crynodeb gwyddoniaeth

Asiantaeth yr Amgylchedd Cymru
Environment Agency Wales

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Asesiad effaith ar wlyptiroedd: ffocws ar Faterion Hydrolegol a Hydroddaearegol. Adroddiad Cam 2

Crynodeb Gwyddoniaeth SC020072

Bydd staff Asiantaeth yr Amgylchedd yn gwneud asesiadau effaith ar wlyptiroedd am amrywiaeth o resymau gan gynnwys tynnu dŵr daear a rheoli perygl llifogydd. Nod y prosiect hwn oedd i wella ein dealltwriaeth cysyniadol o systemau gwlyptir, ac i adolygu'r dulliau a'r arfau priodol ar gyfer asesu effeithiau anthropogenig ar wlyptiroedd. Mae'r ymchwil yn cynnwys gwlyptiroedd dŵr croyw ac ardaloedd yn y gorlifdir, ond nid yw'n cynnwys ardaloedd ar yr arfordir.

Mae tri cham pwysig yn bodoli ar gyfer gwneud asesiad: sefydlu dealltwriaeth gysyniadol gychwynnol: profi a mireinio'r ddealltwriaeth gysyniadol; a darogan canlyniadau effeithiau hydrolegol.

Gellir cynorthwyo'r ddealltwriaeth gysyniadol drwy deipoleg 11-plyg syml o wlyptir, wedi'i seilio ar leoliad y dirwedd. Mae hyn yn help i roi trefn ar syniadau ac yn nodi ym mha ddulliau posibl y mae dŵr yn mynd i mewn i ac yn gadael y gwlyptir (e.e. glawiad, anweddiad, gollyngiad dŵr daear, all-lif wyneb).

Mae datblygu dealltwriaeth gysyniadol yn broses ailadroddol oherwydd bod gwybodaeth ynghylch y safle'n datblygu drwy arsylwadau, monitro, dadansoddi a modelu rhifol. Pob tro y gwneir pethau'r eildro, caiff dealltwriaeth gysyniadol ei rhoi ar brawf drwy ei chymharu â'r data sydd ar gael.

Gellir gwirio dosbarthiad cychwynnol drwy ddefnyddio arf syml, megis amcangyfrif o gydbwysedd dŵr y gwlyptir. Os yw'r mewnbynnau a'r allbynnau'n cydbwyso (os digwydd newid o ran faint a storir o fewn y gwlyptir) yna mae hyn yn helpu i gadarnhau'r ddealltwriaeth gysyniadol.
Mae'r anhawster a geir wrth fesur rhai mecanweithiau trosglwyddo dŵr yn golygu y gall mewnbynnau ac allbynnau beidio â chydbwyso'n union bob amser: mae'r cydbwysedd dŵr yn dderbyniol os yw'r gweddill yn dod fewn gwall mesur. Os yw'r anghydbwysedd yn sylweddol, hwyrach bydd yn rhaid ailystyried dealltwriaeth gysyniadol.
Fel bod y ddealltwriaeth gysyniadol yn datblygu, mae angen iddi gael ei rhoi ar brawf drwy ddefnyddio arfau mwy cymhleth a data mwy manwl. Mae arfau cymhleth yn cynnwys modelau hydrolig llif wyneb, megis ISIS a modelau dŵr daear megis MODFLOW. Mae meini prawf ar gyfer dewis y model cywir yn cynnwys:

- Gall y model gynrychioli effeithiau megis tynnu dŵr?
- A ellir cyflunio'r model er mwyn cynrychioli'r ddealltwriaeth gysyniadol o'r gwlyptir?
- A all y model rhagweld newidiadau perthnasol yn y gwlyptir, megis lefel y dŵr yn y pridd?
- A yw digon o ddata ar gael, neu a ellir eu casglu o fewn cyfyngiadau amser a chyllid y prosiect?

Hyd yn oed os yw safleoedd yn debygol o fod angen model rhifol cymhleth, mae'n ddoeth i ddechrau gydag arfau syml. Gellir arbed amser ac arian os yw'n digwydd nad yw'r asesiad angen dadansoddiad mwy cymhleth. Mae'r agwedd hon hefyd yn galluogi i sicrwydd ansawdd data gael ei werthuso.

science summary

Asiantaeth yr Amgylchedd Cymru
Environment Agency Wales

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SCHOXXXXXXXX-B-P

Impact assessment of wetlands: focus on hydrological & Hydrogeological Issues. Phase 2 report

Science summary SC020072

Environment Agency staff undertake wetland impact assessments for a variety of reasons including groundwater abstraction and flood risk management. This project set out to improve our conceptual understanding of wetland systems, and to review the appropriate methods and tools for assessing anthropogenic impacts on wetlands. The research includes freshwater wetlands and floodplain areas, but excludes coastal areas.

There are three major steps for undertaking an assessment: establishing an initial conceptual understanding; testing and refining the conceptual understanding; and predicting consequences of hydrological impacts.

The conceptual understanding can be aided by a simple 11-fold typology of wetland, based on landscape location. This helps structure ideas and identifies the possible ways in which water enters and leaves the wetland (e.g. rainfall, evaporation, groundwater discharge, surface outflow).

Developing a conceptual understanding is an iterative process as knowledge of the site develops through observations, monitoring, analysis and numerical modelling. At each iteration, current conceptual understanding is tested by comparison with available data.

Initial classification can be checked using a simple tool, such as a water balance calculation of the wetland. If the inputs and outputs balance (given a change in storage within the wetland) then this helps confirm the conceptual understanding. The difficulty of measuring some water transfer mechanisms means that inputs and outputs may not always balance precisely: the water balance is acceptable if the residual is within measurement error. If the imbalance is significant, conceptual understanding may need to be revised.

As the conceptual understanding develops, it needs to be tested using more complex tools and more detailed data. Complex tools include surface flow hydraulic models, such as ISIS and groundwater models, such as MODFLOW. Criteria for selecting the right model include:

- Can the model represent impacts such as abstraction?
- Can the model be configured to represent the conceptual understanding of the wetland?
- Can the model predict relevant changes in the wetland, such as soil water level?
- Are sufficient data available, or can they be collected within the time and funding constraints of the project?

Even if sites are likely to need a complex numerical model, it is advisable to start with simple tools. Time and money can be saved if the assessment turns out not to need more complex analysis. This approach also enables data to be quality assured.

Three levels of data collection are identified and uncertainty is usually reduced as more information is collected.

- A desk study: using topographical and geological maps, and discussions with staff who know the site.

- A site visit: viewing the site, taking photographs, talking to local people, undertaking simple field investigations such as soil augering
- Monitoring the site: using dip wells, piezometers, ditch water level recorders, making soil physical measurements, such as hydraulic conductivity

Once an acceptable level of conceptual understanding is reached, tools may be used to predict, for example, changes in wetland water level, for a given surface or groundwater abstraction rate.

Recommendations for future work include:

- Developing procedures for assessing the hydrological impact of wetlands;
- Applying a range of simple and complex models to a set of wetlands where good data exist;
- Producing a field manual for quantifying water transfer mechanisms, including ease and cost of application and reliability of results.
- Trialling the typology based on landscape location and water transfer mechanisms using examples of wetlands across England and Wales to assess its utility for developing conceptual understanding of wetland hydrology;
- Researching the impact of internal water management within wetlands including mitigation measures;
- Developing methods for incorporating short-term records of wetland hydrology into a longer perspective by comparing with longer term river flow or groundwater data;
- Studying wetland evaporation, by: producing a database of existing evaporation measurements; developing guidelines for estimating evaporation from different instruments/data sets; and establishing new measurement studies from wetlands not previously monitored.

This summary relates to information from Science Project SC020072 reported in detail in the following output(s):-

Science Report: SC020072/SR
Title: Impact assessment of wetlands: focus on hydrological & Hydrogeological Issues. Phase 2 report

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