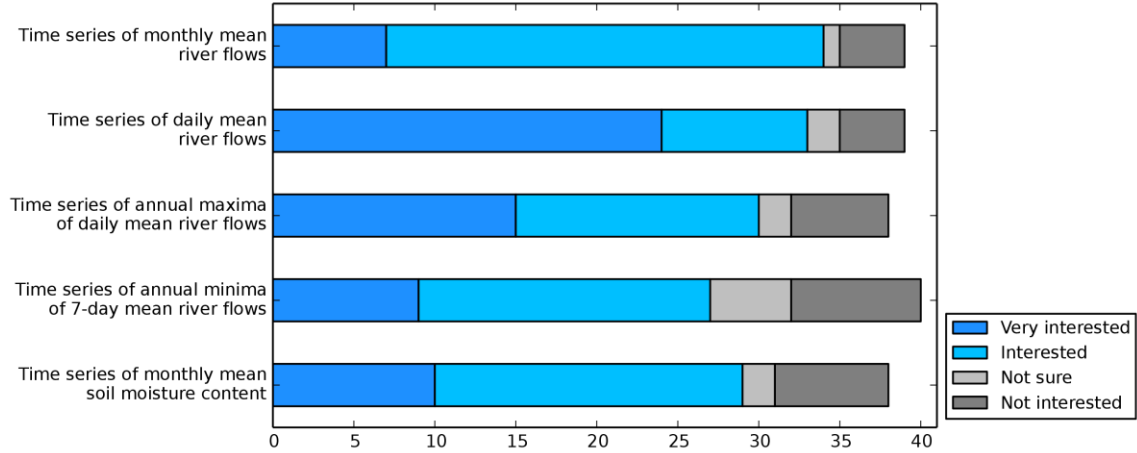
**Q5. Which of the following data related to future projections of river flows are you interested in?**

There is a lot in interest in potential future changes in river flows, although slightly less so in changes in soil moisture or water quality (see [Box 7](#)). Respondents to this question also asked for:

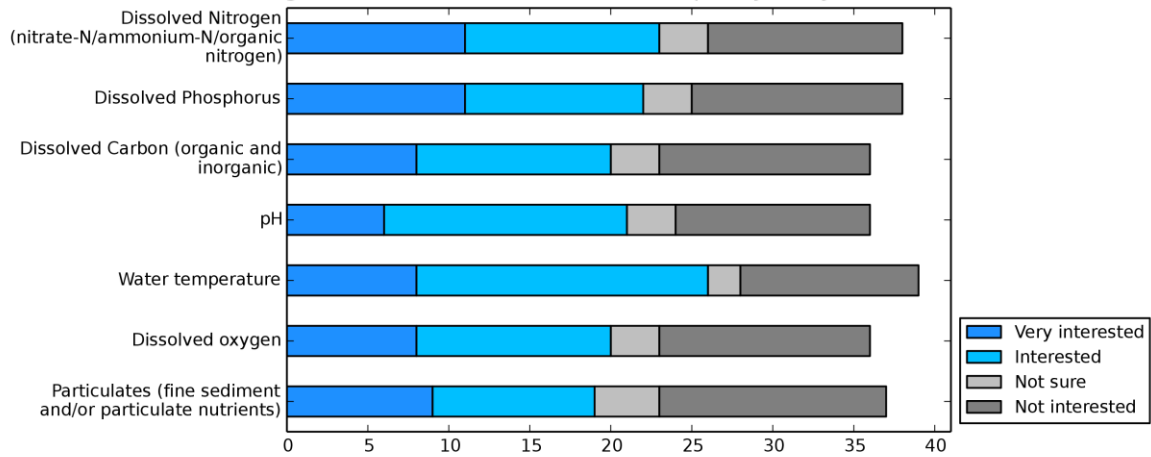
- *Effects on freshwater biodiversity and ecosystem processes.*
- *Provided in relation to equivalent potential future precipitation and water demand.*

**Box 7: The results for Questions 3-5**

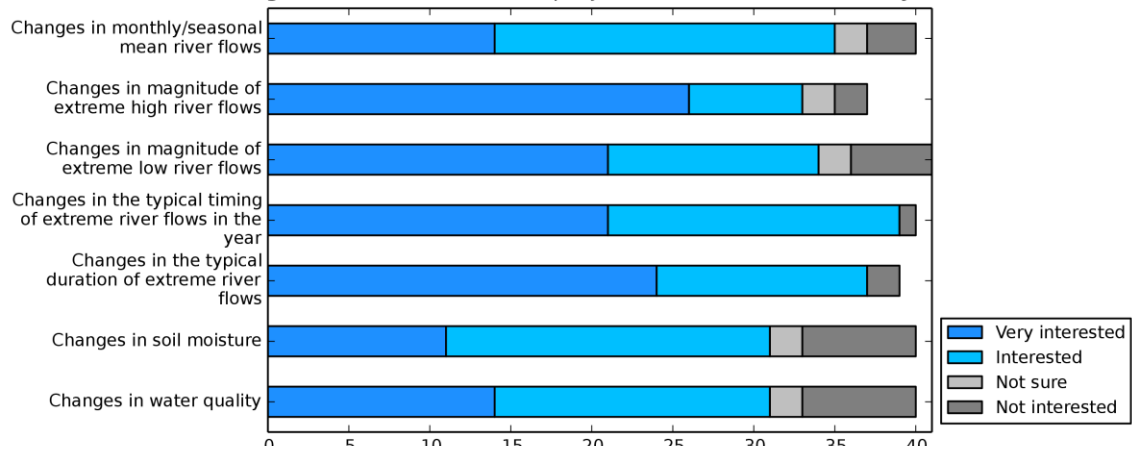
3. Which of the following variables related to water quantity are you interested in?



4. Which of the following variables related to river water quality are you interested in?



5. Which of the following data related to future projections of river flows are you interested in?



**Q6. Which of the following sets of flow projections are you interested in?**

There is a lot of interest in data from further flow projections, especially alternative UKCP18 products and alternative RCPs (see [Box 8](#)).

**Q7. Which of the following future time-horizons are you interested in?**

There is more interest in near- rather than far-future time-horizons, although high interest in all horizons as well as in transient projections and projections relative to Global Mean Surface Temperature changes from pre-industrial (see [Box 8](#)).

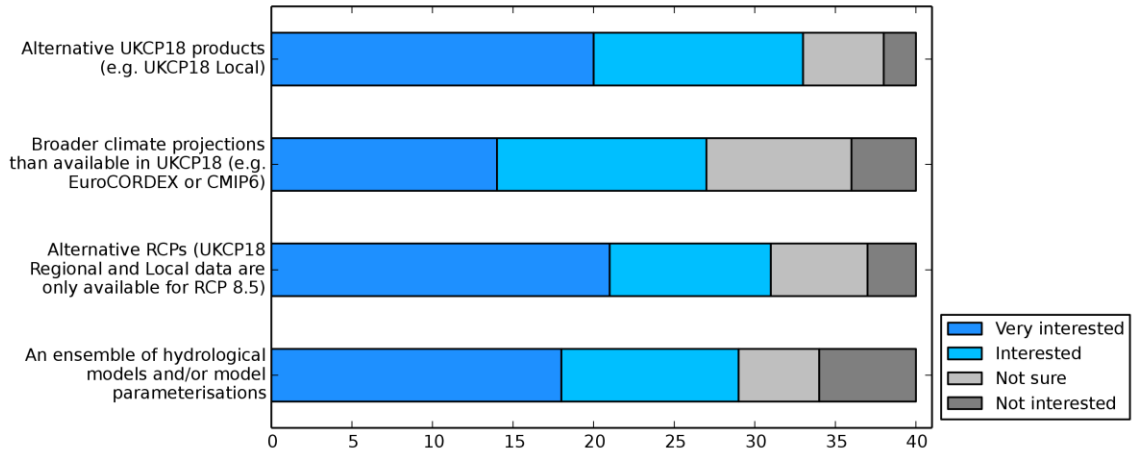
**Q8. Are you interested in potential evapotranspiration data for the following land covers?**

There is interest in potential evaporation data for a range of land covers, although less than for river flows (see [Box 8](#)). Respondents to this question also asked for:

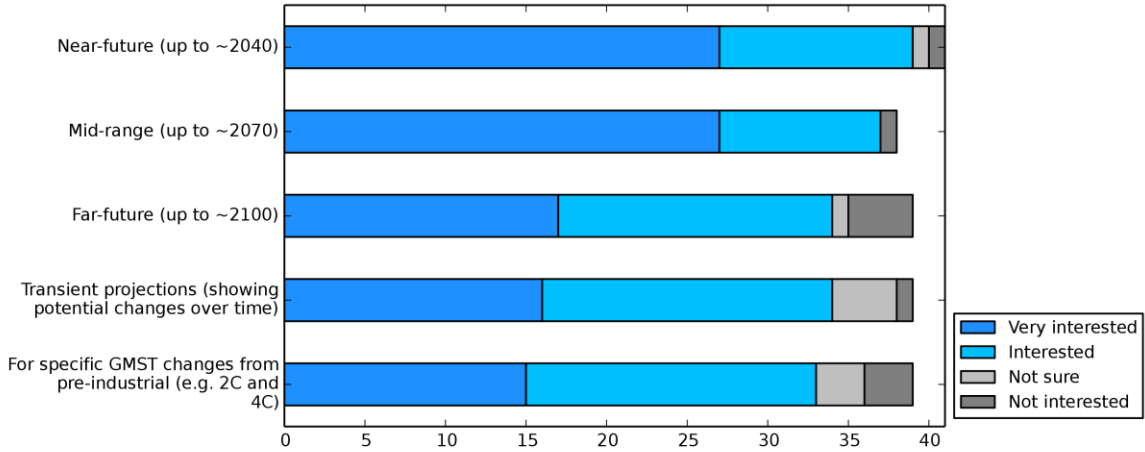
- *Bio fuel crops, current and future real land use.*
- *All major land cover types.*
- *Moorland.*
- *Heather moorland, blanket bog, wet heath, ericoid-rich and graminoid-dominated variants included.*

**Box 8: The results for Questions 6-8**

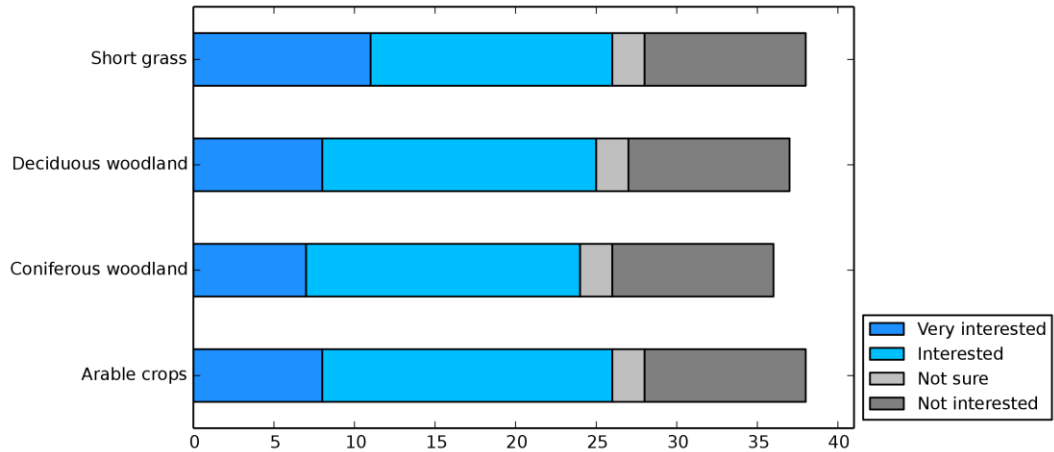
6. Which of the following sets of flow projections are you interested in?



7. Which of the following future time-horizons are you interested in?



8. Are you interested in potential evapotranspiration data for the following land covers?



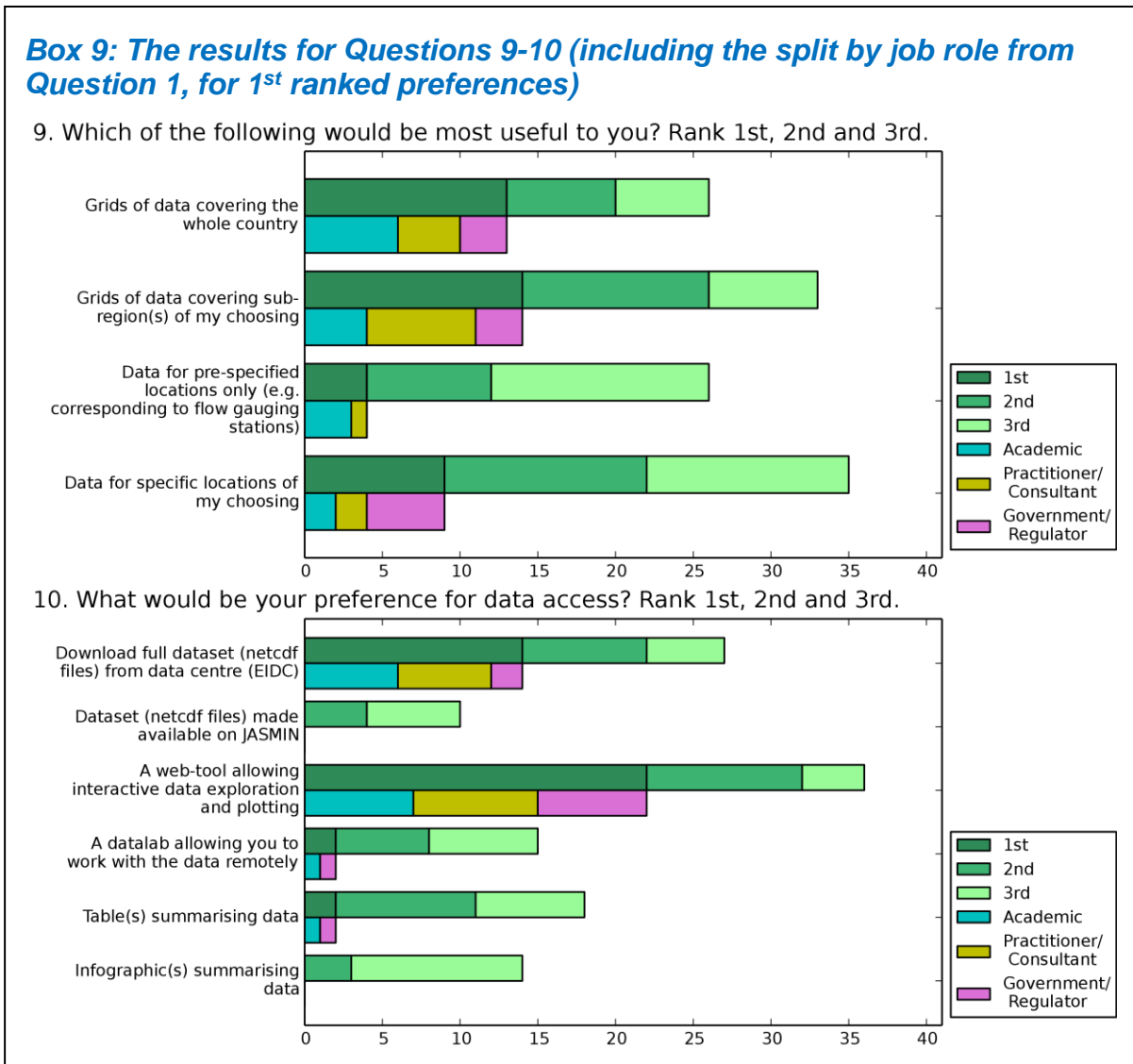
**Q9. Which of the following would be most useful to you?**

More respondents overall expressed a preference for data for specific locations of their choosing, although more expressed a 1<sup>st</sup> preference for grids covering sub-regions or the whole country (see [Box 9](#)).

However, the 1<sup>st</sup> preference varied by the job role of the respondent (from Q1). ‘Academic’ respondents tended to have a 1<sup>st</sup> preference for grids covering the whole country, while ‘Practitioner/Consultant’ respondents tended to have a 1<sup>st</sup> preference for grids covering sub-regions, and ‘Government/Regulator’ respondents tended to have a 1<sup>st</sup> preference for data for specific locations of their choosing.

**Q10. What would be your preference for data access?**

Most respondents expressed a preference for a web-tool, with a large proportion also being happy downloading the full dataset as netcdf files from the Environmental Information Data Centre (EIDC; see [Box 9](#)). A web-tool tended to be the 1<sup>st</sup> preference regardless of the job role of the respondent (from Q1).





**Q11. Do you have any other preferences for data format or access?**

Respondents to this question asked for:

- *API*
- *For it to be useable for us we need the data to be available under OGL, if not the time taken to resolve licensing is longer than the time it takes us to use the data. The licensing conditions have to allow commercial use e.g. by developers and consultants.*
- *Ideally need datasets for specified areas, e.g. water resource zone, river catchment.*
- *Data cookie-cut to National Park boundaries.*

**Q12. Do you have any other comments or suggestions?**

Respondents to this question said:

- *This would be an incredibly useful resource - please can we have it!*
- *I am particularly interested in data at a Scotland wide scale and more detailed data for specific research catchments. We value the dataset that are made available via UKCEH/UK-SCAPE. Thank you.*
- *Access to the rainfall and PET data is critical to allow water companies and regulators to run their own models.*
- *Changes in runoff?*
- *Thank you for consulting everybody!*
- *Clarification of the cost of any data and its current availability would be very useful.*
- *An understanding of potential impacts of C:N ratios on meta vegetation change.*
- *Access to all river stretches, not just at gauging stations.*

## 4 Conclusions

The survey results will be used to guide the datasets produced in the remainder of UK-SCAPE WP2.2 (due to finish in March 2023), as well as by other projects and in potential follow-on work.

In terms of data format, we would like to try to allow for the differing preferences of respondents with different job roles. In terms of data access, a large proportion of respondents were happy to download full datasets as netcdf files from the EIDC. There are already six datasets from UK-SCAPE WP2.2 freely available for download from the EIDC, along with short grass potential evaporation data for the UKCP18 Regional ensemble (produced by Hydro-JULES) – see Appendix 1. However, most respondents expressed a preference for “a web-tool allowing interactive data exploration and plotting”; the possibilities for this will be explored.

## 5 Acknowledgements

Thanks to UKCEH colleagues Ali Rudd, Rosie Lane, Matt Brown and Nick Reynard for comments on early drafts of the questionnaire, and Jan Dick for comments on the draft report.

## 6 Appendices

### *Appendix 1: Datasets on EIDC*

Kay, A.L., Rudd, A.C., Davies, H.N., Lane, R.A. and Bell, V.A. (2021). Grid-to-Grid model estimates of river flow for Great Britain driven by observed data (1980 to 2011). NERC Environmental Information Data Centre. doi:10.5285/2f835517-253e-4697-b774-ab6ff2c0d3da.

Kay, A.L., Rudd, A.C., Davies, H.N., Lane, R.A. and Bell, V.A. (2021). Grid-to-Grid model estimates of river flow for Northern Ireland driven by observed data (1980 to 2011). NERC Environmental Information Data Centre. doi:10.5285/f5fc1041-e284-4763-b8b7-8643c319b2d0.

Kay, A.L., Rudd, A.C., Davies, H.N., Lane, R.A. and Bell, V.A. (2021). Grid-to-Grid model estimates of soil moisture for Great Britain and Northern Ireland driven by observed data (1980 to 2011). NERC Environmental Information Data Centre. doi:10.5285/c9a85f7c-45e2-4201-af82-4c833b3f2c5f.

Kay, A.L., Rudd, A.C., Davies, H.N., Lane, R.A. and Bell, V.A. (2022). Grid-to-Grid model estimates of river flow for Great Britain driven by UK Climate Projections 2018 (UKCP18) Regional (12km) data (1980 to 2080) v2. NERC Environmental Information Data Centre. doi:10.5285/18be3704-0a6d-4917-aa2e-bf38927321c5.

Kay, A.L., Rudd, A.C., Davies, H.N., Lane, R.A. and Bell, V.A. (2022). Grid-to-Grid model estimates of river flow for Northern Ireland driven by UK Climate Projections 2018 (UKCP18) Regional (12km) data (1980 to 2080) v2. NERC Environmental Information Data Centre. doi:10.5285/76057b0a-b18f-496f-891c-d5b22bd0b291.

Kay, A.L., Rudd, A.C., Davies, H.N., Lane, R.A. and Bell, V.A. (2022). Grid-to-Grid model estimates of soil moisture for Great Britain and Northern Ireland driven by UK Climate Projections 2018 (UKCP18) Regional (12km) data (1980 to 2080). NERC Environmental Information Data Centre. doi:10.5285/f7142ced-f6ff-486b-af33-44fb8f763cde.

Robinson, E.L., Kay, A.L., Brown, M., Chapman, R., Bell, V., Blyth, E.M. (2021). Potential evapotranspiration derived from the UK Climate Projections 2018 Regional Climate Model ensemble 1980-2080 (Hydro-PE UKCP18 RCM). NERC Environmental Information Data Centre. doi:10.5285/eb5d9dc4-13bb-44c7-9bf8-c5980fcf52a4.



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