

FOOTPRINT

Functional **T**ools for **P**esticide
Risk Assessment and
Management

**FOOT-FS: Overview &
Demonstration**



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FOOTPRINT Meeting 22 November 2007, Barza d'Ispra, Italy



What is FOOT-FS?



- > FS = **F**arm-**S**cale
- > Objective: To provide a farm-scale software package to assess pesticide losses and ecotoxicity risks.
- > Users: Could be farmers, but more likely to be consultants, researchers and others who want to explore scenarios at the farm and field level



- > Farm-scale perspective...



Farm-Scale Perspective



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FOOT-FS Software



- > The main function is to provide a Field Risk Assessment to identify losses via drift, drainage, run-off & erosion, and leaching
- > Acknowledge point-sources are important, but cannot be quantified, so a standalone best practice audit accompanies the field risk assessment.

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Risk Assessment



- > Activity (application of pesticides)
- > Analysis (model fate and transport)
- > Assessment (ecotoxicity)
- > Risk interpretation (low, moderate, high risk)
- > Mitigation options



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Field Risk Assessment



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Field Risk Assessment: Components



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Field Risk Assessment: Data



- > **Equipment:** sprayers, nozzles, drift mitigation potential
- > **Products:** pesticide brands, active substances, proportions, formulations, rates and dates of application
- > **Climate:** rainfall, temperature, etc. - climate zone
- > **Landscape:** Windbreaks (size and type), Water bodies (type, dimensions, distance from field)
- > **Land management:** e.g. buffer zones
- > **Crop:** type
- > **Soil:** Potentially 1 of 900+ possibilities

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Field Risk Assessment: Data Management



- > The general approach has been to minimise and simplify data input and management
- > This has been achieved by:
 - grouping the input data into common 'reusable' blocks of data (programmes and scenarios)....

Assessment	Data
	- Brand 1 - 1/1/07 - 1 l/ha - Brand 2 - 1/1/07 - 1 l/ha etc. - Wheat - Clay - Zone 1 - Sprayer X etc.

Traditional Approach

Assessment	Pesticide Programme X	Data Products Rates Dates
	Field Scenario Y	Data Crop Soil Climate
	Equipment Z	Data Sprayer Nozzle

FOOT-FS Approach

- keeping the user interface relatively simple where possible

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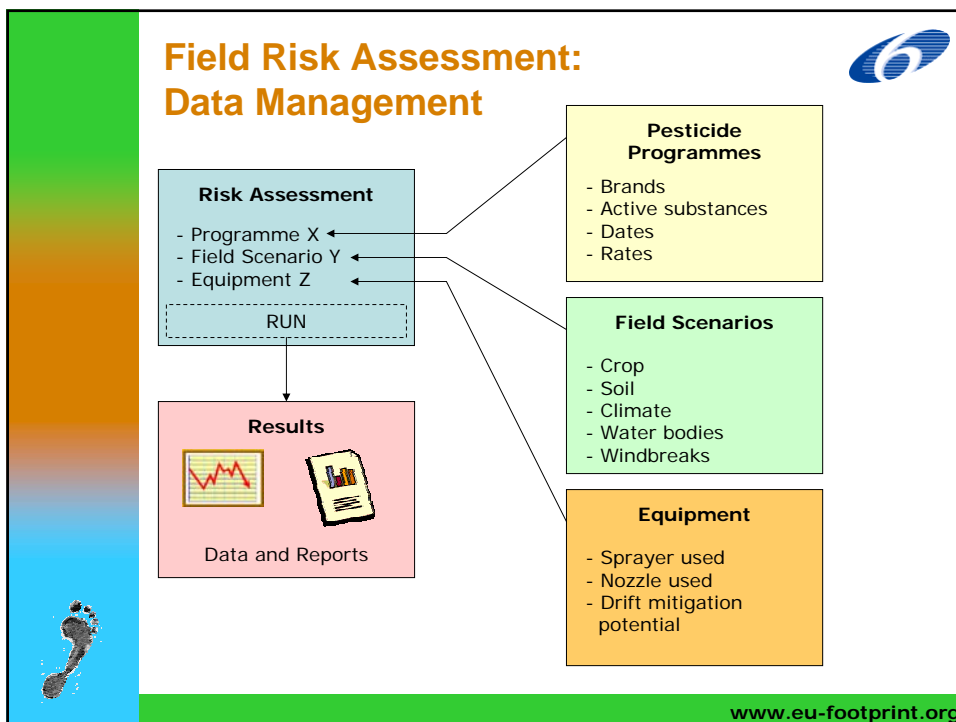
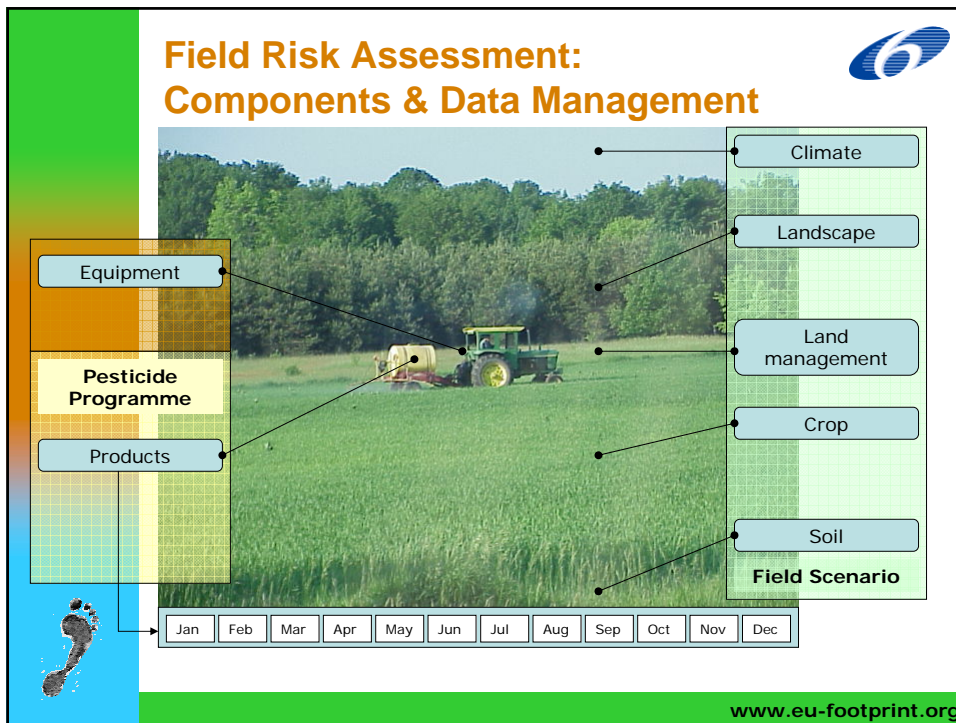


Field Risk Assessment: Components & Data Management



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Pesticide programme builder Brands database



> Build up a database of pesticide products / 'brands' and each brand has:

- name, active substances & concentrations
- e.g. Venzar Flo, contains lenacil 69.9 g/l and phenmedipham 95 g/l
- This type of information is available on the label of the product...



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Example Pesticide Product Label



PULL HERE TO OPEN ▶

ZAPPIT[®]

DX

Herbicide

Postemergence Herbicide for Control of Perennial and Annual Grass Weeds

Active ingredient:
Fluazifop-P-butyl
Butyl (R)-2-[4-[5-(trifluoromethyl)-2-pyridinyl]oxy]
phenoxy]propanoate*.....24.5%

Other ingredients.....75.5%

Total.....100.0%

* Zappit DX herbicide contains 200 g (+) isomer (fluazifop-P-butyl) per litre
Contains petroleum hydrocarbons

KEEP OUT OF REACH OF CHILDREN.
CAUTION

EU Reg. No. 200-007
EU Est. 01707-2B-07
Product of United Kingdom
Formulated in the USA
SCP 007B-MOM 1234

10 litres
Net Contents

*Friendly
Chem Ltd.*

Active
substance

Concentration
of active in
brand

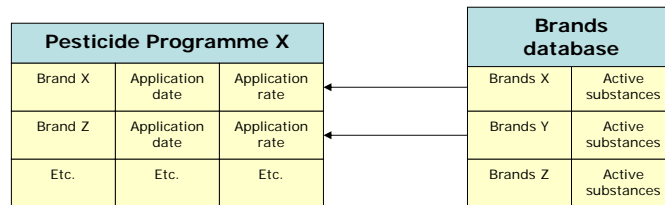


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Pesticide programme builder



- > Then build pesticide programmes using the 'brands' database as resource



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Example: Pesticide Programme X



Pesticide brands (products) applied, with date and rate of application:

Product Applied	Date of application	Field Application rate
Sting ECO	1 st February	3.0 l/ha
Pyramin DF	15 th March	1.7 kg/ha
Venzar Flo	6 th April	0.4 l/ha
Betanal Progress	21 st April	0.75 l/ha
Debut	21 st April	30 g/ha
Venzar Flo	21 st April	0.4 l/ha
Agriguard Clopyralid	21 st April	0.5 l/ha
Flusilade	23 rd April	0.5 l/ha
Goltix WG	5 th May	1.7 kg/ha
Agriguard Clopyralid	5 th May	0.5 l/ha

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Example: Pesticide Programme X



Converted to amounts of active substance:

Product Applied	Date of application	Active substances & concentration	Actual field rate
Sting ECO	1 st February	Glyphosate 120g/l	0.36 l/ha
Pyramin DF	15 th March	Chloridazon 65% w/w	1.1 kg/ha
Venzar Flo	6 th April	Lenacil 66.9g/l Phenmedipham 95g/l	26.8 g/ha 38 g/ha
Betanal Progress	21 st April	Ethofumesate 128g/l Phenmedipham 62g/l Desmedipham 16g/l	96 g/ha 46.5 g/ha 12 g/ha
Debut	21 st April	Triflurosulfuron-methyl 50% w/w	15 g/ha
Venzar Flo	21 st April	Lenacil 66.9g/l Phenmedipham 95g/l	26.8 g/ha 38 g/ha
Agriguard Clopyralid	21 st April	Clopyralid 200 g/l	0.1 kg/ha
Flusilade	23 rd April	Fluazifop-P-butyl 250 g/l	0.42 l/ha
Goltix WG	5 th May	Metamitron 70% w/w	1.2 kg/ha
Agriguard Clopyralid	5 th May	Clopyralid 200 g/l	0.1 kg/ha



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Field Scenario Builder



> Firstly, create a farm and associated fields

> Then for each field, enter:

- Field size and crop (select from a list)
- Soil type (electronic flowchart/questionnaire)
- Climate zone ('clickable' map)
- Windbreaks (data entry screen)
- Water bodies (data entry screen)

(these can be set the same for all fields or differently for each field)

> Each field is a single scenario



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Example Field Scenario Y



- > Field size: 3ha
- > Crop: Sugar Beet
- > Soil Type: O22i
- > Climate zone: 2 (temperate maritime climate)
- > Windbreak: 3m wide, evergreen hedge
- > Water Body: River, 20m from crop, 5m wide, 2m deep, running along 50m of the field edge

Note: Land management options, e.g. buffer zones, grass strips are still to be added

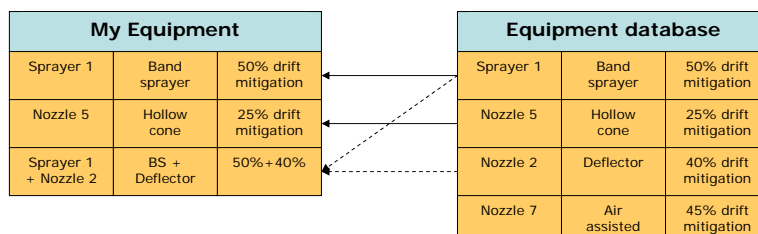


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My Equipment



- > The user creates a database of the equipment that is available
- > Then builds a list to use when constructing the risk assessment, known as “My equipment”, which can include sprayer/nozzle combinations



Note: The “My Equipment” list is intended to provide a short list of those items typically used by the user, as potentially the equipment database could become large, especially if a list of available sprayers and nozzles are distributed with the software.



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Example: Equipment used

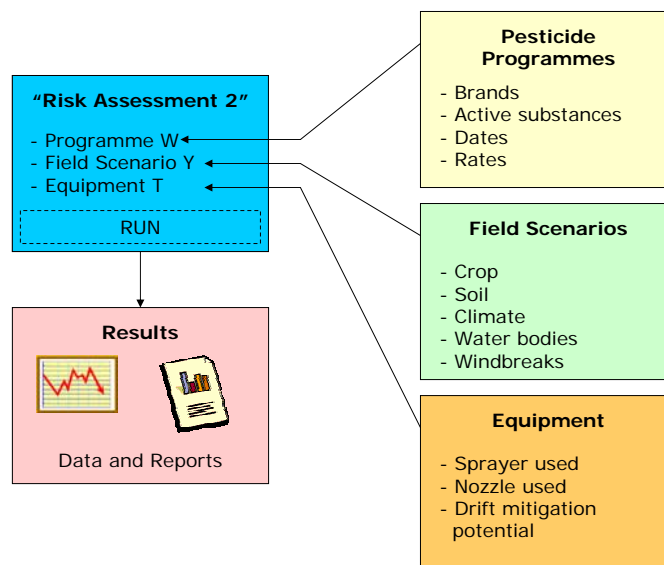


Pesticide Programme X:

Product Applied	Date of application	Sprayer	Nozzle
Sting ECO	1 st February	Sprayer 1	Nozzle 5
Pyramin DF	15 th March	Sprayer 1	Nozzle 5
Venzar Flo	6 th April	Sprayer 1	Nozzle 5
Betanal Progress	21 st April	Sprayer 1	Nozzle 2
Debut	21 st April	Sprayer 1	Nozzle 2
Venzar Flo	21 st April	Sprayer 1	Nozzle 2
Agriguard Clopyralid	21 st April	Sprayer 1	Nozzle 2
Flusilade	23 rd April	Sprayer 1	Nozzle 5
Goltix WG	5 th May	Sprayer 1	Nozzle 2
Agriguard Clopyralid	5 th May	Sprayer 1	Nozzle 2

My Equipment		
Sprayer 1	Band sprayer	50% drift mitigation
Nozzle 5	Hollow cone	25% drift mitigation
Sprayer 1 + Nozzle 2	BS + Deflector	50%+40%

Field Risk Assessment

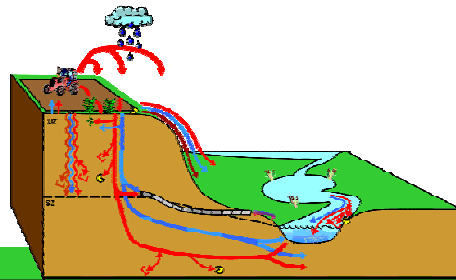


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The Risk Assessment Fate and Transport



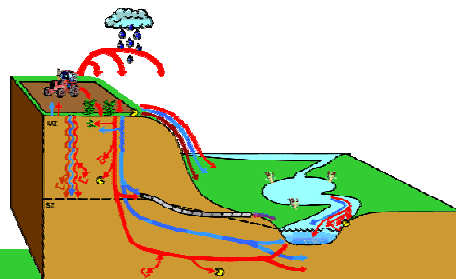
- > Drift
(currently operational with real data)
- > Drainage
(currently operational with dummy data)
- > Run-off & Erosion
(currently operational with dummy data)
- > Leaching to groundwater
(not operational)



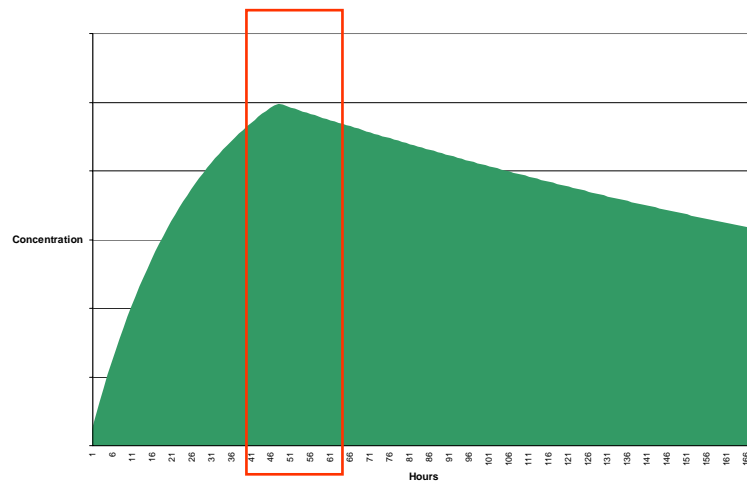
Predicted Environmental Concentrations - PECs



- > Inputs from drift, drainage and run-off/erosion
- > Use STEPS 3 to calculate PEC
- > Time weighted average to obtain the 24 hour period (during 7 days - 168 hours) with the highest concentration...



Predicted Environmental Concentrations - PECs



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Ecotoxicity



> The PECs and data from the pesticide properties database are then used to calculate Toxicity Exposure Ratios (TERs) for:

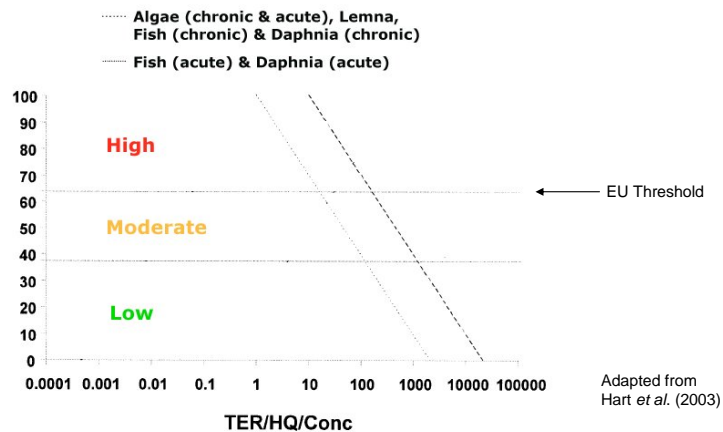
- Fish (acute)
- Fish (chronic)
- Invertebrates (acute)
- Invertebrates (chronic)
- Algae (acute)
- Algae (chronic)
- Aquatic plants



Risk Interpretation



> TERs are converted to a risk score and risk band for each taxa using the following:



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Risk Interpretation



> General approach for the results/interpretation screen:

- summary screen / overview
- more detailed information and analysis
- 'raw' output data

> Currently:

- Exploring ideas
- We have risk alerts (high and moderate) for each taxa for each active substance applied
- Results can be displayed in a number of ways
- Display screens still under development, but have some prototypes working and other ideas under development for communicating risks

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Interpretation/Results



- > At a summary level we have a simple indicator bar for each active substance applied, based on the number of **low**, **moderate** and **high** ecotoxicity risk alerts generated:



- > Another idea is to use icon alerts for different taxa when moderate or high alerts are triggered, e.g.:



Fish



Invertebrates



Algae



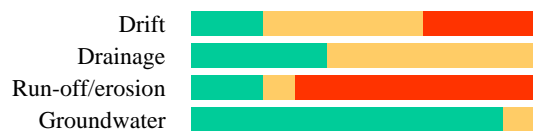
Plants

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Interpretation/Results



- > Currently, no overall 'indicator' of risk for all the pesticides applied to a field
- > Not a single score, as this can hide risks
- > A risk profile may be one option, e.g.



- > This can show the key pathways that are presenting a risk

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Interpretation/Results



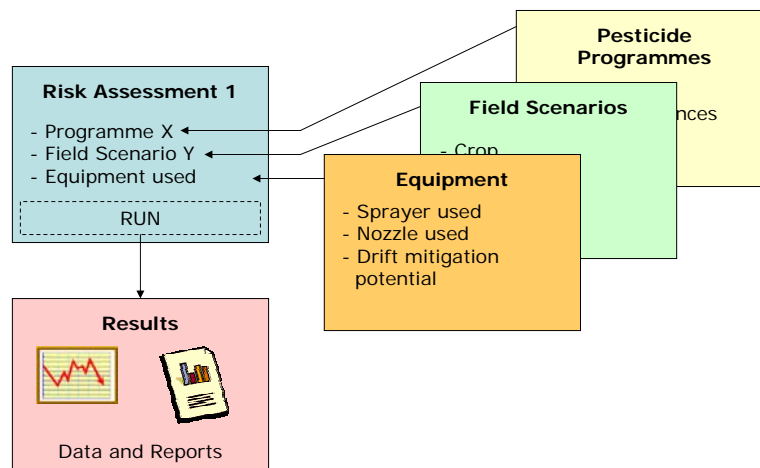
> There is the facility for users to 'drill down' to more detailed fate and ecotox data:

- Fate data (losses via different pathways) and concentrations
- Toxicity Exposure Ratios
- Risk scores

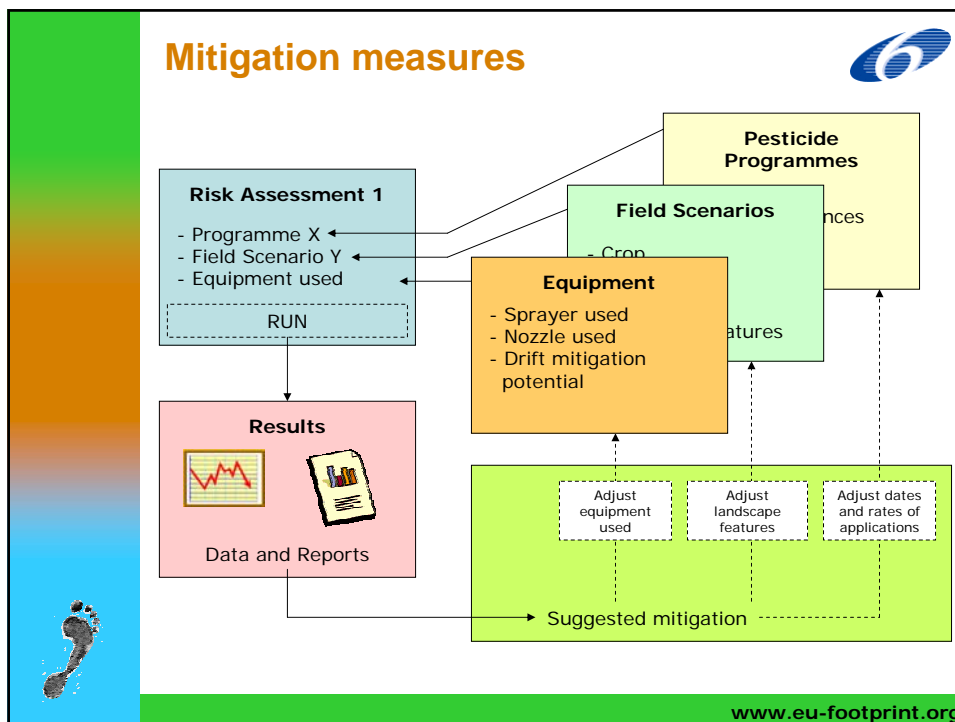


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Mitigation measures



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- ## Bringing it all together: The FOOT-FS Shell
- > My Data (data management)
 - Pesticide programme builder
 - Field scenario builder
 - My equipment
 - Data manager (import and export facility)
 - > FOOT-FS Assessments
 - Open, edit and run risk assessments
 - View results and risk interpretation
 - Explore mitigation options
 - > Toolbox
 - Point-source pollution audit
 - Pesticide Properties Database (PPDB)
 - ~~Bigfoot~~ MACRO
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FOOT-FS Demonstration



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To conclude

- > It is a work in progress, so is subject to change
- > We welcome thoughts, comments and suggestions - the 'wish list' is now open
- > Please send any comments to:

aeru@herts.ac.uk



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