

General

1. What is FOOTPRINT SUGAR?

FOOTPRINT SUGAR (SUrface water / GroundwATER contRiBution index) is an innovative index which tells you whether water falling on a particular zone mostly contributes to groundwater recharge (i.e. infiltrating areas) or to discharge to surface water.

2. Is FOOTPRINT SUGAR based on modelling?

No, FOOTPRINT SUGAR is based on measured data only! The information which is used to compute the index is:

- i) altitudes in the form of a DTM (Digital Terrain Model);
- ii) a surface water network (this gives you the location of rivers and streams across a given region); and
- iii) the spatial distribution of Standard Percentage Runoff (SPR) values which are attached to FOOTPRINT soil types.

3. What is the Standard Percentage Runoff (SPR)?

The Standard Percentage Runoff (SPR) provides an indication of the propensity of soils to transfer water to nearby streams in a catchment. SPR is based on the examination of the response of streams to rainfall events occurring on the catchment. Initially developed in the UK, the method has been extended and validated at the EU level recently. A SPR value is attached to each FOOTPRINT soil types.

4. What are FOOTPRINT soil types (FSTs)?

FOOTPRINT soil types are a classification of soils in Europe according to the way water and agricultural pollutants such as pesticides are transferred through soil profiles.

5. How do you compile FOOTPRINT SUGAR?

The concept is simple. You first use the Digital Terrain Model to reconstruct a synthetic surface water network (in essence, you say that water moves in the landscape through low-lying points). You then compare your synthetic surface water network and the real one (i.e. that measured in the field) and you work on the differences between the two networks. Say that based on differences in altitudes, you've assumed that there should be water flowing in a particular location, but there is no river observed: it means that water must have infiltrated before reaching the low-lying point and you are in an infiltrating zone. Since this methodology is based on differences in altitudes, it was no surprise that early versions of FOOTPRINT SUGAR were found to under-perform for areas or countries which are relatively flat. To address this, we integrated in the calculations information on the propensity of soils to transfer water to nearby streams in a catchment (the Standard Percentage Runoff or SPR). This information is attached to each FOOTPRINT soil type.

6. How does FOOTPRINT SUGAR relate to the IDPR index which has been used in France and a number of other EU countries (e.g. Slovenia)?

FOOTPRINT SUGAR is partly based on the concepts implemented in IDPR. The main difference between IDPR and SUGAR is the integration of information on water pathways in soil through the Standard Percentage Runoff.

7. What do the colours correspond to?

FOOTPRINT SUGAR values vary from 0 to 100. A value of 0 (darkest red) means that the water in this particular area is contributing almost exclusively to groundwater recharge through infiltration, i.e. there is no transfer to river. These conditions are



usually found in karstic areas where the water quickly infiltrates in the karstic system. Note that the karstic groundwater system may be in contact to surface waters through springs and resurgences. A value of 100 (darkest green) means that the water is contributing exclusively to the surface water network and there is no infiltration to groundwater systems. These conditions are usually found in zones covered by wetlands.

8. [Has the work being published yet?](#)

A paper is currently being drafted by FOOTPRINT partners.

9. [Does FOOTPRINT SUGAR fill a gap in knowledge?](#)

We were unable to source an EU-wide hydro(geo)logical map at the beginning of FOOTPRINT in 2006. FOOTPRINT SUGAR is the response of the consortium in view of this lack of knowledge.

10. [Do you consider any kind of information related to permeabilities in the calculation of FOOTPRINT SUGAR?](#)

No, not directly. The permeabilities are reflected to some extent in the SPR values, but we don't have to feed permeabilities to calculate FOOTPRINT SUGAR. This is clearly a strength of the index.

11. [Is FOOTPRINT SUGAR a qualitative or quantitative index?](#)

Good question. We consider the index to be qualitative, but somebody might demonstrate as part of a validation exercise that it can be used quantitatively.

12. [Which datasets were used to generate the national data offered for download on the FOOTPRINT web site?](#)

The FOOTPRINT SUGAR data offered for download was based on the 3 following datasets:

- i) the 1:1,000,000 DCW river network dataset;
- ii) the SRTM 90 m x 90 elevation dataset; and

III) the FOOTPRINT agro-environmental scenarios dataset (1:1,000,000 scale).

13. [Why didn't you use better resolved datasets?](#)

Because we wanted to generate an EU-wide consistent dataset. The three datasets mentioned above are the best EU-wide datasets to our knowledge. Trials were undertaken with national datasets for surface water network, but these were found to lead to great differences in results between the various EU countries due to heterogeneity in the resolution and detail of national datasets.

14. [How can I access the data?](#)

By clicking on the blue box at the bottom of this page.

Known limitations

1. [Does FOOTPRINT SUGAR work better/worse in some countries than in others?](#)

Yes. Since FOOTPRINT SUGAR is partly based on differences in altitudes, we expect the performance of FOOTPRINT SUGAR to be less in relatively flat countries such as the Netherlands or Belgium, although we've done our best to address the issue by integrating the SPR component of the FOOTPRINT soil types in the calculations.

2. [Why do you provide FOOTPRINT SUGAR maps for individual countries rather for the entire EU?](#)

To avoid any misuse of FOOTPRINT SUGAR. See point below.

3. [Can I compare FOOTPRINT SUGAR across large areas?](#)
FOOTPRINT SUGAR does NOT account for climatic differences. A given shade of colour in say Spain and Denmark may therefore not represent the same contribution to groundwater recharge or discharge to surface water.
4. [Are man-made features such as canals accounted for in FOOTPRINT SUGAR?](#)
No! Please note that this is likely to lead to inaccuracies in areas where the influence of man on the local hydrology is significant.
5. [What is wrong in Norway, Sweden and Finland?](#)
The SRTM dataset which is used in FOOTPRINT SUGAR only partly covers those countries as it extends to 60° north only. We can therefore provide FOOTPRINT SUGAR maps for limited areas in these countries. If you have a full DTM for these 3 countries, we would be interested in hearing from you.
6. [Why don't you provide any data for Cyprus, Iceland, Malta, Turkey?](#)
Because we are lacking soil information for these four countries which are not covered by the FOOTPRINT soil types which are derived from the EU Soil Geographic Database of Europe.

Applications

1. [Will FOOTPRINT SUGAR be used in the FOOT tools?](#)
Yes. FOOTPRINT SUGAR will be used in FOOT-CRS (the FOOTPRINT tool operating at the catchment scale) and FOOT-NES (the FOOTPRINT tool operating at the national scale).
2. [Can I use FOOTPRINT SUGAR for application unrelated to pesticides?](#)
Yes, sure. FOOTPRINT SUGAR is an hydro(geo)logical index, it does not relate to pesticides specifically. It can in particular be used in risk assessments for nitrate, industrials, veterinary medicines, etc.
3. [What are the possible uses of FOOTPRINT SUGAR in the field of pesticides?](#)
The data can be used in many different ways. In the case of pesticides, they can be used to:
 - i) design or optimise monitoring strategies;
 - ii) identify areas of special interest for protection of surface water and/or groundwater;
 - iii) assess groundwater vulnerability (e.g. by combining SUGAR with depth to aquifer, pollutant usage, etc.);
 - iv) provide more realistic assessments of GW vulnerability in the field of pesticides, by combining predicted pesticide loss at 1-m depth with SUGAR. This is what we do in FOOT-CRS and FOOT-NES.
4. [Can FOOTPRINT SUGAR be produced for catchments?](#)
Yes. In fact, the methodology was first developed for catchment-scale applications.
5. [Can I generate FOOTPRINT SUGAR myself?](#)
Our initial plan was to fully automate the production of FOOTPRINT SUGAR and to distribute automated tools for everyone to use. Unfortunately, it became apparent that

expertise is still required in the running of the automated toolbox.

6. **Can you generate highly resolved FOOTPRINT SUGAR maps for us?**

Yes, possibly. You'll need to forward us the following information: a DTM of the region under study, a drainage network dataset and a FOOTPRINT soil map. We can help you produce a FOOTPRINT soil map from an existing soil map or you can produce it yourself using the FOOTPRINT soil decision tree which will be released by the end of 2008. All datasets should be loaded in a GIS software.

7. **Is there a cost associated with the production of highly resolved FOOTPRINT SUGAR maps (e.g. for catchment scale applications)?**

Yes. The EU funding for FOOTPRINT paid for the production of the series of maps offered for download. Any additional work on FOOTPRINT SUGAR is beyond the EU funding and will be subject to a charge.

8. **How much would it cost?**

Please contact us through aeru@herts.ac.uk to have an estimate of the cost associated with your requirements. The costs are dependent on the size of your study area, the quality of your datasets, the availability of a FOOTPRINT soil map for your area.

Evaluation aspects

1. **Has FOOTPRINT SUGAR being validated?**

Yes and no. FOOTPRINT SUGAR has not benefited from a detailed validation study, but our initial work in this area shows that FOOTPRINT SUGAR performs well across Europe.

First, the FOOTPRINT SUGAR approach relies on the combination of methodologies which have been used in a number of countries in the past and which have been validating. The IDPR index has been used extensively in France for the last 10 years to quickly identify infiltrating zones across the landscape and has been shown to perform adequately across the country. The IDPR index was also developed for other countries (e.g. Slovenia) where it gave satisfaction. The SPR index was initially developed on the basis of an examination of measured responses of streams to rainfall events in the UK. The concept was recently extended and evaluated for the entire EU (Schneider M.K., Brunner F., Hollis J.M. & Stamm C. 2007. Towards a hydrological classification of European soils: preliminary tests of its predictive power for the base flow index using river discharge data. Hydrology and Earth System Sciences, 11:1-13.)

Beyond the fact that FOOTPRINT SUGAR combines validated methodologies, the index was found to fit well with preconceptions of FOOTPRINT experts in hydro(geo)logy regarding the distribution of areas contributing to groundwater recharge and discharge to surface water in various countries (France, The UK, Germany, Denmark, Italy).

The maps produced are also found to fit closely with geological maps for various countries, although no information regarding geology is fed into the calculations.

2. **How can FOOTPRINT SUGAR be validated?**

This has been the subject of much discussion within FOOTPRINT. Our best suggestions at this stage are:

- i) the use of chloride data in boreholes, in combination with information on loads;
- ii) the comparison of FOOTPRINT SUGAR maps against hydro(geo)logical maps where available.

Credits and conditions of use

1. Who's behind SUGAR?

A team of FOOTPRINT scientists, including Vincent Mardhel (BRGM, France), Delphine Allier (BRGM, France), Anker Hojberg (Denmark, France), John Hollis (Independent consultant, UK) and Igor Dubus (FOOTPRINT/BRGM, France).

2. Who's behind FOOTPRINT?

A team of EU scientists originating from 15 partner organisations representing 9 countries. The project is coordinated by Dr Igor Dubus.

3. Why do you make FOOTPRINT SUGAR available for free through the project web site?

FOOTPRINT is a research project which aims at being really useful to those involved in risk assessment for agricultural pollutants, and especially pesticides. We believe that FOOTPRINT SUGAR is innovative and does fill a gap in our knowledge of water transfers in EU landscapes. If FOOTPRINT SUGAR is useful to us, why not make all benefit from it?

4. What are the conditions of use?

FOOTPRINT SUGAR in the form of national maps are provided for free. The only thing we ask is that i) the FOOTPRINT project is acknowledged every time you use or present FOOTPRINT SUGAR (see below), and ii) the EU funding of the project is acknowledged explicitly.

5. How can I provide a proper acknowledgement in a report or publication?

Until our FOOTPRINT SUGAR paper is accepted for publication, use the following reference: FOOTPRINT (2008). FOOTPRINT SUGAR, the SURface water / GroundwATER contRibution index. Produced as part of the EU-funded FOOTPRINT project SSPI-CT-2005-022704. <http://www.herts.ac.uk/aeru/footprint/tools/sugar.htm>.

6. How can I provide a proper acknowledgement in a Powerpoint presentation?

Please put the FOOTPRINT logo (which is available from the [FOOTPRINT website](#)) and the URL of the project web site (www.herts.ac.uk/aeru/footprint) on your slide(s).

7. How can I provide a proper acknowledgement on a FOOTPRINT SUGAR map?

Please put the FOOTPRINT logo and the URL of the project web site (www.herts.ac.uk/aeru/footprint) on your maps.

Help / Support / FAQ / Contacts

1. Will FOOTPRINT SUGAR be supported in the long term?

Yes, the index will be supported by the FOOTPRINT support group.

2. I've got a question which does not appear in the FAQ section. What do I do?

Contact us and we'll add your question to the section.

3. How can I contact you?

All enquiries should be directed to aeru@herts.ac.uk.

4. How can I keep aware of the latest developments in FOOTPRINT?

By visiting the [FOOTPRINT website](#) on a regular basis, and contacting the FOOTPRINT team to subscribe to the FOOTPRINT announcement list.