Final report

for the CORE Organic II funded project

‘ProPIG’

Farm specific strategies to reduce environmental impact by improving health, welfare and nutrition of organic pigs

Christine Leeb and ProPIG Consortium
(List of partners and contributors see page 2 and 3)

Period covered: 1.11.2011-31.3.2015

Project acronym:	ProPIG			
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Post project summary suitable for web publication

ProPIG consists of 9 partners in 8 countries (AT, CH, CZ, DE, DK, FR, IT, UK) with the aim to assess and improve animal welfare and environmental impact of organic pig farming:

- **Three husbandry systems**: indoor with outside run (IN) / partly outdoor (POUT) / outdoor (OUT) were defined and compared.
- **Standard Operating Procedures ('SOPs')** were created for Feed- and Soil Sampling and the process of assessment and feedback ('Health and welfare planning').
- **Animal welfare assessment protocols** were developed based on WelfareQuality® and CorePIG. Together with questions regarding environmental impact, nutrition and economy these were integrated into an
- **Automated Recording and Feedback Software Tool** ('PigSurfer'= PIG **SUR**veillance, **FE**edback and **R**eporting), a software tool enabling on-farm data collection and immediate feedback (including presentation of data as benchmarking) using a tablet computer.
- **Farm visits**: After repeated **observer training**, three visits were carried out, in AT (16 farms), DE (16), DK (11) CH (9), CZ (1), FR (4), IT (9) and UK (8). During the first visit the farmer was interviewed, animals assessed, medicine and productivity records collected and feed and soil samples taken. Results were discussed with each farmer and farm specific goals and measures were agreed during the second visit. Using 'PigSurfer' during the final visit, it was possible to assess animal health, welfare, nutrition and feed the results back immediately to farmers as 'farm plans' including benchmarking across all 74 pig farms.

As a result **two practical tools** for further use by farmers and advisors were created:

- A 'Catalogue of improvement strategies' (COIS) for animal welfare challenges was developed based on expert opinion as well as farmers strategies. This was transferred into a '**Handbook for Farmers'**, a hard cover ring-binder, allowing practical application on farm.
- Furthermore a '**Decision support tool for environmental impact'** ('EDST') was created in the form of an interactive spreadsheet, which identifies areas of possible improvement regarding environmental impact through a structured questionnaire, suggests measures which might be beneficial and provides information on where to find more detailed resources.

Generally based on the parameters assessed, it was shown, that a high level of **animal health and welfare** was found in most farms, with a few parameters which should be improved across all systems (e.g. vulva deformation from previous injury in sows). When comparing the three husbandry systems, OUT weaners and fatteners had better health regarding respiratory problems and diarrhoea and OUT sows less MMA and lameness, with POUT having some advantages as well over IN (e.g. lameness of sows). Regarding productivity, losses of piglets did not differ across systems; mortality of IN fattening pigs was lower than in POUT and their feed conversion rate was better.

Life Cycle Assessment (LCA) of global warming potential (GWP) was influenced mainly by feeding of fattening pigs and variation within a husbandry system was higher than between systems, indicating that good values can be achieved in all systems.

Regarding **acidification potential** (AP) **POUT** were better than IN and regarding **eutrophication potential** (EP) POUT were better than OUT.

Three clusters were identified on the basis of environmental impact, a 'high, 'medium' and 'lower' with similar numbers of each husbandry system in all three of them.

The three systems did not differ regarding **N balances.** After clustering, N import from feed purchase was identified as main influencing factor. IN were significantly lower than POUT/OUT regarding **P balances**.

No significant relationship between health, welfare and environmental impacts was found when comparing the LCA clusters with an 'animal health and welfare score' ('%GOOD'), individual animal based parameters or correlations between AP/EP/GWP and the '%GOOD.

Farm specific strategies were evaluated by farmers' opinion and assessing within-farm improvement in measured criteria over 12 months. The median number of aims per farm was 2 (1 to 4), with fertility, nutrition, health and lesions most commonly addressed. In total 74.8 % of measures were partly/completely implemented and 81.6 % of goals were partly/completely achieved.

Pre-project summary

Robust and competitive organic pig production needs to encompass low environmental impacts and good animal health and welfare. In theory, improving animal health and welfare reduces environmental impacts through decreased medicine use, improved growth rates and feed conversion efficiency. However, as data on environmental impacts are scarce, the extent of such improvement has never been verified on working farms.

In organic pig production, health and welfare improvements must be implemented through preventive approaches, optimal disease management and innovative systems regarding outdoor areas. This poses a challenge to the farms. Together, organic regulations, different national welfare regulations and different building traditions have promoted the development of a variety of housing systems, outdoor rearing and management strategies across the EU. The relative environmental impacts of these have not been quantified. This diversity offers real potential to aid improvement, if the 'best' can act as role models for others, which might be more effective than adapting practice derived from experimental systems. This project includes data recording on organic pig farms, calculations of nutrient balances and Life Cycle Assessment for several contrasting scenarios and the development and evaluation of farm specific improvement strategies.

At the beginning of the project, husbandry systems will be defined, (e.g. outdoor / partly outdoor / indoor with outside run). After development of on-farm assessment protocols, a cross-sectional survey and a prospective cohort study will be carried out on about 25 farms of each system across eight different European countries. Environmental impacts will be assessed using both Life Cycle Assessment and calculations of nutrient balances at farm and outdoor area level. Animal health and welfare will be evaluated from outcome measures of clinical scoring and selected behavioral parameters. Results will be fed back to farmers as benchmarking reports, based on which the farmer will decide farm specific goals and strategies to achieve these. As an outcome, all farms create their individual health, welfare and environmental plan, which will be reviewed after one year to allow continuous development.

The relationship between health, welfare and environmental impacts will be examined using factor analysis and multiple correspondence analyses. Thereby, farms can be grouped based on common housing and management characteristics, and groups be compared regarding outcome parameters. Furthermore, the effect of farming system on health, welfare and environmental impact will be assessed with multivariate models, taking into account the climatic conditions. The farm specific strategies will be evaluated by assessing within-farm improvement in measured criteria over 12 months. Dissemination activities will include the development of a decision support tool for improvement of environmental impact and a summary of successful improvement strategies (codes of practice). These will be presented as a booklet and training material for organic pig farmers and advisors, which will be introduced during national courses.

The proposed project will take a holistic approach and combine several key objectives: management of outdoor areas, disease prevention, optimizing nutrition and innovative interacting strategies for improvement to support extension services.

1. Main results, conclusions and fulfilment of objectives

1.1 Summary of main results and conclusions

During ProPIG on-farm data were collected twice from 74 organic pig farms regarding health, welfare, productivity, feeding, economy and environmental impact using specifically developed Software (PigSurfer). These detailed data were used to implement strategies for improvement on all involved farms based on 'farm reports' including benchmarking. Furthermore this information together with scientific expertise and farmers experience contributed to the development of a 'Handbook for Farmers' and an 'Environmental Decision Support Tool' (EDST), which are now available for pig farmers across Europe. Additionally the data collected were analysed to compare the three main husbandry systems of organic pigs in Europe (indoor, partly outdoor, outdoor) regarding environmental impact, animal health and welfare and their interaction.

ProPIG consists of 9 partners from 8 countries (AT, CH, CZ, DE, DK, FR, IT, UK), building on the previous CoreOrganic project 'CorePIG' consortium but with a different partner in DE and expanded to include the Czech Republic (2 partners: Bio-I and IAS). Sweden (JTI), who was originally a partner (and WP leader) in ProPIG, had to withdraw due to lack of funding. However, Eva Salomon (JTI) offered the contribution of her expertise including own funding of travel expenses to the workshops and was actively involved in the expert group on environmental impact (soil).
All countries participated in all three work packages. On-farm visits were carried out in all countries, ranging from one farm in CZ to 16 in DE/AT, depending on the number of organic pig farms and funding available. The fields of expertise needed were mostly covered by the partners, however, several additional experts were involved, either from the partner institutions or from outside. Those experts were included (either in general or on a national level) due to their expertise regarding areas which were less well covered by the consortium (e.g. LCA). They contributed different amounts of work, either supervising the PhD- / Master student in connection to ProPIG (e.g. Werner Zollitsch, BOKU; Stefan Hörtenhuber, FIBL) or acting as experts, when discussing potential improvement strategies (e.g. Denmark: the research group Epidemiology and Management, AU-ANIS; Germany: Ralf Bussemas, BAT).
The consortium formed three expert groups:

1. animal health and welfare
2. environment (LCA/soil)
3. improvement-strategies

For **communication** between partners and expert groups a 'Dropbox Folder' was established and managed by the coordinator to share documents such as protocols, photos, lists of farms ('Farm planner') and more. Additionally to emails, web meetings were held between the coordinator and all three Workpackage leaders on a regular basis (on average 5 meetings/year).
Immediately after the start of the project the whole group met at the **First Workshop and Expert Meeting in Austria/Vienna,** at BOKU 9.-11. November 2011, in order to:

- Discuss the structure/organisational matters (e.g. consortium agreement)
- Introduce and discuss WP 1-3 (by WP leaders)
- Summarise (inter)national related projects (e.g. ICOPP)
- Plan dissemination activities (common articles/website/national stakeholder meeting)

Working in Groups – Development of parameters/strategies:

- Animal health and welfare – animal scoring sheet (Annex 1)
- Environmental impact (e.g. vegetation cover sheet – Annex 1)
- Economy and nutrition
- Improvement strategies ('Catalogue of Improvement Strategies')

On the last day, an excursion to a typical Austrian organic pig farm was organized to relate and discuss the first draft of parameters to the situation on farm.

Using the results from this workshop all expert groups started to work on lists of parameters (animal health and welfare, nutrition, environment, economy) and a supplementary dictionary was established to define unclear terms (see also Annex 1).
The parameters were integrated into '**PigSurfer**' (=PIG **SUR**veillance, **FE**edback and **R**eporting) a Software tool (Handbook: Annex 3) developed by Andreas Strack (Germany) enabling via tablet pc:

- on-farm data collection: interview (e.g. management, land use, nutrition), productivity and medicine records, animal based assessment
- benchmarking those data with existing data (either same country/same system/across countries)
- immediate creation of a 'farm report' (Annex 3)

The first version was pilot tested in Austria (for indoor systems) and Italy and Denmark (for outdoor systems) and a few adaptations were made.
The **Final version** is available via a link to a dropbox folder, which can be found in Annex 10.

It was decided to create **a logo for ProPIG** which was created free of charge by Carina Trestl ©Carina Trestl/trestl.at symbolizing the combined goal to improve animal welfare and environmental impact.

The **Second workshop and Expert meeting** was held in France/Rennes, at INRA, 2.-4. May 2012:

- General assessment procedure and introduction to 'PigSurfer'
- Further discussion of interview and records; health and welfare parameters;
- Dictionary (for definition of terms used in PigSurfer) and further steps regarding parameters (validity, references, hypothesis);
- Qualitative interview regarding expectations of farmers (Results: Annex 6)

Furthermore a **training session** on animal based assessment was carried out using pictures and videos. The assessment was then applied on an outdoor pig farm, where additionally environmental assessment (e.g. vegetation cover) was discussed. During the next day, two additional farms were visited and groups of sows/weaners/finishers were assessed by all on-farm observers independently in order to monitor the effects of training (Inter-observer repeatability (IOR) 1).
As observer agreement was not satisfactory for all parameters, observer training and tests were repeated in three further sessions (for easier logistics; IOR 2):

28. -29.6. 2012: Re-Training and Repeatability Testing in Austria of AT; DE; CH
16. -17.7. 2012 Re-Training and Repeatability Testing in Austria of CZ and IT
10.-12. 10. 2012 Training and Repeatability Testing in DK of DE, DK and UK

The **Third workshop and Expert meeting** was held in Fossano, **Italy** from 21. -24. May 2013 to discuss first results, strategies for data analysis, development of the 'Environmental decision support tool', the 'Catalogue of improvement strategies', dissemination and the next round of farm visits. Furthermore, two Italian pig farms were visited with another discussion of parameters and assessment of animals (25 sows, 13 weaners groups, 10 finishing groups) by on-farm observers to calculate IOR3. The **first steering group meeting** was held to discuss relevant topics (e.g. Training of observers/methods to ensure inter-observer reliability).
As agreement of observers with the gold standards was still not satisfactory, it was agreed to hold two more sessions (IOR4) in Austria and Denmark

6.-8.8 2013: Re-Training and Repeatability Testing in Austria of AT; DE, CH, CZ, IT,
19.-20.8.2013: Training and Repeatability Testing in Denmark of DK and UK

The **Fourth workshop and Expert meeting** was held in Frick/Switzerland at FIBL on 20th and 21st January 2014, where the main aim was to present first results (on animal health and welfare, GHGE, improvement strategies), discuss next steps for further analysis (e.g. economic impact, soil, feeding) and work together on tools such as the "Handbook for Farmers" and the Environmental decision support tool. Experts from FIBL gave presentations on environmental impact and layout for 'Handbook for Farmers` and a member of the Swiss funding body participated at the meeting.

The **Fifth Workshop and Expert meeting including an Open Meeting** for related projects was held in Newcastle, UK at Cockle Park (Univ. Newcastle) from 22nd to 24th of September 2014. The first day was dedicated to discussion of results (animal health and welfare, environmental impact and improvement strategies), tools developed ('Handbook for farmers', Environmental decision support tool) and publication and dissemination of those. Furthermore the second day was an 'open day' where results from ProPIG (e.g. P balances, PigSurfer, Feed) were shared and discussed along with five related projects with three invited external experts (ANIPLAN; AssureWEL, Improve-P, ICOPP; LowInputBreeds). On the final day an excursion was organised to visit a ProPIG farm, where specific issues connected to outdoor pig farming and animal health were discussed.

During **several research stays, intensive exchange** between several partners happened and joint work on assessment tools and data analysis was performed:

- Research stay of R. Brandhofer(BOKU) at INRA for methods of LCA
- Research stays of G. Rudolph (BOKU) at FLI during three periods (11.11. - 27.11.2013, 6.1. - 19.1. and 12.5. - 28.5.2014) working on analysis of AHW and ENV data.
- Joint data collection in France by M. Holinger (FIBL) with A. Prunier (INRA).

Inter observer reliability (IOR) test results

Observer training and agreement tests were implemented before each of the two rounds of farm visits. Each training and test (T1a and T2a) was repeated once (T1b and T2b) in three sessions because observers did not reach sufficient agreement in the respective first training. In general, prevalence of problems to be scored was so low that only agreement and no correlations could be calculated (median gold standard prevalence across parameters and sessions: 0 %, n = 17 to 62 per parameter).

At least three observers did not reach ≥ 70 % agreement for the parameters lesions and swellings in fatteners and sows (T1b and T2b) and low BCS in sows (T1b) which is why these parameters were excluded from analysis. For all other parameters agreement of each observer with the gold standard ranged from 70 to 100 % with a median of 90.5 % at T1b and 75 to 100 % with a median of 100 % at T2b (details see appendix 10 - animal health, welfare and productivity manuscript).

Farm recruitment was carried out using various routes (farmer meetings, - journals, contacts at advisory bodies and farmer organisations). The following inclusion criteria were defined:

Table 1 Inclusion criteria for farms

must be	aim for	avoid if possible	do not include
converted to organic for at least 2 years (conversion 100% certified)	combined farrow-finish farms	farrowing only or finishing only farms	
	'typical' working organic pig farm	special needs persons farms, research and teaching farms	
	>20 sows in herd	<20 sows in herd	<10 sows in herd
	>100 finishing places (in those countries where finisher only farms cannot be avoided)	<80 finishing places (in those countries where finisher only farms cannot be avoided)	
	farms which fulfil all EU organic regulations	farms with obvious breaches to EU organic regulations	

During the **first farm visits** the following procedure was followed:

1. Introduction of ProPIG to farmer (using a ProPIG leaflet for farmers)
2. The qualitative questionnaire was carried out
3. Using PigSurfer, an interview was conducted (e.g. management, land use, nutrition) and productivity- and medicine records were collected (approx. 2-4 hours).
4. A representative number of animals was assessed (2-4 hours depending on herd size)
5. Feed samples on selected farms were taken
6. Brief feedback to farmer and explanation of next steps

In August (3.8.2012) partners from AT, CZ, DE, UK were able to discuss first experiences from farm visits and JY Dourmad (FR) visited (31.8.2012) Austria to discuss and finalize the procedure of LCA evaluation and train the Austrian Master student.

For the **second visits** for each farmer a farm specific report was printed out from PigSurfer, covering a brief description of the farm and all relevant animal based parameters (for one example farm plan see Annex 3) benchmarked using data from all other farms of the same country (in CZ Austrian data were used).
The following procedure was suggested for the second visit:

- Try to include all people, working with pigs and additionally advisors/vets, if wanted by farmer
- Explanation of the process of 'Farm health and welfare planning' (Standard Operating procedure ('SOP') improvement):
    - The plan reflects the situation in comparison to other farms, no judgment
    - The farmer should identify one to three goals for the herd
    - The researcher is there to facilitate/support the process
    - The farmer should have a pen to make notes during the discussion and write down the goals and measures in the end onto the 'Farm report summary'.
- Summary of first visit using the farm report
- Detailed discussion of all goals and measures to achieve those, using the 'Catalogue of Improvement Strategies' as a basis
- Definition of goals and measures
- Collection of soil samples (AT 4 farms, CH 3, CZ 1, DE 3, FR 4, IT 8) using 'SOP soil sampling'. In DK and UK due to winter conditions during farm visit 1 and 2 it was not possible to collect soil samples.

The **third visits** were carried out as a normal advisory visit would be performed, supported by PigSurfer, which enables data collection and feedback within a half day visit. In order to review also the previous 'farm plan', including implementation of measures and achievement of goals, the farm plan from visit 2 was printed out in advance. Furthermore, farm specific results from analysis of environmental impact (soil, LCA) were prepared to be able to discuss these with each farmer.
During the visit the same sequence as in visit one combined with visit 2 was followed:

1. Using PigSurfer, an interview was conducted (e.g. management, land use, nutrition) and productivity- and medicine records were collected
2. A representative number of animals was assessed (2-4 hours depending on herd size)
3. Calculation of collected data as benchmark with data from first visits of all other 74 farms with PigSurfer and printing of new 'Farm plan'
4. Qualitative Farmer Interview and explanation of LCA/soil results
5. Implementation of new 'Farm plan` following procedure from second visit and SOP

Summary of main results:
Three husbandry systems were defined and described- Indoor with outside runs (IN), partly outdoor systems (POUT) and outdoor systems (OUT). The definition of these can be found in the description of Workpackage (WP1) as well as in Annexes 9a and 10.

Several tools for farmers and advisors aiming at farm specific surveillance and improvement were developed:

- **'PigSurfer`** for Surveillance, Feedback and Reporting of Animal health and welfare: Software
- **Handbook for Farmers** on Animal health and welfare: a ring binder booklet
- **Environmental Decision support tool**- a excel based decision support tool

Data regarding animal health and welfare (AHW) and environmental impact (ENV) as well as farm aims and improvement measures were collected on **74 farms** (AT: 16, CH: 9, CZ: 1, DE: 16, DK: 11, FR: 4, IT: 9, UK: 8), of which 34 were IN, 29 POUT and 11 OUT.
During the initial farm selection, farms with incomplete production chains (e.g. finishing farms) were paired with farms from whom they bought / to whom they sold pigs. These thus complete production chains (PC) were the units of observation for all ENV calculations.
For **analysis** in a first step all data were checked for plausibility and completeness and parameters with insufficient repeatability (e.g. lesions and swellings) were excluded from further analysis.
The three husbandry systems (IN / POUT / OUT) were compared regarding animal health, welfare and productivity as well as environmental impact:

Animal health, welfare and productivity (AHW)
Prevalence of AHW problems were compared at two levels using nonparametric tests: a) current location during assessment (indoor or outdoor), and b) system of the farm (indoor, partly outdoor, outdoor = IN, POUT, OUT, respectively).
Generally based on the parameters assessed, it was shown, that a high level of **animal health and welfare** was found in most farms, with few parameters, which could be improved across all systems (e.g. vulva deformation from previous injury in sows).
When comparing the three husbandry systems OUT weaners and fatteners had better health regarding respiratory problems and diarrhoea and OUT sows less MMA and lameness, with POUT having some advantages as well over IN (e.g. lameness of sows). Regarding productivity, losses of piglets did not differ across systems. Mortality of IN fattening pigs was lower than in POUT and their feed conversion rate was better.
Environmental impact
ENV analysis consisted of Life Cycle Assessments (LCA) regarding global warming (GWP), acidification (AP) and eutrophication (EP) potentials. Additionally, N and P balances were calculated for each PC. ENV results were compared between PC system (IN, POUT, OUT; nonparametric tests) and PC were clustered based on their LCA results.
Life Cycle Assessment (LCA) of global warming potential (GWP) was influenced mainly by feed, followed by direct emissions of animals. Furthermore, most emissions were associated with the fattening stage. Variation within a husbandry system was higher than between systems, indicating that good values can be achieved in all systems.

- **POUT** were better than IN regarding acidification (AP), and regarding eutrophication (EP) they were better than OUT.
- **Three clusters** were identified, a 'high', 'medium' and 'lower' environmental impact, plus two clusters with one PC only. No difference between clusters was found regarding number of PCs of IN, POUT and OUT systems.
- The three systems did not differ regarding **N balances;** after clustering N import from feed purchase was identified as the main influencing factor. IN were significantly lower than POUT/OUT regarding **P balances**.

Nutrition
Most farms have diets that differ between groups of pigs in order to adjust the nutrient intake to the nutrient needs. However, about 40% of the farms with sows use a single diet for lactating and pregnant sows. Similarly, about 60% of the farms with fatteners have a single diet for all fattening pigs.
Therefore, the **feeding strategy should be improved in numerous farms** by using, at least, three types of diets:

- one during the sucking and post-weaning period,
- one for lactating sows and the early fattening period,
- one for pregnant sows and the late fattening period.

This will allow a better use of feedstuffs with high amino contents, especially lysine that should be reserved to the animals with the highest needs. This will avoid wastage of protein and allow a better matching between intake and needs of the pigs, better performance of the pigs, better economic results and less environmental impact. Using EvaPig or another calculator may be very useful to check the nutrient content of the diets and especially the protein content.

Relation between Animal health and welfare with environmental impact
Furthermore, AHW results were compared between LCA clusters (correlations, nonparametric tests). No significant relationship between health, welfare and environmental impact was found when comparing the LCA clusters with an 'animal health and welfare score' ('%GOOD'), individual animal based parameters or correlations between AP/EP/GWP and the '%GOOD.

Farm specific improvement strategies were evaluated by farmers' opinion and assessing within-farm improvement in measured criteria over 12 months. The median number of aims per farm was 2 (1 to 4), with fertility, nutrition, health and lesions most commonly addressed. In total 74.8 % of measures were partly/completely implemented and 81.6 % of goals were partly/completely achieved.

Conclusions
ProPIG results indicated that most organic pig farms across Europe did encompass relatively low environmental impacts and good animal health and welfare. The three main husbandry systems (IN/POUT/OUT) did not differ regarding GWP, however in other aspects environmental results were inconsistent. Variation within system was much greater than differences between systems. Regarding animal health and welfare, OUT systems had advantages, whereas IN systems performed better regarding fattener productivity. The goal to reduce environmental impacts by improving animal health and welfare (e.g. decreased medicine use, improved growth rates and feed conversion efficiency) was followed, as farmers chose fertility, nutrition and health as the main topics for improvement and implemented the selected measures to a high degree. The consequences for environmental impact require a longer term assessment to take account of the delay in realised outcomes and seasonal influences. ProPIG did take a holistic approach and combined several key objectives: management, disease prevention, optimizing nutrition and innovative interacting strategies for improvement to support extension services.

1.2 Fulfillment of objectives

'The aim of this project is to investigate the interaction of animal health and welfare, with nutrition and environmental impact and to create and disseminate a tool to improve both aspects of organic pig production'.

The developed software 'Pigsurfer' provides a solid basis to achieve the overall aim to investigate and improve animal health and welfare, nutrition and environmental impact as it includes: animal welfare (e.g. scan sampling of oral behaviour), health (e.g. MMA treatments), nutrition (e.g. thin sows, feed ration), and environmental impact (e.g. manure management). The possibility to summarise this information and feed results back to farmers as a farm report enables a discussion with the farmer to identify areas to improve. The potential measures to achieve those selected goals are compiled in the 'Handbook for farmers', which is a collection of measures based on expert opinion, literature and farmers' strategies. Furthermore the 'Environmental decision support tool' allows farm specific improvement of environmental impact including references and benchmarks.

The tools developed were not only successfully used for 74 organic pig farms within ProPIG, but are also available in several languages and can be used across Europe for (organic) pig farms of all three existing husbandry systems.

- *To identify animal environment interactions in the three different housing systems for organic pigs (outdoor / partly outdoor / indoor with outside run) across the European climate zones*

Even though numbers of farms in the different husbandry systems were not completely evenly distributed it was possible to compare either husbandry systems of pig categories or 'production systems' (breeding to finishing period). The hypothesis, that all three systems are similar when well-managed, was upheld regarding environmental impact (GHGE and N), while POUT systems had advantages regarding EP and AP and animal health and welfare was better for some aspects in OUT systems. One of the main influencing factors for environmental impact (feed conversion rate of fattening pigs) was better in IN systems.

- *To develop and implement farm specific strategies to reduce environmental impacts by improving health, welfare, nutrition and management of organic pigs*

Development and implementation of farm specific strategies was facilitated by PigSurfer, enabling a structured evaluation of the situation including benchmarking with other organic farms and within farm over the duration of the project. Farmers most frequently chose aims for improvements related to fertility (29), lesions (19) and nutrition (19) and chosen measures were frequently partly or fully implemented (74,8%).

- *To disseminate knowledge to national advisory bodies and farmers*

Information regarding results of ProPIG was provided to advisory bodies and farmers. All 74 participating farmers did benefit directly from the farm individual planning process, which was carried out twice within the project. Furthermore in several national farmer/advisor meetings information on ProPIG was (and will be) disseminated.

2. Milestones and deliverables status

Table 2 Milestones

No[1]	Milestone name	Planned delivery month[2]	Actual delivery month[2]	Means of verification
M 1.1	Identification / determination of housing and management systems to be assessed	5	5	Communication of decision to all participants via shared dropbox folder (WP1 protocols)
M 1.2	Assessment protocol for animal health and welfare and environmental impact	6	6	Protocols available to include into an automatic recording and feed back tool
M 1.3	Automatic recording and feedback tool (handheld benchmarking system)	8	8	Tool – 'PigSURfer' ready to be used on farm- first farm visits started in Project month (PM) 8
M2.1 (ab)	Observer training	8/20	12/19	1st and 2nd training completed, sufficient level of observer agreement reached
M2.2	Farm visit 1: assessment of animals and environment	13	18	1st farm visit completed in all countries
M2.3	Farm visit 2: feed back, implementation of improvement strategies	14	21	2nd farm visit completed Aims and measures agreed and documented in all farm reports
M3.1	Decision support tool for enviromental impact	20	35	Beta version of software ready to be tested during farm visit 3
M2.4	Farm visit 3: re-assessment for evaluation of improvement strategies	26	27	Final farm visit completed in all countries
M3.2	Improvement strategies for the farming system summarised as 'catalogue of improvement strategies - COIS'	30	38	'Code of practice' booklet ready for use
M3.3	Evaluation of improvement strategies	32	38	Internal summary report
M3.4	Dissemination / publication of 'catalogue of improvement strategies' during national training courses	36	38	Courses carried out

[1] Please use the numbering convention <WP number>.<number of milestone/deliverable within that WP>. For example, deliverable 4.2 would be the second deliverable from work package 4.
[2] Measured in months from the project start date (month 1).

Table 3 Deliverables

No[1]	Deliverable name and language	Nature[3]	Dissemination level[4] and link to the document	Planned delivery month[2]	Actual delivery month[2]
D3.1	Project Website (English)	Website	PU www.coreorganic2.org/Propig	6	9
D1.1	On-farm assessment protocols for animal health, welfare and environmental impacts (English)	Protocol	INT (Annex 1)	6	6
D2.1	Health, welfare and environmental plans for all farms (English/French/German/Italian/ Czech/Danish)	Protocol	RE (farmers) (Annex 3)	14	19 (DK/UK)
D3.2	Midterm report (English)	Report	PU	18	18/20
D3.3	Decision support tool for reducing environmental impacts	Software	PU (Annex 5 a and b)	32	38
D3.4	Article in professional journal on decision support tool for reducing environmental impacts	Article	PU (Annex 13)	32	38
D1.2	Automatic recording and feedback tool (handheld benchmarking system)	Software PigSurfer	P (Annex 3 and link in Annex 10)	36	36
D3.5	Publication on the effect of the three housing/outdoor systems on environmental impacts across countries and climate zones	Report	PU (Annex 9a and 9b)	36	38
D3.6	Publication on the association between animal health and welfare and the environmental impacts in the three different housing/outdoor systems.	Publishable Report and Article in Farmers Journal	PU (Annex 11)	36	38
D3.7	Booklet for organic farmers/ advisors (Catalogue of improvement strategies), introduced to farmers and advisors during national courses	Booklet= handbook	PU (Annex 4 E, F, C)	36	38
D 3.8	Final report	Report	PU	36	38

[3] Please indicate the nature of the deliverable. For example Report, Paper, Book, Protocol, Prototype, Website, Database, Demonstrator, Meeting, Workshop…

[4] Please indicate the dissemination level using one of the following codes: PU = Public; INT= Internal (Restricted to other project participants); RE = Restricted to a group specified by the consortium; CO = Confidential, only for members of the consortium.

Additional comments (in case of major changes or deviation from the original list)

Table 4 Changes from original plan: M2.2 + M2.3: farm visits and D.2.1 (farm plans)

	farm visit 1		farm visit 2		
country	**start**	**end**	**start**	**end**	**reasons for delay**
AT	3.7.2012	20.8.2012	5.11.2012	7.12.2012	No delay
CH	13.7.2012	11.10.2012	26.11.2012	8.3.2013	Slight delay (visit 2): Some difficulties to find appointments for the farm visits.
CZ	16.8.2012	16.8.2012	18.11.12	18.11.12	No delay
DE	29.10.12	30.1.13	09.1.13	6.2.13	Slight delay: initially assigned and trained farm assessor had to be replaced due to severe illness
DK	3.12.12	24.1.13	19.4.13	17.5.2013	Delay: In DK it was decided, in addition to what was originally planned, to form an expert team discussing possible improvement strategies to discuss with the farmers in advance of the 2nd farm visit. This has caused the delay.
FR	4.9.2012	11.9.2012	15.12.2012	15.1.2013	Slight delay
IT	3.8.2012	12.10.2012	6.11.2012	13.12.2012	No delay
UK	2.11.2012	9.5.2013	May 2013	August 2013	Delay: difficulty in recruiting farms meeting the ProPIG size criterion due to contraction in the national organic pig production

The Decision Support Tool for Reducing Environmental Impacts was delayed due to unplanned staff issues of partner 3 - NU (extended sick leave of project scientist; WP leader S. Edwards retired onto reduced hours contract).

Cost neutral extension of project due to delay of farm visits and reduced work force of environmental group for 2 months (until 31.12.2014) was requested on 7.9.2014 and accepted by funding bodies.

3. Work package description and results:

WP 1	Definition of systems and development of assessment protocols of animal health, welfare and environmental impacts

Responsible partner: Partner no 3; NU, Gillian Butler

Original description of work:

Identification and definition of the three housing/outdoor systems will be based on the amount of time spent during the year with access to paddocks and their type of flooring (soil / concrete). This will be done using data from the CorePIG survey, literature and expert knowledge. Two small groups of experts (formed by partners and external experts) will provide content and criterion validation of the issues of animal health and welfare and environmental impacts, respectively. Based on existing protocols (e.g. WQ©, (2009), Goossens et al. (2008)), **assessment tools** for animal health, welfare and environmental impact for use on farm will be created including training material for assessors. This includes the development of an automatic recording and feedback tool (handheld benchmarking system) and a Decision Support Tool for Reducing Environmental Impacts. In addition, a catalogue of possible improvement strategies will be collated in a working document for farm planning in WP 2.3, to be used by assessors as a 'back-up' for problems out of their range of experience. The experts will also be involved in ongoing training and support. Furthermore one group of experts will provide expertise on approaches to motivate improvement through farm specific planning strategies and formulate a common procedure to implement these on organic pig farms. A fourth group of experts will be responsible from an early stage onwards for the design of sampling protocols and data analysis.

Potential parameters for an on farm assessment protocol (to be developed in WP1 for use in WP2)

Environmental impacts will be assessed using both the methodological framework of Life Cycle Assessment (LCA) and calculations of nutrient balances at farm and outdoor area level. Pooled samples of feed and soil will be analysed on selected farms. To explain cause-effect mechanisms, additional information about nutrient flows within the farm will be used, such as manure management, feed management, pig housing and use of outdoor areas. On-farm data collection will include data on farm structure (e.g. buildings, manure management, hygiene procedures), resource input (energy, feed nutrients, bedding material, fertilizers, proportion of nutrients from on-farm grown feed, geographical origin and transport mode for feed ingredients produced off-farm) and farmer practices (fertilization, rotation of pig and crop areas, stocking rates) as well as outcomes such as net input/output of nutrients (N, P) at farm and outdoor area level and evaluation of vegetation cover in outdoor pasture. Furthermore, on selected farms utilization (in feed) and accumulation (in soil) of N, P, will be measured and soil fertility based on soil texture, organic matter (OM) and pH assessed.

Pig health and welfare will be assessed on farm during one day visits. A representative number of groups of each age category (pregnant sows, weaners, finishers) will be observed using quantitative and qualitative methods for scoring animal based parameters based on an adapted WQ© protocol (BCS, lesions, cleanliness). On each farm breed (conventional or local) and breeding (longevity) will be recorded and productivity (e.g. sold piglets/sow/year, mortality) and veterinary treatment data will be collected using existing records and additional basic data collected by the farmer during the project year if necessary. A simple MS Excel® tool to calculate rations based on feed ingredients will be used to assess nutritional inputs for evaluation of feed management.

Farmers: At the beginning and the end of the monitoring period, a brief qualitative questionnaire will be used to explore expectations, satisfaction, opinions and goals of farmers and their families. This will allow integration of farm specific goals into the improvement process and give a qualitative evaluation of the project from the farmers' point of view. Some **basic economic data** will be collected to allow to evaluate competitiveness of the farms in the study and to

describe the economic consequences of improvements. This will be based on performance data (e.g. number and weight of pigs sold/sow/year, resource inputs detailed previously) and national prices/figures. Fixed costs will be estimated from farm structure data, collected as detailed previously.

Report on results obtained and changes to the original plan/WP aims:

A- results obtained:

The working definition for the 3 systems was :

- **Indoor - pigs** live in buildings with access to an outdoor run or a small sacrifice soil area for permanent pig use - not integrated into crop rotation.
- **Partly outdoor - pigs** spend part of the year or production cycle in each system type (at least one production stage is fully housed while the rest is outdoor. A production stage could be dry sows, lactating sows, e.g. group suckling, weaned piglets or finishing pigs. The combination of indoor and outdoor production might occur within the same farm or in linked farms if piglets are produced on one farm but finished on another, or seasonal housing of animals ('Swedish system').
- **Outdoor Pigs** live permanently outdoors with shelter for sleeping but unrestricted access to the soil (shelter could be a temporary hut or permanent building). Paddocks are integrated in crop rotation and not just a sacrifice area for permanent pig use.

Assessment tools (Animal/Environment/Farmer) Documentation used on farms are attached. This includes a qualitative interview with the farmer (Annex 6), assessment of animal health and welfare and vegetation cover in paddocks (Annex 1). Data necessary for LCA were integrated in PigSurfer and used in an excel calculation sheet. Inputs were collected for all farms on animal performance, housing, manure management, feed composition and origin, which were used to predict greenhouse gas emissions, acidification, eutrophication potential and land use - expressed per ha as well as per kg live weight pig at slaughter.

The automatic recording and feedback tool (PigSurfer) was ready for use on a tablet computer for the training session in France and was widely used throughout the project to record inputs and generate farm benchmarking reports (Annex 3).

Standard operational procedures (SOPs) were developed for collection of feed and soil samples as well as how to facilitate the discussion during the second farm visit on areas to improve and measures to achieve this (Annex 2).

Economic data were obtained from each partner country on feed costs and the prices obtained at sale for organic pigs. These were used to calculate the margin over feeds costs for different recorded scenarios of good and poor farm performance, value of pigs sold and feed costs. Under all 3 production systems the most efficient farms were able to generate a profit, even with the challenging circumstances of high feed costs and low pig sales, whilst the least efficient made a considerable loss, alleviated only by both low feed costs and high pig prices (Annex 7)**.**

Soil samples were taken according to the standard protocol on a sample of 23 farms to give a total of 45 sets of matched paddock areas with High, Low or No pig influence. Samples were analysed for extractable and total Phosphorus, and for mineral and total Nitrogen. On most farms/paddocks the presence of pigs had a high influence on extractable and total P, and mineral and total N. However, nutrient concentration varied strongly between countries and farms, and sometimes even between paddocks on the same farm (Annex 9c).

Feed sample data collected on the composition of diets on each farm were used to estimate their nutrient content using the Evapig database. The estimated energy and essential amino acid content were then compared to calculated pig requirement for the relevant production stage. Whilst many farms operated appropriate feeding, some showed poor feed management, with a common diet across different production stages giving inadequate amino acid supply despite environmentally damaging oversupply of crude protein (Annex 8).

B- comments on deviations from the original plan:

The omission of Sweden from this call between drafting and implementing ProPIG resulted in the loss of expertise covering the environmental impact within the consortium. This made it challenging to deliver some of our milestones, although the 2 months extension to the project has permitted these to be achieved.

WP 2	On-farm assessment and application of improvement strategies of animal health, welfare and environmental impacts

Responsible partner: Partner No 6, DJF-AU, Tine Rousing

Original description of work:

A prospective cohort observational study will compare the health and welfare status and environmental impacts of the three husbandry types. Each cohort will consist of approximately 25 farms distributed across eight European countries and various climate zones. This will include in total 75 farms: Austria (15), Czech Republic (1), Denmark (12), France (4), Germany (15), Italy (8), Switzerland (8), and UK (12). Outcome parameters will be selected measures of health, welfare and environmental impacts defined in WP1 and their economic consequences. The consortia will use their existing contacts and additional farmers will be invited to participate in the project using advertisements through organic associations' bodies and in pig farming journals.

Farm visits will be carried out by trained assessors who will start recording data after reaching a set level of inter-observer reliability. During farm visits national advisors will assist knowledge transfer to and from producers. There will be three visits to participating farms:

- visit 1: Assessment and data collection of environmental impacts and animal health and welfare
- visit 2: Feedback of summarised information from visit 1. The information will be presented as 'benchmarking' (ranking of national data). Based on this a 'plan' will be written with the farmer, which includes the goals set by the farmer for improvement of animal health, welfare, nutrition and management of outdoor areas and manure utilization, and intended improvement strategies. This will include the use of HACCPs from CorePIG, if relevant. The researcher will act as a facilitator to support the farmer on his/her decisions and provide strategies for improvement of animal health, welfare, nutrition and management of outdoor areas and manure utilization. If requested by the farmer, the advisor and/or consulting veterinarian for the farm will be encouraged to participate.
- between farm visits, farmers will be supported during the implementation process by phone and email.
- visit 3: Takes place one year after visit 1. It includes re-assessment of the farm situation regarding animal health and welfare and environmental impacts using the same parameters as before. Also economic key data will be collected during this visit. Furthermore a new plan will be made together with the farmer in order to allow for a continuation of the process. At this stage it is possible to benchmark farms of all countries within and across husbandry systems.

Report on results obtained and changes to the original plan/WP aims:

A- results obtained:

The planned 3 cohort study – one for each of the 3 different housing systems defined in WP1 'indoor', ´partly outdoor' and 'outdoor' - is based on a total of 74 farms from the different project member countries. Detailed information on the distribution of housing systems between the different countries is given in Table 5.

Table 5 Numbers of farms per country. AT = Austria, CH = Switzerland, DE = Germany, IT = Italy, CZ = Czech Republic, DK = Denmark, FR = France, UK = United Kingdom

system	AT	CH	DE	IT	CZ	DK	FR	UK	total
a) indoor	12	7	13	2	0	0	0	0	34
b) partly	3	2	3	3	1	11	4	2	29
c) outdoor	1	0	0	4	0	0	0	6	11
total	16	9	16	9	1	11	4	8	74

Training of observers: in total four training sessions were held to achieve common standards of assessment across all partners and countries.

At **first farm visits** data for quantification of animal health, welfare and environmental impact were collected. These data were based on farmers' interviews on management and production and direct observations of the animals and husbandry, including quality of grass cover in paddocks. Furthermore, feed samples were taken for all farms (except DK) and soil samples for selected farms.

Data of the first farm visits were entered in a software tool (PigSurfer) - and farm specific reports on animal health, welfare and production were created (Annex 3). Reports including the individual farm results benchmarked anonymously with the results of the other farms from the same country were, at the **2nd farm visit,** presented to and discussed with the individual farmers. The farmer, facilitated by the project partners defined goals and measures for improvement of selected issues. Where relevant, parts of HACCP-programs derived from the project CorePIG were utilised. All information collected across member countries together with project partner input on improvement strategies formed the basis of the 'Catalogue of improvement strategies' (COIS) for animal health and welfare in organic pig production across Europe.

At the final 3rd farm visit a follow-up quantification of animal health, welfare was carried out. In Table 6 an overview of implementation and success as assessed by farmers' self-evaluation is presented. Areas most commonly addressed by farmers were fertility, nutrition, health and lesions. The median number of aims per farm was 2 (range 1 to 4). Out of 69 farms, 26 % (n = 18) set 1 aim, 36 % (25) set 2 aims, 30 % (21) set 3 aims, and 7 % (5) set 4 aims for their farm. Out of 59 farms where farmers had subjectively judged the achievement of aims [no DK], 34 % (20) judged all aims as achieved, 8 % (5) judged none and the remainder (58 %, n = 34) judged some but not all as achieved. Achievement rates were similar to implementation rates (e.g. both high regarding lesions; both low regarding respiratory problems).

Table 6 Numbers and proportions of improvement strategies implemented and goals achieved (self-evaluation by farmer)

aim category	Measures not implemented	Measures partly implemented	Measures fully implemented	Measures total	Measures (%) partly/fully implemented	Aims (%) partly/fully achieved
diarrhoea	4	2	9	15	73,3	**75,0**
fertility	18	15	30	63	71,4	**82,8**
health	5	7	18	30	83,3	**75,0**
lesions	5	7	19	31	83,9	**94,7**
management	3	4	13	20	85,0	**86,7**
nutrition	9	12	14	35	74,3	**89,5**
parasites	2	1	7	10	80,0	**71,4**
respiratory	11	4	7	22	50,0	**58,3**
total	57	52	117	226	74,8	**81,6**

B- comments on deviations from the original plan (Table 4**):**
According to the original work package description it was planned to include in total 75 farms, assuming, they were all breeding to finishing.
Due to recruitment difficulties in UK (due to contraction in the national organic pig production) 9 farms were visited (instead of 12), of which one dropped out for the final visit. In other countries some minor deviations in number of farms occurred due to:

- either difficulty recruiting a sufficient number of farms within the defined categories of housing systems (DK: 11 instead of 12 farms),
- or difficulties in recruiting a sufficient number of breeding to finishing farms. Thus more farms were included in order to be able to cover all animal groups: in AT/DE (16 instead of 15 farms) IT/CH (9 instead of 8 farms).

WP 3	Analysis, evaluation and dissemination
Responsible partner: Partner No 7, FLI, Sabine Dippel	
Original description of work: Analysis of associations between housing and management systems regarding health and welfare and environmental impact will consist of two stages. Stage 1 is based on the data collected at visit one, which represent data of a cross sectional survey. The farming types will be compared regarding health and welfare and environmental impact using nonparametric statistics. Furthermore, data will be summarised with factor analysis and multiple correspondence analysis. These analyses allow the formation of farm groups based on characteristic traits, which can then be used for comparisons of e.g. disease prevalence or environmental impact. In stage 2, the data from farm visits 1 and 3 together with the records collected over one year will form the basis for a more detailed analysis of effect of farming type on health and welfare and productivity. The appropriate statistical methods will be chosen depending on the hypotheses and exact nature of data (type of data, distribution etc.), but will probably include multivariate regression and generalised mixed models. The improvement strategies applied during one year between farm visits 2 and 3 will be evaluated by analysing number of implemented measures and goals achieved and by comparing the findings of visits 1 and 3. The effect of improvement strategies will be assessed using nonparametric or parametric statistics as appropriate. Parameters will be identified in advance, where it is reasonable to expect measurable effects even within this short period of time (one year). **Dissemination activities** will include articles on all relevant findings in scientific and professional/industry journals. Booklets and training material for organic pig farmers and advisers will be developed based on results and experiences from the study, which will be introduced during national courses. The Automatic Recording and Feedback Tool (handheld benchmarking system) and the Decision Support Tool for Reducing Environmental Impacts will also be introduced during national courses and be made publicly available via a project webpage.	

Report on results obtained and changes to the original plan/WP aims:

Data regarding animal health and welfare (AHW) and environmental impact (ENV) as well as farm aims and improvement measures have been collected on 74 farms (Table 5). During the initial farm selection, farms with incomplete production chains (e.g. finishing farms) were paired with farms from whom they bought / to whom they sold pigs. These thus complete production chains (PC) were the units of observation for all ENV calculations.

Prevalences of AHW problems were compared at two levels using nonparametric tests: a) current location during assessment (indoor or outdoor), and b) system of the farm (indoor, partly outdoor, outdoor = IN, POUT, OUT, respectively). ENV analysis consisted of Life Cycle Assessments (LCA) regarding global warming potential (GWP), acidification (AP) and eutrophication (EP) potentials. Additionally, N and P balances were calculated for each PC. ENV results were compared between PC system (IN, POUT, OUT; nonparametric tests) and PC were clustered based on their LCA results. Furthermore, AHW results were compared between LCA clusters (correlations, nonparametric tests). Analyses are described in detail in annexes 9 to 12.

Results AHW (details in annex 10): In general, prevalence of AHW problems was low across farms. Seven parameters differed significantly for at least one production stage in animals assessed indoors or outdoors, and between farm systems. Two additional parameters differed each in animals assessed indoors or outdoors, and between farm systems, respectively.

Results ENV (details in annex 9): The largest proportion of environmental impact originated from feed, followed by direct emissions from animals. Most emissions were generated in the fattening stage. GWP did not differ between PC systems, yet AP was significantly lower in POUT than in IN, and EP lower in POUT than in OUT. LCA cluster analysis resulted in 3 clusters of higher, medium and lower environmental impact, plus two clusters with two PC only. Numbers of IN, POUT and OUT PC did not differ between clusters.

No significant association were found between AHW and environmental impact (annex 11).

For all aim categories but respiratory problems, farmer implemented >70 % of measures and reached >70 % of aims (annex12). The effect of measure implementation on outcome parameters is currently being analysed.

Dissemination (see ch. 4 for details):

Several leaflets with a project description were distributed to stakeholders. ProPIG partners presented ProPIG at 15 stakeholder workshops, as well as in 5 posters and 1 presentation at international conferences.

A booklet for farmers with comprehensive knowledge on AHW problems and improvement strategies across all housing systems is currently in print as a robust ring binder (in English, translated into German, French and Czech). The Decision Support Tool for Reducing Environmental Impacts is available through the website link https://www.dropbox.com/s/5af0b17uqymrmk8/EDST.xls?dl=0.

The handheld benchmarking system (PigSurfer) is available from the consortium and its publication on the internet is being prepared.

B- comments on deviations from the original plan:

Analysis of AHW data was less complex than originally planned because of the relatively low average prevalence of problems on the farms and thus lack of variation in the data (annex 10). Analysis of improvement strategy effects took longer than expected due to the individuality of farm measures. The Decision Support Tool for Reducing Environmental Impacts was delayed due to unplanned staff issues of partner 3-NU (extended sick leave of project scientist; WP leader S. Edwards retired onto reduced hours contract).

4. Publications and dissemination activities

4.1 List extracted from Organic Eprints

Contributions related to CoreOrganic II events:

1. http://orgprints.org/20408/
   {Projekt} ProPIG: Farm specific strategies to reduce environmental impact by improving health, welfare and nutrition of organic pigs. Laufzeit: 2011 - 2014. Leiter/in: Leeb, Dr. Christine, University of Natural Resources and Life Sciences (BOKU). Sat Apr 20 14:02:48 2013 CEST.
2. http://orgprints.org/20095/
   Leeb, C. (2011) ProPIG. CORE Organic II Research Seminar, Paris, France, 29 November 2011. Sat Apr 20 14:02:48 2013 CEST.
3. http://orgprints.org/ ....
   Leeb, C. (2013) ProPIG. 2nd CORE Organic II Research Seminar, Amsterdam, Netherlands, 15 May November 2013.
4. http://orgprints.org/27989/
   Leeb, Christine (2014) Presentation at Core Organic II Research Seminar - Farm specific strategies to reduce environmental impact by improving health, welfare and nutrition of organic pigs. Stockholm, 1st October 2014.

Peer reviewed contribution at scientific conferences:

5. http://orgprints.org/22582/
   Rudolph, Gwendolyn; Bochicchio, Davide; Butler, Gillian; Dippel , Sabine; Dourmad, Jean Yves; Edwards , Sandra; Früh, Barbara; Illmann, Gudrun; Meier, Matthias; Prunier, Armelle; Rousing, Tine; Salomon, Eva; Silerova, Jitka; Sorensen, J.T.; Urban, Jiri; Vertes, Francois; Winckler, Christoph und Leeb, Christine (2012) ProPIG - Organic pig health, welfare and environmental impact across Europe. Poster at: Minding Animals, Utrecht, The Netherlands, 4-6 July 2012.: Sun Apr 28 23:26:25 2013 CEST.
6. http://orgprints.org/22616/
   Rudolph, Gwendolyn; Bochicchio, Davide; Butler, Gillian; Dippel, Sabine; Dourmad, Jean Yves; Edwards, Sandra; Früh, Barbara; Illmann, Gudrun; Meier, Matthias; Prunier, Armelle; Rousing, Tine; Silerova, Jitka; Salomon, Eva; Sorensen, J.T.; Urban, Jiri; Vertes, Francois; Winckler, Christoph und Leeb, Christine (2012) ProPIG – Betriebsspezifische Strategien zur Reduktion der Umweltauswirkung von Bioschweine Betrieben durch Verbesserung von Tiergesundheit, Wohlergehen und Ernährung von Bioschweinen. [Farm specific strategies to reduce environmental impact by improving health, welfare and nutrition of organic pigs.] Poster at: Tagung Forschung und Lehre zur Ökologischen Landwirtschaft an der Universität für Bodenkultur, Wien, Österreich, 18.10.2012. Sat May 11 19:16:09 2013 CEST.
7. http://orgprints.org/25627/
   Rudolph, Gwendolyn; Bochicchio, Davide; Brandhofer, Roland; Berner, Alfred; Butler, Gillian; Dippel, Sabine; Dourmad, Jean Yves; Edwards, Sandra; Früh, Barbara; Holinger, Mirjam; Holmes, Diane; Illmann, Gudrun; Knop, Denise; Meier, Matthias; Prunier, Armelle; Rousing, Tine; Salomon, E.; Silerova, Jitka; Sorensen, J.T.; Urban, Jiri; Vertes, Francois; Winckler, Christoph und Leeb, Christine (2014) 'ProPIG' Challenges and opportunities for on farm pig researchers: How to collect sound scientific data on animal health, welfare, nutrition and environmental impact AND act as a facilitator to improve these aspects at the same time? Poster at: The 11th European IFSA Symposium, Berlin, 1.4.-4.4.2014. Sun Nov 23 19:42:38 2014 CET

8. http://orgprints.org/26928/
   Dippel, Sabine; Bochicchio, Davide; Holinger, Mirjam; Holmes, Diane; Knop, Denise; Prunier, Armelle; Rudolph, Gwendolyn; Silerova, Jitka und Leeb, Christine (2014) Trough or bowl? Observers need training for assessing resource as well as clinical parameters. In: Mounier, Luc und Veissier, Isabelle (Hrsg.) *Proceedings of the 6th International Conference on the Assessment of Animal Welfare at Farm and Group Level*, Wageningen Academic Publishers, Wageningen, NL, S. 182. Sun Nov 23 19:42:38 2014 CET.
9. http://orgprints.org/26922/
   Leeb, Christine; Bochicchio, Davide; Butler, Gillian; Edwards, Sandra; Früh, Barbara; Illmann, Gudrun; Prunier, Armelle; Rousing, Tine; Rudolph, Gwendolyn und Dippel, Sabine (2014) PigSurfer – SURveillance, FEedback & Reporting within ProPIG for communication with 75 pig farmers. In: *Proceedings of the 6th International Conference on the Assessment of Animal Welfare at Farm and Group level*. Sun Nov 23 19:42:38 2014 CET
10. http://orgprints.org/26945/
    Prunier, Armelle; Rudolph, Gwendolyn; Bochicchio, Davide; Butler, Gillian; Dippel, Sabine und Leeb, Christine (2014) Nutritional characteristics of the diets in organic pig production. In: *Book of Abstracts of the 65th Annual Meeting of the European Federation of Animal Science*, Wageningen Academic Publishers, Wageningen, NL, S. 249. Sun Nov 23 19:42:38 2014 CET.

Farmers and advisor meetings

11. http://orgprints.org/24279/
    {Projekt} *ProPIG - A research project to help organic pig production - leaflet for farmers.* Laufzeit: 2011 - 2014. Leiter/in: Leeb, Dr. Christine, CoreOrganic2. Sun Nov 23 19:42:38 2014 CET.
12. http://orgprints.org/20076/
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Master- and PhD Theses

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- **Gwendolyn Rudolph** (2015): Effect of husbandry system on animal health, welfare and environmental impact of organic pigs in selected European countries. PhD thesis. University of Natural Resources and Life Sciences (BOKU), Vienna, Austria. https://forschung.boku.ac.at/fis/suchen.hochschulschriften_info?sprache_in=de&menue_id_in=107&id_in=&hochschulschrift_id_in=10773
- **Roland Brandhofer** Umweltwirkungen biologischer Schweinehaltung: Vergleich zweier Haltungssysteme auf Basis des Treibhausgas-Potenzials sowie einer Stickstoff- und Phosphorbilanz. Masterthesis. University of Natural Resources and Life Sciences (BOKU), Vienna, Austria. Unpublished
- **Katharina Fohringer:** Risk factor analysis of skin lesions in organic pig husbandry. Masterthesis. University of Natural Resources and Life Sciences (BOKU), Vienna, Austria. Unpublished

4.2 Additional dissemination activities

No	Planned / actual date	(No.) and title	Type:	Partners involved: (partner acronyms)	Type of users addressed	Countries
A	1.3.2012	Introduction to ProPig	Presentation at farmer meeting at FiBL – Bioschweinetagung 2012	FiBL	Farmer, Advisor	CH
B	7.3.2013	Introduction to ProPig	Presentation at farmer meeting at FiBL – Bioschweinetagung 2013	FiBL	Farmer, Advisor	CH
C	May 2012	Na pomoc ekologickému chovu prasat (Help for organic farming of pigs).	Zemědělec č. 33	IAS, Bio-I	Farmers	CZ
D	Aug.2012	Organic free Farrowing systems	Visit Research farm Wels/Thalheim; introduction Welser Bucht/WelCon, group farrowing/suckling	BOKU, IAS, FIBL; FLI (BAT), CRA-SUI	Researchers	AT; DE; CZ; CH; IT;
E	Oct. 2012	Vyzkumní projekt ProPIG. Scientific project ProPIG :	Bioměsíčník č.	IAS, Bio-I	Farmers	CZ
F	26.6. 2012	Presentation	Meeting of the organization of organic farming	IAS, Bio-I	Farmers	CZ
G	10.7. 2012	Presentation	Project Presentation	IAS, Bio-I	Ministry of Agriculture	CZ
H	2012	websites	www.bioinstitut.cz, www.agroweb.cz, www.ctpez.cz.	IAS, Bio-I	Farmers, advisors, organic farming	CZ
I	Sept. 2014	Farrowing systems Excursion	Visit of CZ to Newcastle 'PigSafe pen'	IAS, Univ. Newcastle	Researcher, Company	CZ, UK
J	25.-26.11. 2014	Czech – Austrian organic pig farming days	Excursion, 5 pig farmers, 6 researchers, 1 company	IAS, BOKU	Farmers, advisors, researchers	CZ, AT
L	10.02. 2015	Main results of the Propig project	Presentation at National meeting on organic pig production	INRA	Farmers Advisors Researchers	FR

4.3 Further possible actions for dissemination

Especially the '**Handbook for Farmers'** is an outcome of this project specifically addressing farmers; laminated pages in a ring-binder allow use in the pig barn as well as outdoors. It is translated already into French, German and Czech, however, other languages (e.g. Italian, Spanish, Rumanian) should be considered.

It will be disseminated via common routes by project partners such as FIBL, organic farmer meetings (e.g. BioAustria Bauerntage); however it could also – after additional printing- be disseminated across other countries.

Also **PigSurfer** could also be translated into other languages (currently available in English, German, and Italian) – however, this should be done according to specific interest from countries. PigSurfer offers also potential to be used for other species or applications such as certification or other quality assurance inspections.

Translation of the **environmental decision support tool** is also recommended. So far it is available in English, but its further dissemination could benefit from translation into other languages.

Another possibility to spread outcomes of ProPIG after project end would be national farmer meetings (organised/funded by national bodies) possibly held jointly with similar CoreOrganic II projects (e.g. ICOPP; SafeOrganic, Healthy Hens); results and conclusions could be presented and further discussed.

Furthermore contacts between farmers, advisors and researchers, which were established within ProPIG should be supported to carry on, even when the project is finished- one example is a potential excursion of Austrian organic farmers and advisors to the Czech ProPIG farm.

4.4 Specific questions regarding dissemination and publications

Project website will be updated with final outcomes of ProPIG

List the categories of end-users/main users of the research results and how they have been addressed/will be addressed by dissemination activities

- **Farmers:** At the beginning of this project many activities in all countries were carried out to introduce ProPIG and to recruit farms. All participating farmers were visited several times, and farm specific reports showing farm specific outcomes (including results from feed and soil samples) with benchmarking were delivered, as well as continuous support provided. With 'Pigsurfer' (Automated recording and Feedback Tool) and the 'Handbook for Farmers' useful instruments for all (organic) pig farmers were developed.
- **Advisors/Vets:**
  This group was introduced to ProPIG by leaflets and meetings. The main deliverables 'Handbook for Farmers' and the 'Environmental Decision support Tool' are useful tools for advisors to investigate animal health and welfare problems as well as to give targeted advice for improvement of environmental impact. Furthermore PigSurfer offers a great opportunity to be integrated into professional health and welfare planning approaches, as conducted by existing animal health services, as it enables objective and time efficient data collection as well as tools for communication with farmers (benchmarking/farm plan).
- **Others:** Furthermore the process of 'Health and welfare planning' (Vaarst, 2010) is introduced by this project to organic pig farmers, advisors, vets and researchers across Europe. Knowledge on calculation of rations (e.g. using 'EvaPig'), interpretation of soil analysis as well as results from LCA (GHGE/EP/AP) was gained by those groups.

Summary of National training courses on ProPIG for farmers and advisors (see 4.1 and 4.2):

	Overview of ProPIG	Environmental impact/ EDST	Animal health & welfare/ Handbook
12, 13, 15, 18, A, B, F	x		
14, 16, 17		x	
19, 20, 21	x	x	x
J, L,	x		x

Impact of the project in relation to main beneficiaries of the project results

- **Farmers**

All participating farmers across Europe were directly addressed and the project had a direct impact on these, as not only data collection happened, but improvements were discussed and agreed. The implementation and effectiveness of these measures was be monitored during the final visit. Furthermore the improvement measures suggested by farmers as well as those of experts, which are collected into the 'Catalogue of improvement strategies', can potentially act as a very comprehensive tool to improve animal health and welfare.
Also the results of the project can be used, when deciding on new systems, as data will be available regarding economy, health and welfare as well as environmental impact.

- **Advisors/veterinarians**

The results as well as the delivered tools (Pigsurfer, Handbook for farmers, Environmental decision support tool) can provide not only data regarding advisory work but also very practical tools for individual situations.

- **Scientific community/Decision makers**

The project provides the first comprehensive dataset on measures of animal health and welfare and environmental impact of organic pig farms throughout Europe. This provides benchmarks for future scientific studies and data which can be used to underpin future policy decisions in these subject areas. The Pigsurfer tool can be utilised to facilitate data collection in future scientific studies, and has flexibility to allow modification for use with other systems or species.

5. Added value of the transnational cooperation in relation to the subject

Data collection across countries

- Data collection across countries using one method has the enormous advantage to create a large data set, which is not possible within one country only.
- The evaluation of environmental impacts of different housing systems in Europe can only be carried out in a transnational European project. Besides the distribution of climatic factors, certain types of housing systems are more prevalent in some countries than in others, and the type of crop products used and their geographical origin (and transport distance) varies

Common learning process and exchange of methods:

The transnational knowledge transfer between researchers and farmers in the project facilitated the development of the organic pig production at both the national and transnational level:

- Health and welfare assessment (e.g. CZ behavioural expertise but little experience in on-farm data collection), on-farm assessors were trained in all countries, so a group of experts is now available in all ProPIG countries
- LCA (esp. FR, AT, CH, UK) exchange of methods for calculation across countries
- Health and welfare planning (experiences from Coreorganic ANIPLAN (AT) are shared with other partners; transfer from Dairy health planning into pig farming

Research cooperation established:

Knowledge and network from CorePIg and ANIPLAN was expanded to a new country (Czech Republic) who provided new perspectives and knowledge.

- Austrian PhD student research periods in Germany with S. Dippel
- Austrian Master student stayed in France with JY Dourmad/A. Prunier (short scientific travel stipend 'KUWI') to learn LCA
- Swiss Researcher (M. Holinger) carried out on-farm assessments in France
- Soil experts E. Salomon (Sweden) close contact to consortium, especially IT partner D. Bochicchio
- Knowledge transfer with CoreOrganic ICOPP, ImproveP, Healthy Hens

Experience and learning from different situations

The accumulated knowledge about interactions between housing systems, farm management, climatic factors, animal health/welfare and environmental impact enables identification of the most suitable alternatives of organic pig farming across the varied climatic and societal conditions, thus promoting sustainable and economically competitive development of this sector of animal husbandry

- Farm visits during workshops allow in depth experience of organic pig farms in other countries
- Several opportunities to exchange farmers/students/researchers:
  - excursion of German/Austrian organic pig farmers to UK 2010 following contacts from CorePIG); Excursion from Czech pig farmer researchers to Austrian (organic) pig farms in 2014, planned return visit for 2015

Efficient use of resources

- Software programme would be too expensive for one partner alone
- Layout and printing of a Ring-binder also benefits from joint effort

ANNEX 1: CHANGES IN WORK PLAN AND PROBLEMS ENCOUNTERED

Changes in consortium and work plan

Consortium
The consortium consists of same partners as in the proposal, with only few minor updates:
DE/IT/DK: no changes
AT: Gwendolyn Rudolph was employed as PhD student to carry out the project in Austria
CH: Mirjam Holinger was employed to carry out farm visits
UK: Diane Holmes employed to carry out farm visits
CZ: Gudrun Illmann acts as Czech Project leader, Jitka Silerova carried out farm visits, Misa Melisova contributed to 'Handbook for farmers'
FR: due to restricted availability of funding H. van der Werf was not involved in ProPIG

Workshop 4 and 5 were combined in order to have sufficient resources to allow participation of all on-farm observers on all training sessions.

WP 1
In WP 1 no deviations from original plan; expert groups consist mainly of partners, as little funding for external experts available. Eva Salomon, originally proposed as a partner but obliged to withdraw, participated as a self-funded external expert.

WP 2
According to the original work package description it was planned to include in total 75 farms (now 74), assuming, they were all breeding to finishing. Due to recruitment difficulties in UK (due to contraction in the national organic pig production) only 8 farms were assessed (instead of 12). In other countries some minor deviations in number of farms have appeared: This was due to difficulty in recruiting a sufficient number of:

- farms within the defined categories of housing systems (DK: 11 instead of 12 farms)
- breeding to finishing farms. In this case more farms were included in order to be able to cover all age groups: in AT/DE (16 instead of 15 farms) IT/CH (9 instead of 8 farms).

WP 3
After discussions among the consortium and with the Core Organic office it was decided not to create a separate project website but instead use the common CoreOrganic2 site to present ProPIG to stakeholders. This website was set up three months later than intended due to technical difficulties on the host side.

Problems encountered delays and corrective actions planned or taken, if any:

- Delay of start of farm visits in DE due to sick leave, therefore it was necessary to train another observer; however, farm visits were carried out only with one month delay.
- Insufficient number of farms in UK: Recruitment was stopped, as data were needed to start analysis across all countries.
- Request for extension of project
- Delay in creation of environmental decision support tool

ANNEX 2: COST OVERVIEW AND DEVIATIONS FROM BUDGET

Project budget and costs in € (if in National currencies, please indicate):

Partner no.	1 BOKU	2 FIBL	3 NU	4 CRA – SUI	5 INRA	6 DJF-AU	7 FLI	8 IAS	9 Bio-I
TOTAL BUDGET	99649.0	53083.3	118863.0	90000.0	25000.0	199613.0	159160.8	24334.0	5000.0
Spent at Mid term	61672.0	30136.1	42255.0	33559.4	8640.0	68189.0	82503.7	12000.0	1200.0
Spent in 2nd period	37977.0	28414.3	84622.0	56398.8	16360	131560.8	71316.8	15134	1000
TOTAL SPENT	99649.0	58550.5	126877.0	89959.2	25000	199749.8	153820.	27134	2200
DEVIATION	0	+5467.2	+8014.0	-41.8	0	+136.8	+5340.3	2800	-2800

Person months (PM) spent on the project:

Partner no.	1 BOKU	2 FIBL	3 NU	4 CRA – SUI	5 INRA	6 DJF-AU	7 FLI	8 IAS	9 Bio-I
TOTAL PM budgeted	24	3.75	16.3	31	4.25	15.5	14.75	6	1.6
Spent at Mid term	17	3	6.3	12	4.25	9.75	6.5	4.8	1
PM spent in 2nd period	*7*	*4.9*	*10*	21	1.75	12	8.25	4.0	0.1
TOTAL PM SPENT	*24*	*7.9*	*16.3*	33	6	21.75	14.75	8.8	1.1
DEVIATION	*0*	*+4.15*	*0*	+2	+1.75	+6.25	0	+2.8	-0.5

Reasons for major deviations in spending compared to original budget:

Partner 2: FIBL: In Switzerland the derivation on person months is due to some extra work in relation to the Handbook, the qualitative questionnaire and the soil result descriptions.

Partner 3: NU: The apparent overspend by the team in UK is due to a discrepancy in currency exchange rates between budgeting and the National agreement. In practice, costs in £s matched that arranged locally with DEFRA

Partner 7 FLI: The total budget of 151,948.40 was increased by 4,869.10 EUR for salaries and 2,343.30 EUR for Handbook in German. Leftover budget consists of booklet money and special retained travel funds. Total PM budgeted were increased from 14 to 14.75 PM.

Partner 5 INRA: Analyses of the data regarding LCA and feeding strategy needed more time than expected. This time was spent by permanent scientists and no extra budget was needed.

Partner 8 and 9: CZ: IAS got a contract from the Ministry of Agriculture for IAS and the Bioinstitut together. IAS was more involved in ProPIG and got a part of the money from the Bioinstitut. The money from the Bioinstitut was mainly used for paying the Handbook. The person months were higher as planned, but based on the lower salary in the Czech Republic it was possible to cover these.

ANNEX 3: RECOMMENDATIONS TO THE CORE ORGANIC CONSORTIUM IN RELATION TO LAUNCHING AND MONITORING OF FUTURE TRANSNATIONALLY FUNDED RESEARCH PROJECTS.

- Coordination of joint starting and end point of project with clear communication of one joint date to coordinator/all partners, when to deliver reports
- Clear communication on one joint final report – no national additions to simplify reporting
- Recognition of specific administrative tasks and travel requirements for coordinators and WP leaders
- Very different amounts of funding are sometimes challenging regarding distribution of work across countries- e.g. one farm in CZ compared to 16 farms in Austria/Germany.
- Doctoral college could be a suitable format for further CoreOrganic activities
- Other template for final report
- Use of joint resources and professional support for dissemination to stakeholders (also beyond project end)
- Specific efforts/structures needed for including advisory bodies in projects – language problems/resources available/no structures or responsibilities available for trans/national projects

Further documents as attachment with main contact person(s):

Please note, that several Annexes will be published as **scientific papers or are part of a PhD thesis**- currently (18.3.2016) only Annex 1, 2, 3, 5a can be made available to the public (Orgeprints), with the ProPIG consortium as author.

Annex 1: Farm Assessment protocol including Animal based & resource definitions, vegetation cover sheet, PigSurfer Dictionary (C. Leeb)
Annex 2: Standard Operating Procedure_SOP- soil/feeding/improvement (C. Leeb)
Annex 3: Pigsurfer: Handbook and example Farm report (S. Dippel)
Annex 4: Handbook for Farmers (M. Holinger/B. Früh) in English, Czech, French, German
Annex 5a: Description of Environmental Decision Support Tool_EDST (S. Edwards/G. Butler)
Annex 5b: EDST Environmental decision support tool (G.Butler/S.Dippel)
Annex 6: Qualitative Interview – Results and Questionaires (M. Holinger)
Annex 7: Description of Financial impact (G. Butler)
Annex 8: Feeding strategies (A. Prunier)
Annex 9: Manuscript 'Effect of husbandry system on environmental impact across countries and climate zones'
  - **9a**: LCA including GHGE/AP/EP (G. Rudolph)
  - **9b:** N/P balances (G. Butler)
  - **9c:** Soil results and explanation for farmers (D. Hegglin)

Annex 10: Manuscript 'Effect of husbandry system on health, welfare and productivity of organic European pig farms' (S. Dippel/G. Rudolph)
Annex 11: Manuscript 'Association between health, welfare and environmental impact of organic pigs in three European husbandry systems' (G. Rudolph)
Annex 12: Manuscript 'Improvement strategies for health, welfare and environmental impact on organic pig farms across Europe (C. Leeb/T. Rousing)
Annex 13: Deliverable 3.4. Article in professional journal on environmental impact and environmental decision support tool (G. Butler)

On farm scoring

The assessment is carried out from a **distance of 0,5 meter visually only**. (if necessary, use a marker in order to avoid double counting). Assess **only one side** –half of the pigs left, half right. If you can see both sides of the animal, assess the left one.

- Try to **assess all pens**, if not possible:
  - <10 pens: assess all;
  - 10-25 pens: assess 10
  - >25 pens: 15 pens (choose pens across fields/pregnancy stage etc)
- Try to **assess all animals in pen**, if not possible:
  - <25 in pen: assess all;
  - 25-100 pigs in pen: assess 25; (randomly 5 pigs in 5 different places)
  - >100 pigs in pen: assess 50 (randomly 5 pigs in 10 different places)

If it is not possible (e.g. too dirty, too far away) to **assess at least 70% of animals**:

- **"n/a" (for one/more parameters)**

Exploratory behaviour (pregnant sows, weaned piglets, fatteners)

Restricted feeding: observation should not be done immediately before or after feeding.
1 = Step in front of pen, 2 minutes "adaption time"
2 = count **total number** of visible animals in pen
3 = count the **number of standing AND sitting** pigs which are **A), B), C)**
Do not include: pigs drinking or feeding

A) Investigating a manipulable material or object – "Positive" (manipulating, something, a pig should manipulate)
Include if the snout/mouth is manipulating straw, hay, wood (chip), sawdust, mushroom, compost, peat, roughage (if not part of ration) or other material that enables prober investigation and manipulation **OR** in contact with an object („toy") such as hanging object or ball. *Also grazing and rooting in soil is included here.* Only count if these objects/substrates have been provided by farmer

B) Manipulating other pig, pen fittings or muck – "Negative" (manipulating something, a pig should NOT manipulate)
Include if snout/mouth is in contact with any part of another pig, with muck or the floor, fixtures or fittings of the pen. Empty chewing, tongue rolling etc. is included here. Pay attention at feeders or drinker to discriminate between manipulation of fittings and eating/drinking.

C) Stone chewing i.e. manipulating a stone/s with the snout or mouth – often audible

Respiratory problems (weaned piglets, fatteners)

0 = no signs of problems in group
1 = ≤ 1 coughing or sneezing per ≤ 20 pigs within 5 min
2 = > 1 coughing or sneezing per ≤ 20 pigs (includes also any acutely ill pig(s) affected with obvious pneumonia (laboured breathing, discoloration of ears, blood/purulent discharge)

Body condition score (BCS; pregnant sows) (adapted from DEFRA; 1998)

To score the animals encourage them to stand up

Thin sow
visually thin, hips and backbone very prominent, no/very thin fat cover over hips and backbone

Normal
hips and back well covered, rear view oval

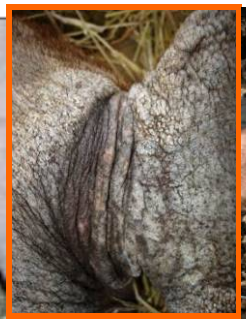
Fat sow
very round appearance from the rear, thick fat layers on hips and back

Ectoparasites (pregnant sows, fatteners)

Count **number of animals** with obvious ectoparasites such as **mites** [Sarcoptes suis], **lice** [Haematopinus suis], **ticks** [Ixodes spp] or **clinical signs** in most cases combined with **itchiness**:

- **small red dots** on whole body (fresh infections in younger animals);
- **crusts** - usually behind ear, tail base or on lower extremities in older pigs

Lice eggs (small white dots) **Lice** (black)



Mange: grey/brown crusts tail base, lower limbs and on/behind ear

Eye inflammation (weaned piglets, fatteners)

Count number of animals with **red, swollen conjunctiva**

0= Normal eye

1= eye inflammation: red, swollen conjunctiva

Swellings (pregnant sows, fatteners)

Look at **all four legs**, count **number of animals** with at least 1 obvious swelling **>3 cm diameter** on at least one of the four legs. (Abscesses (e.g. from injections) on other locations of leg are not included)

0= No swelling, straight line of limbs

1= Swelling (>3cm),
typical regions: point of hock, lateral/plantar on metatarsus, lateral of accessory digit

Lesions (pregnant sows, fatteners)

Count **number of animals with ≥ 3 body lesions** (red scratch, wound or crust) **>3cm long or >1 cm diameter**. Shoulder lesions in sows are counted separately.

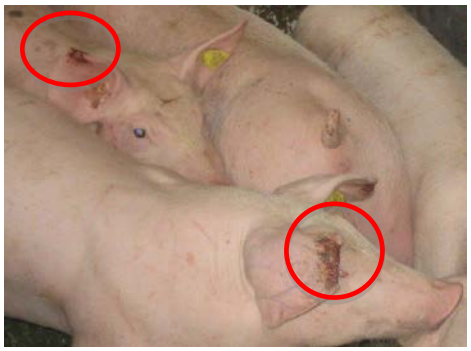
1= >=Body lesions > 3cm

Ear Lesions (weaned piglets, fatteners)

Count **number of animals with crusted, reddened ears skin surface (** > 1cm diameter) **up to anatomical changed structure, clearly missing parts of ear tips or/and earlobes.**

Crusted, reddened ear skin surface

Missing parts of earlobes



Missing parts of ear tips

(pregnant sows)

Count number of sows with evidence of a **pressure lesion (ulcer)** on the shoulder (typical location on spine)
Includes: reddening of the area without penetration of the tissue, open wound, healing lesion or scar tissue

1= shoulder lesion: reddening

1= shoulder lesion open wound

Vulva lesions (pregnant sows)

Count **number of animals** with bleeding wounds or scabs of all sizes. (does not include discharge)

0= Normal vulva

1= Vulva lesion

Deformed vulva (pregnant sows)

Count number of animals with vulva of abnormal shape or missing parts

1= Deformed vulva

Lameness (pregnant sows, weaned piglets, fatteners)

All pigs have to stand up, encourage them to walk some steps.
Count number of obviously lame animals
obviously lame = **clearly visible reduced weight bearing** on one limb ("limping") up to animal being unable to walk

1= Lame: reduced weight bearing on left hind (can also be red or dirty)

1= Lame: no weight bearing on front legs

Tail lesions (weaned piglets, fatteners)

Count **number of animals** with any **scab or bleeding wound** (inspect carefully: hanging tail or swollen tails- might be early indicators of tail lesions)

0= Normal tail (no lesion, normal length as hairs on tip of tail)

1=Tail lesion (count also as "short tail" as tail is obviously shorter

Short tail (weaned piglets, fatteners)

Count number of animals with tails shorter than natural length (natural length includes hairs on tip of tail)".

1= Short tail, no lesion

1= Short tails (count also as "tail lesion" as tails are swollen/with crusts)

Runts (weaned piglets, fatteners)

Count number of animals with **at least two of the following indicators** present:
obviously smaller than the other animals,
visible spine, pale, hairy coat, long face, large ears, sunken flank

1= Runt: Long face, large ears, sunken flank

1= Runt: Visible spine, hairy coat, obviously smaller

Diarrhoea (weaned piglets, fatteners)

Assess faeces for signs of **abnormal consistency, abnormal colour, abnormal smell on animals and in the pen** for the group and assess **as diarrhoea when 2 of those signs are abnormal**

0 = no diarrhoea
1 = mild diarrhoea in pen:
- **≤ 1** pig with diarrhoea per ≤ 20 pigs

2 = severe diarrhoea in pen:
- > **1** pig with diarrhoea per ≤ 20 pigs

1= Pig with diarrhea: abnormal color and consistency

Pigs requiring hospitalization (pregnant sows, weaned piglets, fatteners)

0 = no pig requiring hospitalization
1 = >= one pig needing hospitalization in pen: include pigs that are **obviously sick, weak,** have **problems to cope with the group** (access to food and water) and should be kept separately in order not to avoid further complications of the disease (e.g. severely lame, severely tail bitten…) and/or spreading of the disease (e.g. severe diarrhea),

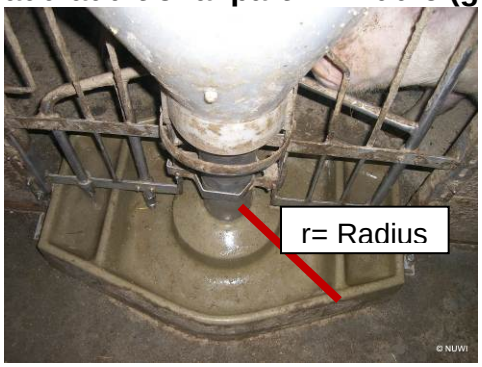
The assessment is carried out for each pen, where animals are assessed.

- Try to **assess all pens**, if not possible:
  - <10 pens: assess all;
  - 10-25 pens: assess 10
  - >25 pens: 15 pens (choose pens across fields/pregnancy stage etc)

Trough: longitudinal provision of food for one or more animals, separation of feeding places max. until shoulder)
Round feeders: circular provision of food for several animals
Spread on the ground: no obvious container for food provision
Individual feed stalls: longitudinal provision of food for one sow; with separation of whole length of animal

Examples of Troughs

Examples of Round Feeders; if difficult to measure radius properly estimate and add additional part in middle (green)



Red line indicates how to measure diameter (diameter = r x 2)
Round trough

Individual feeding stalls:
S= **s**elf lockable by sow: mechanism which enables animals to enter the stall individually AND protects animal during feeding (no other sow is able to enter)
F= lockable by **f**armer: mechanism in place, which allows farmer to lock sows during feeding into stalls individually or as a group (no matter, if actually done or not)
SF= self lockable by sow as well as by farmer
No= **n**ot lockable: no mechanism in place (or broken equipment) to lock feeding

Not lockable

Not lockable (front)

Self lockable by sow

F= lockable by farmer

If there are Electronic Sow Feeders: Can the sows leave them forwards?

YES: door at the front, so that sow does not need to go backwards when leaving the station
NO: no door at the front, sow has to leave the station backwards

Possible to leave to the front

Are pig being fed ad lib? (weaned piglets, fatteners, sows)

YES = ad lib = there is feed available 24h/day and it's present when you are there
NO = not available 24h, includes also, when farmer lets pig empty the trough in the night

How many functional drinkers are in the pen / paddock?

Count number of functional drinker/ing places
Functional = for age group adequate flow rate (l/min), height/position of drinker, clean;
***Trough**: e.g. count as 3 functional drinkers if 3 pigs can drink at the same time
***2** nipple drinkers on top of each other always count as 1 functional drinker, as pigs mostly cannot use both at the same time

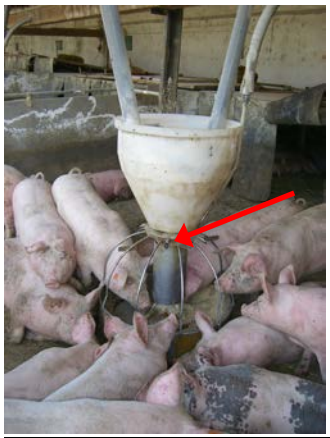
Where do pigs drink from?

Nipple drinker: pig has to take nipple into mouth in order to access water
Bowl drinker: metal bowl for pigs where is some standing water, pig needs to press some form of nipple to refill it
Trough: access to open water, automatic refilling
Pond/lake: natural/artificial water resource, does not include wallows
Running nat. water


Nipple


Bowl


Trough


Nipple drinkers on top of feeder

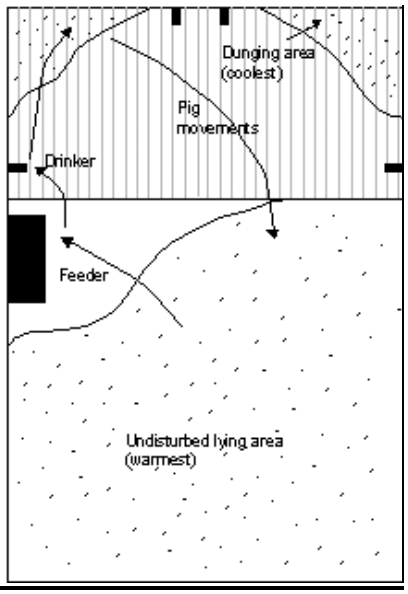

lateral/side


2 nipple drinkers on top of each other always count as 1 functional drinker

Do include nipples **on top**; **do not** include **lateral/side** nipple

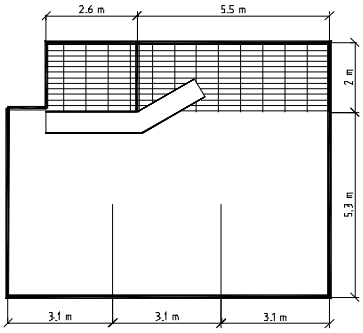
Is there an obvious division between lying area and feeding/activity area?

YES: obvious (some structural element, which clearly separates two functional areas, animals do not need to cross lying area and disturb resting sows when moving to outside area. No drinkers/feeders (troughs or racks) in the lying area.
NO: no obvious division between lying and feeding area, resting animals are disturbed by others crossing the area for going outside, provision of drinkers/feeders in the lying area



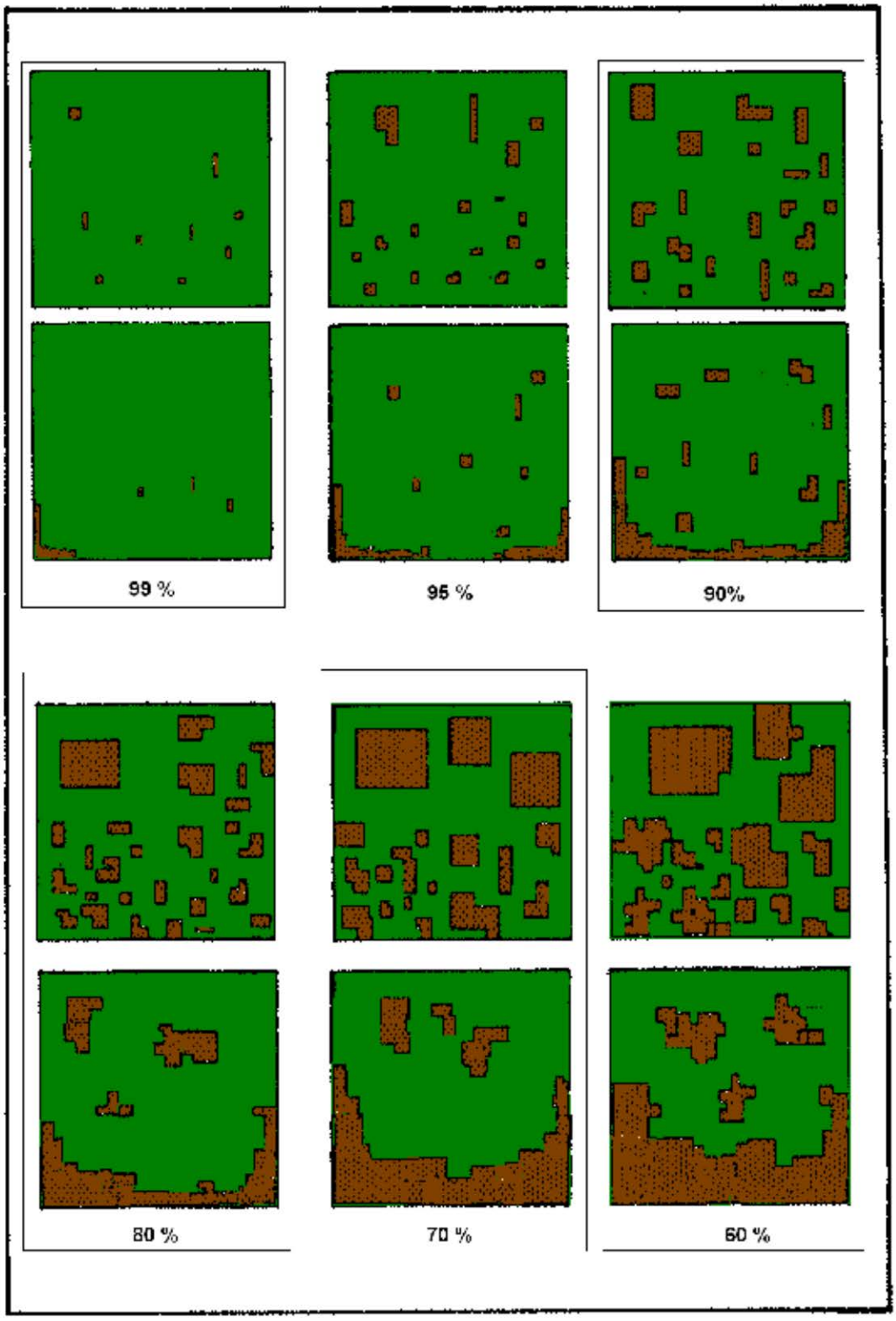
Is the lying area subdivided into separate lying niches?

YES: lying area is surrounded by three walls, max. place for 8-10 sows
NO: no subdivision of lying area into niches (no walls or other structural elements in this area)

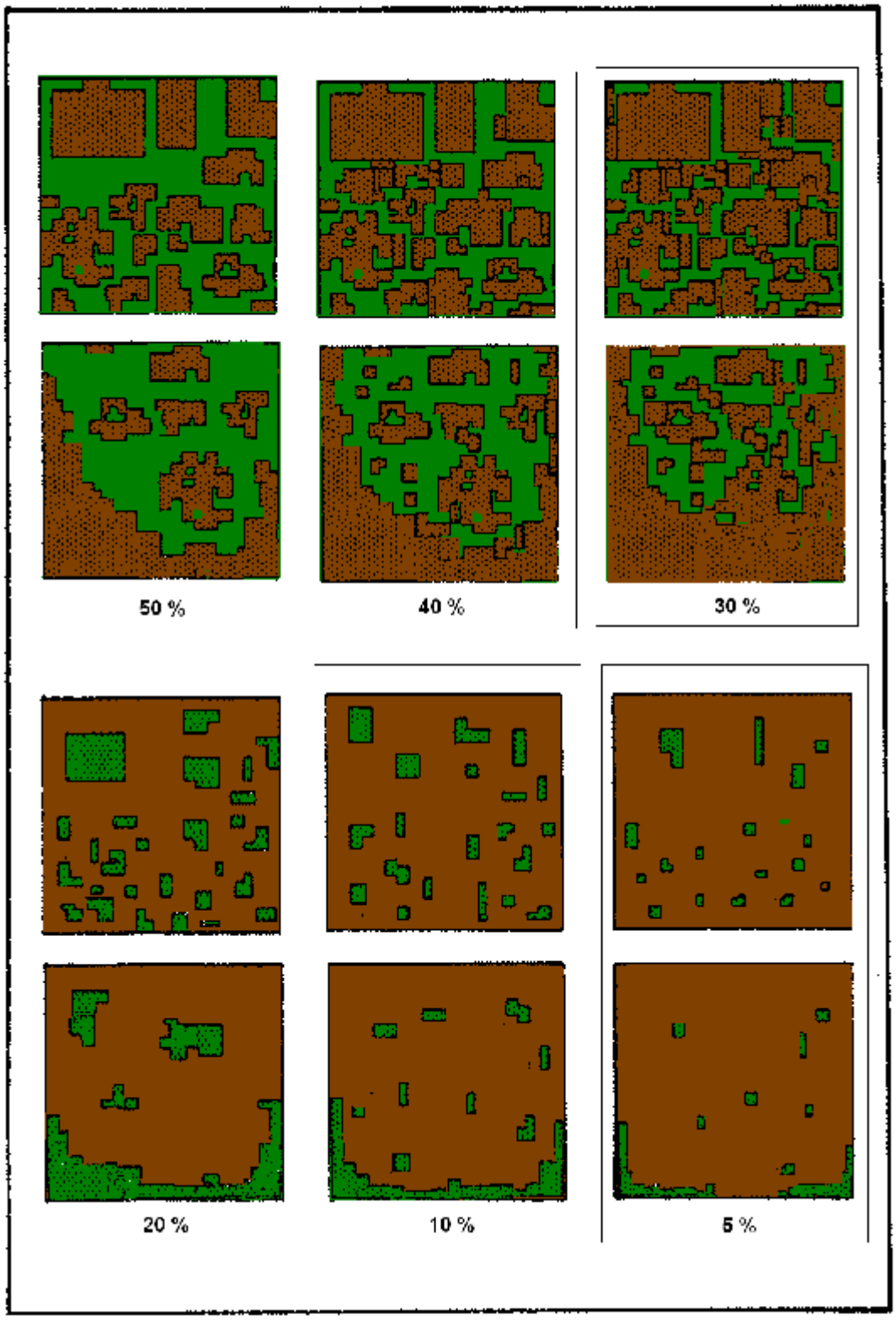


Lying niches

ProPig - Grass Cover evaluation



ProPig - Grass Cover evaluation



Animal and Resources	parameter definition	source
batch farrowing	farm management system, where groups of sows with the same stage of pregnacy (with a certain number of weeks apart e.g. 3 weeks) are kept to allow to manage the farm as "all in all out". pregnant sows arrive together into the farrowing room, farrow within a day or two of each other and leave together after weaning	addapted JŠ, CL
castration	Surgical removal of or rendering nonfunctional an animal's gonads. Here referring to male pigs only.	Adapted "Dictionary of farm Animal Behaviour" , Hurnik, Webster,Siegel", 2ed., 1995
conventional breed	Large White, Landrace, F1, Hybrid sows of different names	Pigsurfer
creep feeding	Provision of supplemental feed to young animals prior to weaning.	Adapted "Dictionary of farm Animal Behaviour" , Hurnik, Webster,Siegel", 2ed., 1995
cross-fostering	moving a suckling piglet to a sow which is not its biological mother, e.g. if the litter is very large or the biological mother does not have enough milk	SD
farm type	pig age groups which are kept on the farm: breeding farm (sows and piglets until weaning); farrow to finish - all/more than half of own pigs fattened; fattening only	SD; CL
fatteners	pigs for meat / slaughter >35 kg incl. gilts until first service	CL
feeding system	Ad libitum: unrestricted access to feed, 24h / day. Limited / restricted feeding: provision of less feed than the animals would consume ad libitum.	Adapted "Dictionary of farm Animal Behaviour" , Hurnik, Webster,Siegel", 2ed., 1995
functional drinker	amount of water that flows (flow rate) in a given time (1 min) should be adequate, also adequate height/position of drinker for age group	
gilts	Gilts are young sows for replacement. no extra category. Gilts are counted as "fatteners" while being kept "with" them, as "pregnant sows" after their first insemination.	
lactating sows	sows in the period of secretion of milk (lactation)	Adapted "Dictionary of farm Animal Behaviour" , Hurnik, Webster,Siegel", 2ed., 1995
medical treatment	i.e. antibiotics, food antibiotics supplements, anti-inflamatory drugs, oxytocin (according to organic farming regulations)	Rennes - discussion
metabolisable energy	(ME) energy from feed available for animals' metabolism.	internet source/GB
MMA	treatment of mastitis, metritis, agalactia (includes all recordings of vet/farmer as "MMA/fever/vulval discharge/Agalactia=no milk" around the first days after birth mostly connected with using Antibiotics/Antiinflammatory drugs/Oxytocin)	CL
nest	Shelter for piglets, closed on at least 3 sides + roof, and floor covered thickly with litter OR external heating provided, and large enough that all piglets can lie inside at once (usually 0.1 sqm per 10 kg piglet); indoor nest = the nest is a separate "structure"; outdoor nest = the nest might be the whole hut; adequate nest = keeps warmness, avoids draught and humidity	SD, Rennes

Animal and Resources	parameter definition	source
nose rings	Metal ring which is pulled through the nasal septum. In pigs used to prevent rooting. Include also metal parts, which are attached to the upper side/s of the snout	Wikipedia
paddock (outdoor)	The total agricultural land and forest used by animals;	Pigsurfer
pen ID	number to be assigned to an observed pen, usually serial, may include letters; if no farm specific numbers always start with one at the pen closest to the entrance	
pregnant sows	sows in the period of developing offsprings in the uterus; sows in service area are counted as pregnant sows even if they are not pregnant (yet)	Adapted "Dictionary of farm Animal Behaviour" , Hurnik, Webster,Siegel", 2ed., 1995
quarantine	The treatment where the newly comming or sick animals are housed separately from the others. Seperately meaning in a building/pen, which has a seperate air space and an extra intrance	JS; CL
replacement rate	the number of new gilts brought into the herd (either by buying or from own herd) that year as a % of the total herd size	SAE; CL
roughage	indigestible portion of plant foods having two main components:soluble (prebiotic, viscous) fiber that is readily fermented in the colon, insoluble fiber that is metabolically inert	Wikipedia
shelter on paddock	provision of protection against danger or discomfort, e.g. wind shields (but excluding housing)	Adapted "Dictionary of farm Animal Behaviour" , Hurnik, Webster,Siegel", 2ed., 1995
sick pen	Separate pen where sick pigs are temporarily housed; perceived as appropriate for sick animals= bedding, provision of food/water/thermal comfort/clean	SD, JS; CL
slatted floor	Wooden, metal or concreet floors with narrow gaps between slats to permit discharge of feces and urine to the external environment, e.g. in a shearing shed, or into a cesspit, the common construction on farms in the northern hemisphere. They are labor-saving but can cause serious damage to feet and limbs if not constructed carefully.	Electronic version of: Saunders Comprehensive Veterinary Dictionary 3rd Edition, by D.C. Blood, V.P. Studdert and C.C. Gay, Elsevier
sows	female animals from first insemination onwards	
teeth clipping	Shortening (included grinding and clipping) the piglets canine teeth to prevent injury to the face of other piglets/the sow udder.	JS
type of drinker	bowl drinker = pressed drinker with metal bowl for pigs where is standing watter, nipple (bite) drinker = adjustable flow for high or low pressure;	internet source
unconventional breed	old breed, local breed, usually low production, e.g. Cinta senese, Mangalitza, includes also more common breeds such as Duroc, Schwäbisch Hällisch;	Pigsurfer
wallowing	activity (considered to be comfort related) characterized by partial submersion of the body into some wet substrate (e.g., puddle, mud) wallowing is most common in pigsand positively correlated with environmental temperature. There should be some water and mud in the wallow, animals should "fit" there.	Adapted "Dictionary of farm Animal Behaviour" , Hurnik, Webster,Siegel", 2ed., 1995
weaners	piglet from weaning until transfer to fattening at ~ 35 kg	Pigsurfer / Rennes

Environmental impact	parameter definition	source
area housing roof	total area (in sqm) covered by a roof	JŠ
compost	1 m3 = 500 kg;	JYD
crude protein	N x 6.25: an indication of the nitrogen content in feed or forages derived from analysis or declaration on purchased feed	GB
grassland	Land covered in grass and or grass/legume swards.	GB
lagoon	like a lake	Rennes - discussion
leachate	liquid draining from manure heap, paved area used by pigs or for composting manure	GB
litter quality	very good = 100 % of litter is clean, dry, and not mouldy good = >50 % - 99 % of litter is clean, dry, and not mouldy poor = >50 % - 99 % of litter is dirty, wet, OR mouldy very poor = 100 % of litter is dirty, wet, OR mouldy	CL, SAE
manure	animal faeces as solids, often mixed with bedding, 1m3 =700 kg	JYD
manure: "coverage"	does a layer of straw count (and how thick does it need to be?)	DK/CL
manure: duration of storage	the time to elapse between manure removal from buildings and spreading on the land	GB
manure: type of treatment	management of manure after removal from housing and before being spread on the land	GB
rainwater drained into slurry	water from rain which runs into slurry storage instead of canalisation	
rotation of paddocks	Land occupied by pigs is changed between batches to give fresh vegetation.	GB
sealed (paved) outdoor area	total area (in sqm) not roofed but draining to storage rather than onto land	JŠ GB
slurry= liquid manure	liquid animal faeces and urine mixed, 1m3 = 1000 kg	JYD
time period with outdoor pigs	how long pigs have been on the same land	SAE, GB
total P	Total phosphorus content of feeds or vegatation	GB

SOP Feed Sampling

The important point to remember when collecting feed is that samples you select need to be **representative** of the feed in question; the amount collected is much less relevant although please check with your laboratory on minimum quality required.

Aim to take a sample from each ration used on the farm (e.g. nursing sown, pregnant sows, weaners, finishers) unless they only vary minimally (e.g. 5% more Soya for lactating sows than for pregnant ones)

Your approach to taking the sample depends on expected variation within and/or between batches – greater care is needed with heterogeneous feeds especially if formulations change over time.

A common approach with homogeneous [pelleted] bulk feed is to take 6 or 8 handfuls from various parts of the bag/bin, at least 25 cm below the surface. If feed is in a deep bin, you may need a sampling lance or spear (as used for grain sampling) which can reach greater depths than your arm.

If sampling a [home] mix of diverse ingredients, take care your handfuls are not bias towards larger particles at the top or finer components that tend to sink to the base.

Guidance

- Aim to use re-sealable plastic bags (see comment [$] below), labelled clearly and unambiguously (including the date) prior to filling. Develop a system to record farm ID, group category or batch of pigs, to enable samples to be linked easily to data collected in PigSurfer.
- If the farm uses purchased feed collect details of ingredients or specification (CP, CF, EE, Ash …) – both are usually on a bag label or purchase invoice if in bulk – take a picture
- Also record any declarations of amino acid content
- For home or locally mixed feeds collect details of the formulation to cross check expected composition with analytical results.

Potential problems:

- Avoid sampling from feed troughs; pigs may have already selected their favourite ingredients or contaminated what is left.
- Be caution of offers to take samples for you; some guidance to the farmer might avoid these being a single handful from the top of a feed store.
- If feed samples become wet either before or after sampling or involve moist ingredients (with a dry matter of < 80%), they need to be frozen within hours of sampling to avoid mould growth – creating a hazard for subsequent analysis.
- [$] If samples are stored in paper bags or if bags are not effectively sealed, moisture could be lost or gained; effectively changing the concentration of constituents.

Analysis to check a) nutrient balances and b) adequacy of feeding

a) Dry matter, nitrogen/protein and phosphorous are ESSENTIAL ON ALL SAMPLES

b) More comprehensive analysis will enable us to assess pig nutrition: moisture/dry matter, ash, crude protein (CP), oil (either by method EE or AEE), crude fibre (CF) or preferably NDF - allowing prediction of metabolisable energy (ME). If using this approach, don't forget to ADD PHOSPHOROUS as in a) above.

Soil sampling introduction ProPIG

Aim of soil sampling in ProPIG

- to characterize the soil (particle size distribution)
- "take a picture" of
    - **soil status** (org. and inorg. C, total N, pH etc.- see *Required measurement*)
    - **"pollution" level** (N and P excesses)
    - Use those data to **provide to the farmers useful information** regarding outdoor areas, our purpose is to support them to improve their soil management.

Hypothesis:

- The presence of pigs modifies the soil, therefore the soil from outdoor areas (from outdoor/partly outdoor farms) must be analyzed
- The status of the soil can be influenced by management (e.g. paddock rotation, crops…)

1. Sampling strategy (type of farms, countries, age groups of animals)

- **Type of farms:**
    - **Outdoor farms and outdoor areas in partly outdoor farm**s, where pig are kept on the soil
    - **Indoor farms**: we have an EU regulation for the spreading of N on land, so we decided **not to take samples** from crop fields.
- **Countries:**
    - Proposal: "selected farms"
    - Depending on budget and number of farms needed for Analysis – please confirm number of farms with Eva/Davide/Tina
- **Age groups**
    - To provide to the farmer a precise soil status we have to sample different paddocks in each farm. To have a complete picture of the farm we have to choose and sample
        - paddocks for **each age group of pigs one** (or more –according to the farmer/costs) representative paddocks of pregnant sows, lactating sows, weaners and finishers.
        - **Representative paddocks**: ask the farmer what paddocks and what information he is interested in for management of his fields (e.g. soil structure/carbon status or soil chemistry/leaching risk/fertiliser value for next crop); if there are alternatives, choose in your opinion the average soil status, don't choose the best or the worst situations.

2. Sampling location:

We have to choose the type and number of sites by experience of the behaviour of pigs in the system (e.g. defecation/feeding/wallowing/grazing/rooting/nest/lying)
To reduce the number of samples the **following areas** have to be sampled:

- **high influence**: toilet and feeding areas. Toilet areas are typically ~10m from the hut or along fencelines bordered by other pigs.
- **low influence**: grazing area
- **no influence**: no pigs (external sample / control area / blank) (The control area will be just outside the paddock where the typology of the soil is the same of the paddock but the pigs don't influence the C, N and P content – so not down the slope where run-off will occur.)
- **Attention**: in **some farms** we could find paddocks in permanent use where pigs feed and occupy paddocks in rotation for grazing; sometimes it is very difficult there to find toilet areas (because of dimensions of the paddock, presence of grass…), so we suggest in those cases to equalize high influence = areas in permanent use and low influence = areas in rotation.

At farm level (**drawing a map**) we can **sample**

- one (or more) external area (the blank; = “no influence”)
- for each age group (pregnant sows, lactating sows, weaners, finishers) one or more representative paddocks
    - **one (or more) areas of "high influence**" and
    - **one** (or more - according to the dimension of the paddock – see below) areas of "**low influence**"
- every sample will be composed by a bulking of several samples from that category.

3. Sampling method

To achieve a representative sampling procedure sample systematically:

- Within the defined site (high, low and no influence areas) take **several soil cores evenly distributed (at least 6)** in a defined area:
- identify the 3 different types of areas, locate it on the paddock map, and in each one collect several subsamples that will be carefully mixed to give the 500 g soil sample.
    - E.g. if 3 places are identified as "high impact zone" 3-4 samples in each one will be gathered to give a representative sample) (you could choose the sub-sample sites randomly or use the W shape)
- After thoroughly **mixing (of subsamples) in a bucket,** take out **bulk samples** of ~500g for analyses.
- System differences can make it difficult to strictly follow the theoretical instructions, e.g. at one farm with narrow paddocks a sample site included two fence lines and in this case we used the W shape to take out the soil cores. This was because the pigs were on patrol along the fence, including some excretion.
- A **record of the sampled sites** and points should be kept: a plan indicating the sample sites, the location of hut, feeding and drinking, the fencelines with an indication of whether adjacent to other pigs. If vegetation is patchy, indicate if vegetation or bare. Any re-sampling should be carried out in the same period (season) as for the initial sample
- In general sampling points should be at least **1 m distant from tree stems and should avoid animal holes and trails**.
- We can use **a small soil auger, a soil core, a small spade or a trowel**.
- Recommended **sampling depth 0-20 cm**
- A recommended **soil sample mass of >500 g** should be collected
- Split in two the soil mass, put **the first part into a cool box (4-6°C)** and **the second in a normal box**
- For **transport:** use a simple plastic bag with clear waterproof label
- For **storage:** the first sample (cool) into a freezer (-20°C) until the end of the second visits, after send a box with dry ice to the lab. The second sample has to be air dried and send to the lab in a normal box.

Label should indicate date, farm (IT 001), paddock identity (paddock 1), pig typology (gestating sows), type of sample (blank, high or low intensity) and location within paddock (in your drawing)

SUMMARY

Sample one paddock for each group of pigs
Three samples each paddock (blank, high and low intensity)
At least 6 subsamples for each sample > 500gr
Split in two the sample
Sample 1 (for mineral Nitrogen) cooled at 4-6°C on farm and after -20°C
Sample 2 (for other analysis) normal plastic bag on farm and after air drying

4. Soil Processing

Samples should be air-dried at 35°C for 3-4 d prior to root removal and sieving.

5. Laboratory Analyses

Soil property measurements will use standard methods of analysis (Klute, 1986; Weaver, 1994; Sparks, 1996; Carter, 1999; Robertson et al., 1999).

Required measurements

- Soil organic C (Walkley and Black) Kjeldahl and total N (Nelson and Sommers, 1996; Lal et al., 1999)
- Mineral Nitrogen (NH4 and NO3)
- Soil inorganic C (Loeppert and Suarez, 1996) (total carbonate)
- Extractable Phosphorus (Olsen) and total Phosphorus.
- Soil pH and electrical conductivity (Thomas, 1996; Rhoades, 1996) Cation exchange capacity.
- Particle-size distribution (Gee and Bauder, 1986)

5. Soil Archiving

Archived soil samples (keep a duplicate of the sample) should be kept in air-tight, non-reactive containers with secure lids and permanent labels (at room temperature).

6. References:

- GRACEnet Protocols: Chapter 1. Guidelines for Site Description and Soil Sampling, Processing, Analysis, and Archiving Mark Liebig, Gary Varvel, and Wayne Honeycutt. (September 2010)
- SOIL SAMPLING PROTOCOL TO CERTIFY THE CHANGES OF ORGANIC CARBON STOCK IN MINERAL SOIL OF THE EUROPEAN UNION. Version 2. Vladimir Stolbovoy, Luca Montanarella, Nicola Filippi, Arwyn Jones, Javier Gallego and Giacomo Grassi Institute for Environment and Sustainability, Institute for the Protection and the Security of the Citizen 2007

Summary of soil sampling

We need to collect soil that is **representative** of the land in question. Nutrient loading will vary widely over the fields depending on pig activity; we have decided to sample i) *hot spots* around feeding and dunging areas (often along fence lines), ii) lower influence areas within the paddocks used for grazing and iii) control samples of comparable soil taken outside the pig paddocks.

Sampling method

- Use a **soil corer, small spade or trowel** to sample soil between 0-20cm deep, aiming to collect approximately 24 cores for 40 m^2
- Within each defined area (high, low and no influence) take **soil cores evenly distributed** (either selected at random or follow a W shape)
- Avoid sampling within **1 m from trees, animal holes, wallows** and trails.
- **Record sampling sites** and points to enable any resampling to be comparable
- Mix the cores thoroughly in a bucket and select 2 subsamples (**≥500 g)** for analyses.
- Use a clearly labelled plastic bags; farm name/number, paddock ID and date.
- Soil for mineral nitrogen assessment (b below) need to be kept cool until it can be frozen; either subsample at the farm and transport smaller samples 'on ice' or transport all samples in a cool box to be subdivided back at base with subsamples frozen (mineral N) and the remainder (for a below) kept at ambient storage.

Analysis:

Analysis listed below should be done on all soil samples (from selected farms), however, the methods used can vary across countries/laboratories.

a. *Analysis from ambient storage and transport:*
   - Extractable phosphorus (Olson) and total phosphorus
   - Soil organic C (Walkley and Black) Kjeldahl and soil inorganic C (Loeppert and Suarez, 1996) (total carbonate)
   - pH (lime requirement)
   - soil texture / particle size distribution (Gee and Bauer, 1986)

b. *Samples frozen for storage and transport*
   a. **Total N** (Nelson and Sommers, 1996; Lal et al., 1999)
   - **Mineral Nitrogen** content:
     i. including: **NO_3**, **NH_4**,
   - **Moisture**

All that need guidance in how to choose type and number of sites please contact Eva Salomon, Sandra Edwards/Gillian Butler and Davide Bochicchio for discussion.

ProPIG farm assessment – first visit

Before the visit

- read the dictionary
- try the protocol on a "trial farm"

General rules

questionnaire

- If the choice answers are "yes" and "no" and the **farmer answer** is a maybe, choose the "worse" answer. E.g. "Is all-in-all-out being applied" – response = "usually": choose "no"
- If the farmer is not sure about a number try to find a sensible answer but do not push for inventing numbers.
- If you cannot answer a question, e.g. because the farm does not know or animals are too dirty, or there is no solid manure on the farm: choose "n/a"

Visit: sequence

1) Interview
2) land use
3) diets
4) records
5) direct observations
6) samples

Interview

- diets: If lactating and pregnant sows get the same ration only enter into fields for pregnant sows and leave lactating sows empty
- make a farm map with information on present paddock use and management, rotation, pig stocking rates

direct observations

- take pictures
- if you are not sure, if a parameter is there – choose the **BETTER** case- e.g. if you are not sure, if the swelling is a swelling – choose "**NO swelling**" (**parameters need to be obvious** in order to explain it to the farmer)

documents additional to Pigsurfer – all in dropbox_WP1_protocol_final assessment tool for farm visits

- scoring key for % of green area: PCTgreenArea.pdf
- animal scoring key:
- soil structure:
- Farmer questionnaire

SOP Health and welfare Planning – second visit

Before the visit

1) **Prepare yourself:**
   a. Read Presentation from Rennes/SOP
   b. Read results from each farm and discuss/read about problems and solutions (involve other experts if necessary)
2) **Prepare the farmer**
   - Encourage farmer to invite Vet or advisor to join during your second visit (if necessary/if wanted by farmer) or otherwise take a copy of the farm report (Benchmarking) for them
   - Encourage farmer to allocate at least 2 hours time and also to invite all relevant familiy members/stockmen for the discussion (take additional copies for them)
3) **Prepare the Plan**
   - Print the plan (Farm plan from Pigsurfer including the benchmarking) twice (at least) in colour
   - Take a (colouring) pen to structure the report
   - Include the first two pages („Farm report summary")
   - If relevant, prepare the HACCP for a problem, you are aware from the first visit

During visit

1) E**xplain the idea of this planning process:**
   - The plan reflects the situation in comparison to other farms, no judgement
   - The farmer should decide, what and how he/she wants to change something
   - The researcher is there to facilitate/support the process
   - The farmer should have a pen to make notes during the discussion and write down the goals and measures in the end onto the "Farm report summary"
2) **Explain and talk the farmer through all parameters/issues**
   - **Explain the general idea** of the plan, the benchmarking using the first parameter
   - do not judge
   - **Wait,** if the farmer asks questions/makes statements „e.g. I know, the respiratory problems since several month- what could I do about it?" or „I never noticed, that my sows have so many lesions – why is this relevant?"
   - Do not give one solution straight away to a problem – better to ask „what would you do about it? Or „why do you believe, that your animals have this problem?"
   - **Suggest from the list** of improvement strategies (`COIS`) by e.g. explaining: „one reason could be …, the other one…." Or on other farms they had good results with …
   - Try to **explain the link between different results** of the farm – e.g. many thin sows and lack of protein in food

3. **Agree on 1-3 „Goals**" and for each goal 2-3 **measures to achieve** those (use list of Improvement strategies"),
   - which **the farmer writes** in his/her plan
   - Copy this or write it down as well

ProPIG farm assessment – Third visit

Before the visit

- Read the pigsurfer dictionary and the animal based and resource scoring sheet
- try the protocol/PigSurfer on a "trial farm"
- it might be beneficial to print the interview from the previous visit/prepare to have it on the laptop during the visit
- prepare/print results of soil/LCA – read explanation to be able to discuss results with farmer

Visit: sequence

1) **Interview**
2) **Diets** (composition/content) – if needed/easier use extra sheet/excel file;
3) **Records** (treatment and productivity)
4) **Direct observations** on animals/resources (incl. additional checklist "skin lesions" for indoor housed age groups, if you have time)
5) Start **PigSurfer** to calculate new "Farm plan" (might take some minutes)- in between:
6) **Qualitative Farmer Interview II**
7) **Explain results** of previous visit to farmer
    - LCA
    - Soil
8) Look at Farm plan/restructure in Word (if time and effort possible)
9) **Print farm plan**
10) **Implement farm plan** (See SOP improvement third visit)

Pigsurfer 1.0
Comprehensive manual

Andreas Strack, Sabine Dippel

Content

Introduction

The PigSurfer software provides functionality to gather data from pig farms, import / export this data, and provide feedback to a farm owner in the form of a report including benchmarks. The software distinguishes two different kinds of users: observers and supervisors. The observers gather survey data on farms, using the questionnaires the supervisor provides. Later on, they export their data to the supervisor, who in turn sends back data for international benchmarking (national benchmarking works without supervisor feedback). Thus, the tasks of the supervisor are to provide questionnaires, to collate the data gathered by the observers, and to provide data for international benchmarking.

The **software** comes with three installation types:

1. Desktop – Supervisor (PigSurfer_Supervisor_.... .jar):
   This is the supervisor version as a runnable java file. It will only be used by Sabine.
2. Desktop – Observer (PigSurfer_Observer_.... .jar):
   This is the observer version as a runnable java file.
3. Android – Observer (PigSurfer_Android_... .apk):
   This is the observer version for installation to an Android tablet device.

You need to have "Java Runtime Environment" installed on your PC / laptop in order to run the software. If you do not have it installed, you can download Java from http://www.java.com/de/download/ . You will need administrator rights for installation.

The third installation type is an android application package and can only be installed on devices running the Android operating system, such as certain tablets or smartphones.

In addition to the software you need to have a **database file** (ending with *.sqlite) in order to use Pigsurfer. The database file contains the questionnaires and any data you enter. Therefore, this is the file you always want to back up.

Technically speaking, the software provides a local web server. Thus, in order to use Pigsurfer, you will have to start the software, reference the *.sqlite file to use, and then go with your internet browser to http://localhost:8080.

As the supervisor version will only be used by Sabine, it will not be referenced any further.

Installation

Desktop version (PigSurfer_Observer_.... .jar)

Before installing, be sure to have a Java Runtime Environment installed as described in the introduction. Download / copy the file PigSurfer_Observer_.... .jar to your computer and then start it by double-clicking the .jar file[1].

You will have received a database file from Sabine which contains the questionnaires and which will also contain your data (PigSurfer_XX_... .sqlite). For trying it out, save a copy of PigSurfer_XX_... .sqlite with the software and rename it so that you know, it's the file with which you have tested Pigsurfer and which does not contain your data. For real data collection, you'd best save PigSurfer_XX_... .sqlite on a (micro) SD card, which you can also use in the tablet.

1 Note that, depending on from where you download the software, it might happen that the file endings are changed from ".jar" to ".zip" or something else. Before starting the software, you have to change the ending back to ".jar".

Once you have started collecting data, always use one PigSurfer_XX_... .sqlite file! The best method is to only use the PigSurfer_XX_... .sqlite file on the SD card, meaning when you use Pigsurfer on your PC or laptop also directly reference the file on the card from Pigsurfer. Make regular backup copies. (For details see “Data handling / practical tips” below.)

Android version (PigSurfer_Android_... .apk)

Accessing the SD card

In order to install the android version of PigSurfer, you need to copy the "PigSurfer_Android_.... .apk" and the database file to the SD card of your android device. The following steps are necessary to do so:

1. Insert the SD card into the tablet.
2. Connect the tablet to the PC / laptop via the USB cable.
3. On tablet: In the top left corner of the screen appears a small icon, indicating that an USB connection has been established.
4. On tablet: Touch the icon and pull it downwards
5. On tablet: On the opening screen, press the button to establish a USB data connection.
6. On PC / laptop: A new drive will show up in the file explorer. Go to that drive and open the folder "sdcard".

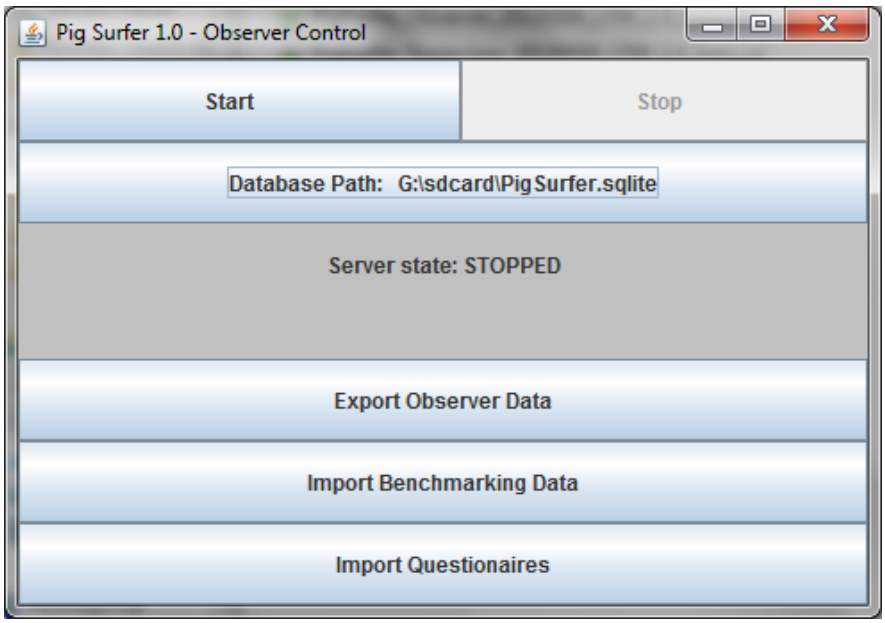
Installing the application

7. On PC / laptop: Copy PigSurfer_Android_.... .apk and PigSurfer_XX_... .sqlite to the "sdcard" directory. You can also make a directory (e.g. called “Pigsurfer”) in which to place the files. However, you will need to remember, where the file is saved (directly in “sdcard” or in a directory in ”sdcard”, because you will have to enter the path and file name on the tablet (see Usage: Software control > Android version).
8. On tablet: Deactivate the USB data connection.
9. On tablet: Start the application "ApkInstaller".
10. On tablet: Select "Install".
11. On tablet: Select "TF Card" as path.
12. On tablet: Select the "PigSurfer_Android_... .apk" and finish the installation.

Usage – Software control

Desktop version (PigSurfer_Observer_.... .jar)

After double clicking of PigSurfer_Observer_.... .jar the following window opens up:



“Start” / “Stop” the Server

Pressing "Start" will start the web server enabling usage of PigSurfer via internet browser. Likewise, "Stop" will stop the server. The grey field below the "Database Path: ..." button will show the current server state (and any other notices).

Selecting the Database (“Database path: …”)

Pressing the "Database Path: ..." button will open a dialog where you can select the path and file name of the database file you want to use (i.e. the one on the SD card). If you do not yet have a database file, you can also enter a file name. After you have imported questionnaires a new database file with the name you have assigned will be created.

Export Observer Data

After pressing this button, you can select a database file to which export your survey data. Usually, this will be a non-existing file that will be automatically created during the export.

Import Benchmarking Data

After pressing this button, you can select a database file containing benchmarking data (which will be sent to you by Sabine during the course of the project). This will add anonymous data from farms not assessed by you to enlarge the benchmarking data base.

Import Questionaires

After pressing this button, you can select a *.sqlite file containing questionnaire definitions, which has been provided by Sabine. However, this only works, if you refer to a database file whi does not yet contain a questionnaire definition, that is, a new file. Note that when importing benchmarking data, the questionnaires are automatically imported, too. Thus, you do not need to import the questionnaires after importing benchmarking data.

Android Version

“Start” / “Stop” the Server

Pressing "Start" will start the web server enabling usage of PigSurfer via the browser. Likewise, "Stop" will stop the server. The field in the bottom half of the screen will show the current state of the server. Note that before first starting the server, you have to specify the path to the database

file (see below).

Selecting the Database (“Database path: …”)

In order to be able to start the server on the android version, you have to type in the path and name of the database file relative to the "sdcard" directory. Thus, for example, if your database file is named "PigSurfer.sqlite", and it is placed directly in the "sdcard" directory, you just type in "PigSurfer.sqlite". If you have created a directory called "Pigsurfer" in the "sdcard" directory and placed the file in there, you would have to type "Pigsurfer/PigSurfer.sqlite".

Usage – PigSurfer: Entering data

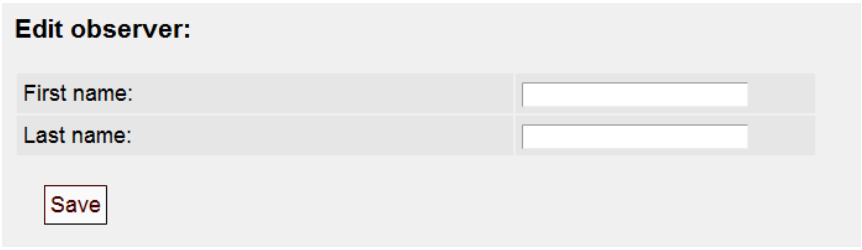
Once you have installed PigSurfer and started the server (the software) you can enter data via your internet browser. You can take any browser you like, but Andreas (the programmer) recommends Google Chrome, because it supports range checks on numeric input fields. This is also the browser which is already installed on your android device.

In order to enter data, you have to provide the following URL in the address field of the browser: "http://localhost:8080". In the following, a walkthrough will be presented, illustrating the use of PigSurfer. It assumes a fresh database received from the supervisor (Sabine).

Walkthrough: Entering data

If this is the first time on this day that you are using PigSurfer, the "Credits" screen will appear:

Click on "Use PigSurfer" to start using the software. If this is your first time you are using the current database, you will first have to enter your name:



After entering your name and pressing "Save", you will be directed to the main menu:

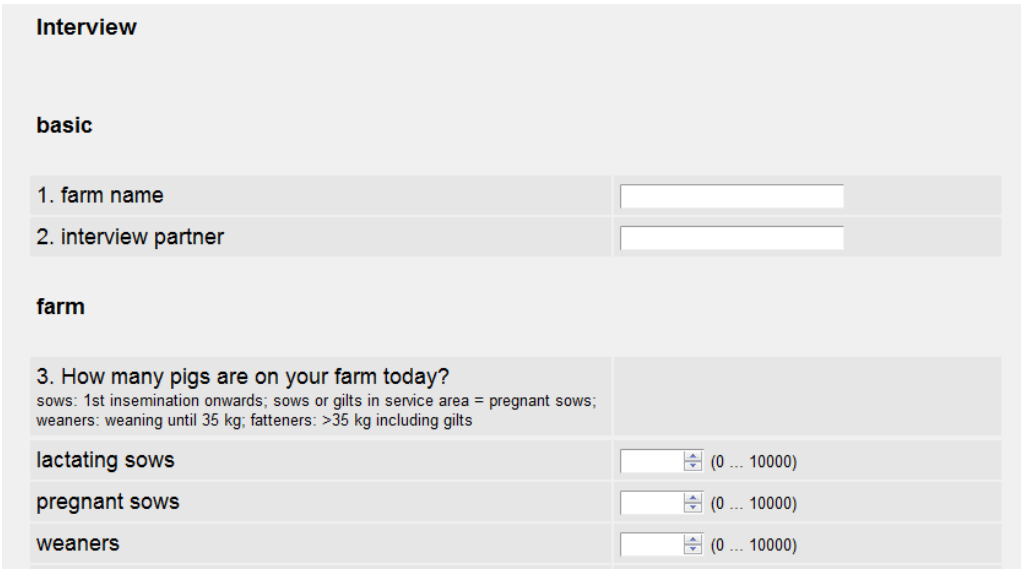
Here you can select the questionnaire you need depending on which part of assessment you are at. “Farm report” leads you to the reporting screen, which will be described at the end of this walkthrough.

After clicking on a button in the list, you will first be asked to enter a new farm (or select a farm if you are e.g. moving from interview to direct observations):

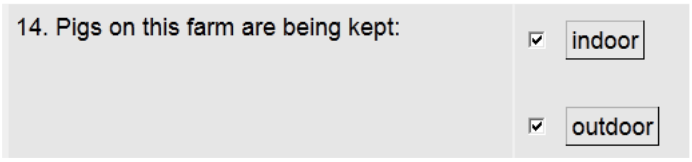
Since there is no farm stored in the database yet, you have to enter the farm you want to do the survey for after clicking "New farm...":

In this example, we have a farm in Germany, to which we assign the identifier (farm number) "12". After saving the farm information, you will be directed to the survey selection screen:

Similar to the farm selection, you have to choose a new survey here, since no prior interview is available in the database. Clicking "New survey..." will open a new interview:



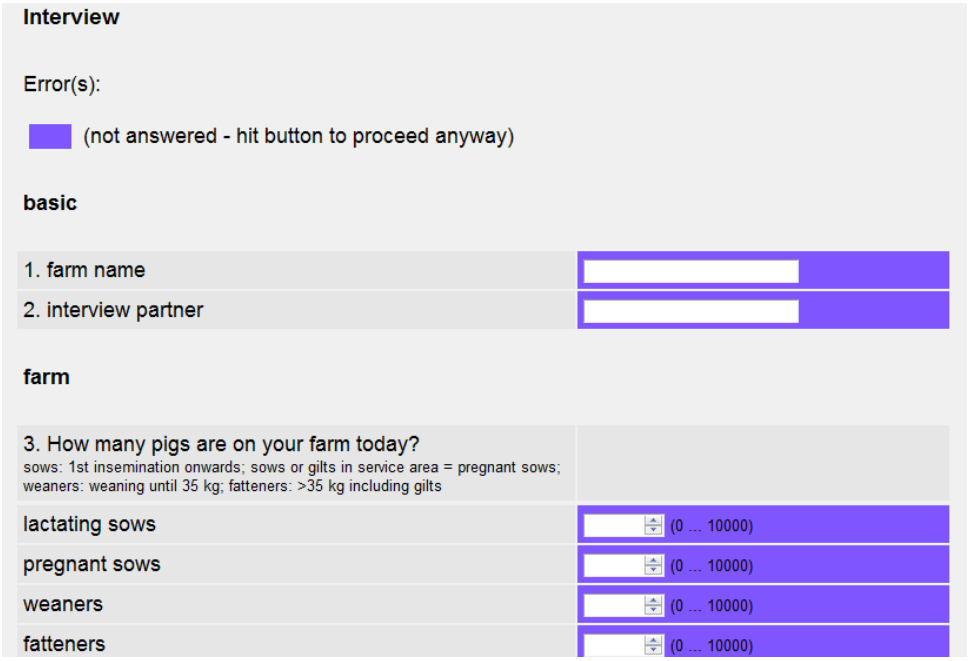
Here you can actually start with your interview by entering values[2]. In some questionnaires you will have to specify a some point whether the farm keeps pigs indoors, outdoors or both. In the interview this is specified at question 14. If a farm has animals indoor and outdoor tick the boxes for both:



Depending on what you have selected, you will see questions for indoor housing, outdoor housing or both on the next screen. If you have made a mistake, simply save everything, and recall the questionnaire form the start screen. You can then change your selections / answers.

Clicking on "Save + Proceed" will save all entered data to the database and proceed with the survey. At this point, Pigsurfer checks for mistakes and also missing data. As none of the questions were answered, all are marked violet. (Unfortunately, it was not possible to apply the "missing data" check to non-remark fields only in this Pigsurfer version.)

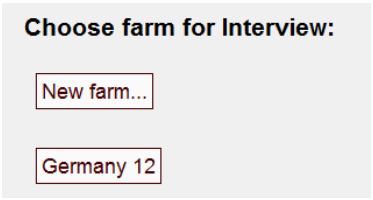
2 Note that the Screenshot is taken from the browser Google Chrome, which supports the numerical input type. You can see this from the up / down arrows. Firefox or Internet Explorer do not support the numeric input format at the time the software was written.



Clicking "Save + Proceed" a second time will save everything as is and take you to the next page of the interview. Don't worry if you have made a mistake. You can re-access any filled out questionnaire from the start screen and change the information.

On the second page of the interview, the button to save the data is labelled "Save" instead of "Save + Proceed" because it is the last page of the interview. Pressing "Save" will save the entered data and direct you back to the main menu (if necessary, asking you for the confirmation of the non-answered questions before doing so).

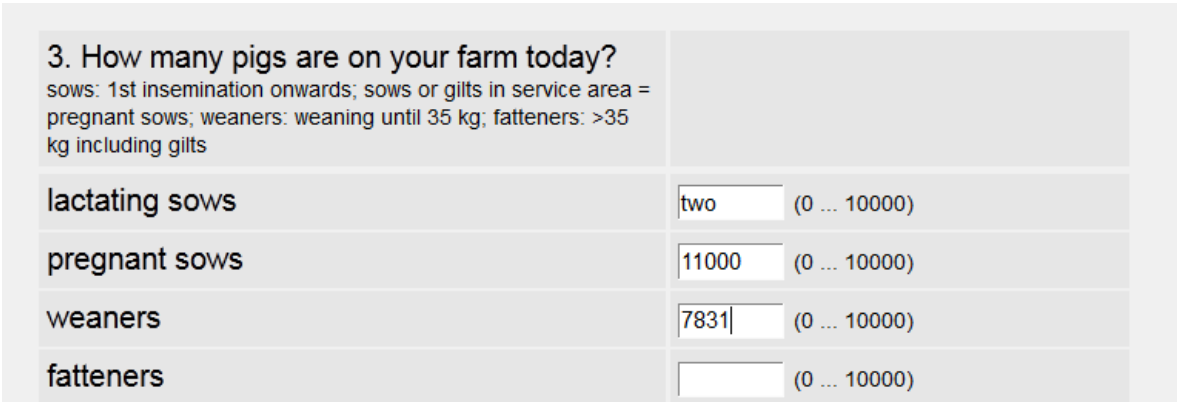
There are two more aspects to the filling out of an interview, which will be described now. First, choose "Interview" from the main menu again. This time the farm selection screen will look like this:



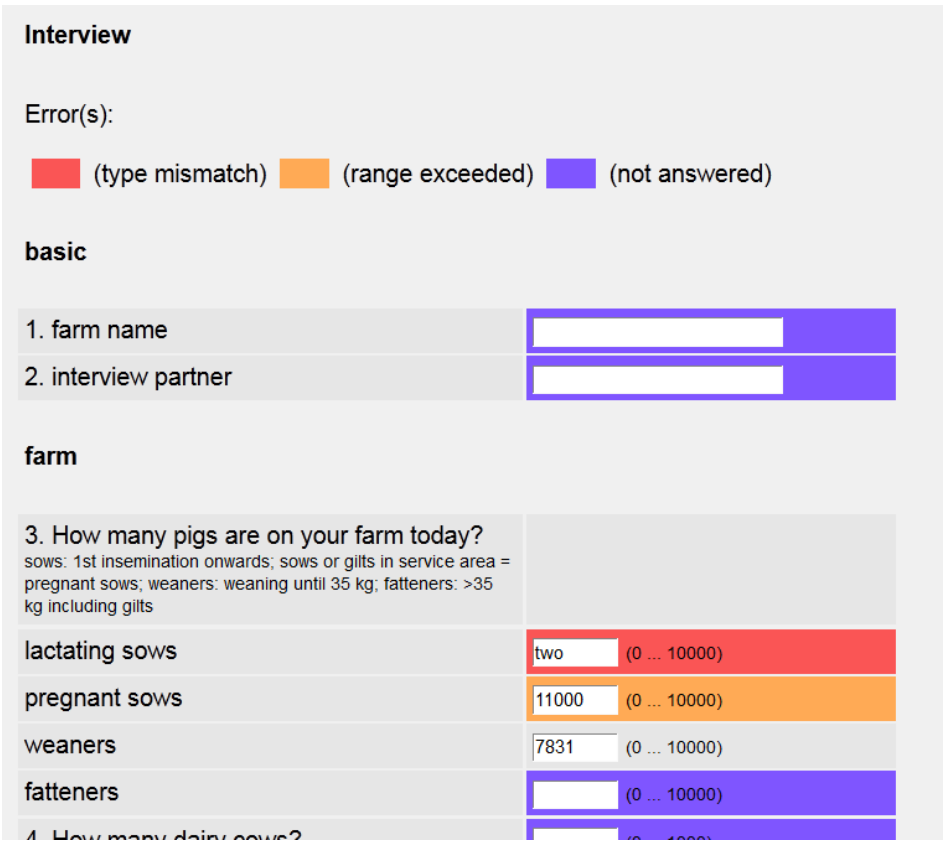
You can now select the previously entered farm "Germany 12". When you select it, the survey selection screen will appear:

Here you can select the interview that we just did by date. If you select the existing interview, the first page of the interview will open again, displaying all the values you entered on this page before. Let us now enter some illegal number values [3]:

3 This would not be possible in Google Chrom, because Chrome only allows valid values tob e entered.



Clicking "Save + Proceed" now will lead to the following error messages:



We have entered a wrong type (lactating sows: text instead of a number) and an out-of-range value (pregnant sows: 11000, where only values up to 10000 are allowed). Correcting these two errors will let you proceed with the interview, where, again, PigSurfer will ask for confirmation of empty input fields if necessary. Type mismatch may also occur when you have used a comma (,), instead of a dot (.) as decimal separator

Another aspect of the interview, that shall be shown here, appears when proceeding to, for example, question 81 on the second page:

feeding

79. How much straw do you use as roughage or bedding on the farm in total?	t / year (0 ... 100000)
80. remarks	
81ff diet content	Edit
86ff diet composition	Edit

The "Edit" buttons will direct you to a tabular input form for “diet content” or “diet composition”. For example, pressing the "Edit" button for diet content (maybe twice, depending on the appearance of the empty-value-confirmation) will lead to this input form:

diet content

		pregnant sows	lactating sows	creep feeding	weaners 1	weaners 2	fatteners 1	fatteners 2	fatteners 3		
kg concentrate fed per animal and day	kg DM / animal / day (0.0 ... 20.0)									kg DM / animal / day (0.0 ... 20.0)	kg concentrate fed per animal and day
		pregnant sows	lactating sows	creep feeding	weaners 1	weaners 2	fatteners 1	fatteners 2	fatteners 3		
kg roughage fed per animal and day	kg DM / animal / day (0.0 ... 20.0)									kg DM / animal / day (0.0 ... 20.0)	kg roughage fed per animal and day
		pregnant sows	lactating sows	creep feeding	weaners 1	weaners 2	fatteners 1	fatteners 2	fatteners 3		
metabolisable energy	MJ / kg									MJ / kg	metabolisable energy

Filling this out and pressing "Save + Proceed" will take you back to the second page of the interview, from where you can proceed further.

Walkthrough: Farm report

This step should be done on laptop or PC, because the tablet might crash due to low memory capacities.

For generating a report with the summed up information collected on the farm, go to the start screen and select "Farm Report". Selecting the farm you want to do the report for (in our case, only "Germany 12" is available) will present you with the report for this farm:

Report for farm Germany 12:

Farm summary

1. farm: --- (Not enough input values available.)

2. farm type: --- (Not enough input values available.)

3. current pig stock:

lactating sows: 2

pregnant sows: 10000

weaners: 7831

Not surprisingly, the report does not contain very much information, since we have almost not filled out anything. When enough data is available, the report will list all information necessary for the summary, including benchmarks. Otherwise it will state “Not enough input values available.”. The following screen shot shows two example benchmarks for test data:

Health and welfare

1. pregnant sows: investigating enrichtment:

20% best farms				20% worst farms	Your farm on 02.05.2012 (mean based on 4 value(s))
52.5 - 41.5 %	41.5 - 38.5 %	38.5 - 34.2 %	34.2 - 27.8 %	27.8 - 11.6 %	31.2 %

2. pregnant sows: investigating other:

20% best farms				20% worst farms	Your farm on 02.05.2012 (mean based on 4 value(s))
22.0 - 25.6 %	25.6 - 28.0 %	28.0 - 35.4 %	35.4 - 41.7 %	41.7 - 55.3 %	37.8 %

The benchmarking displays a value for the considered farm and relates it to all known values of all other farms by generating quintiles and colour-coding the quintile of the considered farm.

Please note that calculating the report will take longer the more benchmarking data is available. This can take well over a minute on a PC, so there is no need to worry, when the result is not displayed immediately. Since your android device will have considerably less computing power than your PC / laptop, the computation is likely to timeout. Thus, you will want to generate the report on your desktop / laptop device.

Data handling

I would recommend to create a test database with TEST as part of the file name for you to try things out. Then make a new database for farm assessment.

The database (your collected data)

Only use one database file (*.sqlite). Make regular back-up copies as described below.

1) Insert a SD card into the tablet.
2) Connect the tablet to the PC / laptop via the USB cable.
3) Establish a USB data connection (see “Installation > Android version”).
4) Save the database file you want to use on the SD card as described in “Installation > Android version”

For recording an interview on your laptop:

5) connect the tablet via USB with your laptop
6) Open Pigsurfer and reference the database on the SD card via “Database path: …”.
7) Start Pigsurfer, record the interview in your web browser, close Pigsurfer
8) Detach the tablet (icon for detaching hardware in lower right corner on Windows screen, just like for USB sticks etc.) and disconnect the cable.

For recording data at the pigs:

9) Start Pigsurfer on the tablet
10) Reference the database on the SD card
11) Record your observations

For generating the farm report:

12) Reconnect the tablet with the laptop
13) Open and start Pigsurfer (still referencing the database file on the SD card).
14) Open Pigsurfer in your browser and select “Farm report” on the start screen.

All data from one farm need to be in the same database in order to generate the report. Sticking to the routing described will prevent data losses and inconsistencies.

Backing up data

Make regular backup copies of your database (*.sqlite) file. In order to do so, make a copy of the *.sqlite file on the SD card. Save the copy in a folder for your backups and add the date when you copied it to the file name. Please keep the backup copies until the end of the project.

Exporting data for Sabine

In Pigsurfer with your database referenced click on “Export Observer Data to Database”. You will be asked to enter a file name and location. Usually, this will be a non-existing file that will be automatically created during the export. After you have created the file, send it via e-mail to

sabine.dippel@fli.bund.de.

Importing data for international benchmarking

During a later stage of the project you will receive the anonymous data from the others to enable an international benchmarking. Sabine will send you a *.sqlite file, which you can then import by clicking "Import Benchmarking Data" and choosing this file.

Note that this import will not create duplicate entries of the surveys that you have sent to Sabine. Duplicate entries will not be imported. Thus, with every import you will only be importing new data.

Data entry

be safe

You should always carry a paper version for all questionnaires in order to be able to assess the farm on paper. Technical devices tend to crash, break or develop strange lives of their own, therefore it's good to have a backup. For printing, open the questionnaire on your laptop or PC and print it via the print function. Try to print from Internet Explorer or Google Chrome, as printouts from Firefox look strange.

moving through questionnaires

You should try to avoid jumping between questionnaires or taking shortcuts. Finish one questionnaire, e.g. interview, save it, then go to the next questionnaire. If you have to interrupt the interview because the farmer's wife has to be rushed to hospital for getting her baby, click "safe + continue" until you have reached "save". You can then come back to enter the lacking information later. If you skip the save-part you might lose data.

from … to … / between … and …

If a farmer answers "between X and Y" or "from X and Y" in a question for which you need to enter a number → calculate and enter the mean between the values.

which answer to choose

If the answer by the farmer lies between answer possibilities → select the "worse" option. E.g. farmer cleans 3 times per week and possible answers are "daily, weekly, monthly" → select "weekly".

no answer opportunity

When you find e.g. a husbandry system which is not listed as an answer for selection → use remarks field.

missing data (n/a)

When you cannot assign a score or make a measurement or assessment, because the item you want to assess is not there → tick "n/a". For example when there is no slurry on the farm all questions regarding slurry storage should be answered n/a (= not available, not applicable).

diets content & ad libitum feeding

kg concentrates and kg roughages are required per animal and day, but farmer applies ad libitum feeding → try and get some information from the farmer on how much of each feedstuff he uses each week/month and for how many pigs and to make the calculation this way.

land use, crops yields etc.

Use average from last 12 months previous to visit.

ProPIG farm plan

The Pig Farm
PIG123
2012

The present farm plan was generated by Lisa Pigresearcher and Stella Hoglover and implemented together with Mr. Pigfarmer on April 01, 2012.

The ProPIG farm report was generated based on best research and advice principles, yet does not replace veterinary advice and treatment in any case.

Contact:
lisa.pigresearcher @propig.eu, P: 01-2345-67
stella.piglover@propig.eu; P: 01-2345-89

For more information see: http://www.coreorganic2.org/propig

Summary

1st AIM:

MEASURES:

2nd AIM:

MEASURES:

3. AIM:

MEASURES:

Report for farm France 1:

Farm summary

1. farm: Pig Farm

2. farm type: farrow to finish - part of the pigs fattened

3. current pig stock:

lactating sows: 14

pregnant sows: 84

weaners: 285

fatteners: 197

4. group size lactating sows: 1.0 - 1.0

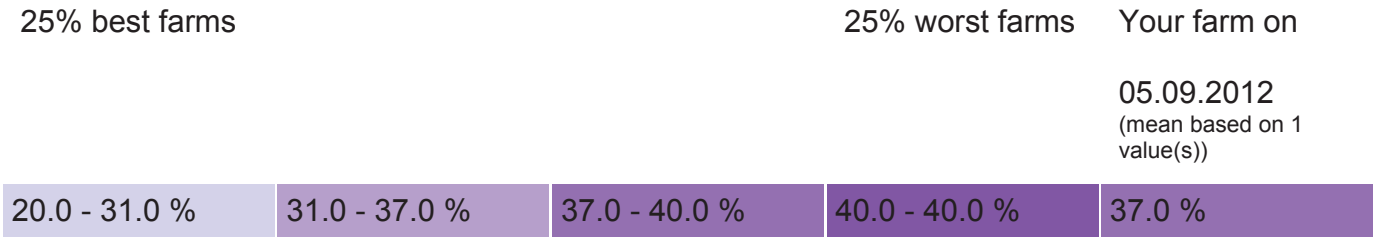
5. group size pregnant sows: 5.0 - 13.0

6. group size weaners: 37.0 - 53.0

7. group size fatteners: 13.0 - 49.0

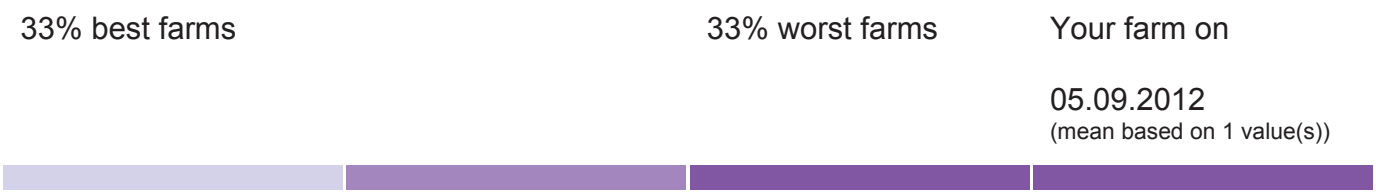
Production and treatment records

1. replacement rate:



2. productive life (farrowings):

3. litters / sow:



2.0 - 2.0	2.0 - 1.9	1.9 - 1.8	1.9

4. total born / litter: No benchmarking available: Not enough input values available.

5. weaned / litter:

33% best farms	33% worst farms	Your farm on 05.09.2012 (mean based on 1 value(s))
9.5 - 9.5	9.5 - 9.0	9.0 - 8.7	9.5

6. weaned / sow:

33% best farms	33% worst farms	Your farm on 05.09.2012 (mean based on 1 value(s))
19.0 - 19.0	19.0 - 17.3	17.3 - 16.0	19.0

7. weaner feed conversion ratio:

25% best farms		25% worst farms	Your farm on 05.09.2012 (mean based on 1 value(s))
1.8 - 2.0 kg / kg	2.0 - 2.1 kg / kg	2.1 - 2.3 kg / kg	2.3 - 2.3 kg / kg	2.0 kg / kg

8. weaner losses:

50% best farms	50% worst farms	Your farm on 05.09.2012 (mean based on 1 value(s))
3.0 - 3.0 %	3.0 - 5.0 %	3.0 %

9. fattener losses:

50% best farms	50% worst farms	Your farm on 05.09.2012 (mean based on 1 value(s))
2.0 - 4.0 %	4.0 - 4.0 %	2.0 %

10. fattener feed conversion ratio:

33% best farms	33% worst farms	Your farm on 05.09.2012

(mean based on 1 value(s))

3.2 - 3.5 kg / kg	3.5 - 4.0 kg / kg	4.0 - 4.0 kg / kg	3.5 kg / kg

11. parasite treatment incidence sows:

100% best farms	100% worst farms	Your farm on 05.09.2012 (mean based on 110 value(s))
200.0 - 200.0 %		200.0 %

12. parasite treatment incidence weaners:

25% best farms			25% worst farms	Your farm on 05.09.2012 (mean based on 1975 value(s))
0.0 - 39.7 %	39.7 - 94.7 %	94.7 - 200.0 %	200.0 - 200.0 %	200.0 %

13. parasite treatment incidence fatteners:

50% best farms	50% worst farms	Your farm on 05.09.2012 (mean based on 525 value(s))
0.0 - 100.0 %	100.0 - 100.0 %	0.0 %

14. diarrhoea treatment incidence suckling piglets: No benchmarking available: Not enough input values available.

15. diarrhoea treatment incidence weaners:

25% best farms			25% worst farms	Your farm on 05.09.2012 (mean based on 1975 value(s))
0.0 - 0.8 %	0.8 - 32.1 %	32.1 - 50.6 %	50.6 - 50.6 %	50.6 %

16. treatment incidence respiratory problems fatteners:

25% best farms			25% worst farms	Your farm on 05.09.2012 (mean based on 525 value(s))
0.0 - 1.9 %	1.9 - 17.4 %	17.4 - 50.5 %	50.5 - 50.5 %	0.0 %

17. MMA treatment incidence:

33% best farms		33% worst farms	Your farm on 05.09.2012 (mean based on 110 value(s))
0.0 - 0.0 %	0.0 - 2.9 %	2.9 - 13.6 %	13.6 %

18. lean meat content: 59.9 kg lean meat / 100 kg carcass (%)

Health and welfare

1. pregnant sows: investigating enrichment:

33% best farms		33% worst farms	Your farm on 06.09.2012 (mean based on 19 value(s))
15.8 - 6.9 %	6.9 - 0.0 %	0.0 - 0.0 %	15.8 %

2. pregnant sows: investigating other:

100% best farms	100% worst farms	Your farm on 06.09.2012 (mean based on 19 value(s))
0.0 - 0.0 %		0.0 %

3. pregnant sows: stone chewing:

100% best farms	100% worst farms	Your farm on 06.09.2012 (mean based on 19 value(s))
0.0 - 0.0 %		0.0 %

4. pregnant sows: % fat sows:

100% best farms	100% worst farms	Your farm on 06.09.2012 (mean based on 76 value(s))
0.0 - 0.0 %		0.0 %

5. pregnant sows: % thin sows:

25% best farms	25% worst farms

				Your farm on 06.09.2012 (mean based on 76 value(s))
4.5 - 13.2 %	13.2 - 20.3 %	20.3 - 29.7 %	29.7 - 29.7 %	13.2 %

6. pregnant sows: % ectoparasites:

50% best farms	50% worst farms	Your farm on 06.09.2012 (mean based on 70 value(s))
0.0 - 0.0 %	0.0 - 4.5 %	0.0 %

9. pregnant sows: % swellings:

33% best farms		33% worst farms	Your farm on 06.09.2012 (mean based on 70 value(s))
0.0 - 0.0 %	0.0 - 1.4 %	1.4 - 5.1 %	1.4 %

10. pregnant sows: % lesions:

25% best farms			25% worst farms	Your farm on 06.09.2012 (mean based on 62 value(s))
9.1 - 18.9 %	18.9 - 38.3 %	38.3 - 38.7 %	38.7 - 38.7 %	38.7 %

11. pregnant sows: % shoulder lesions:

50% best farms	50% worst farms	Your farm on 06.09.2012 (mean based on 62 value(s))
0.0 - 0.0 %	0.0 - 1.6 %	1.6 %

12. pregnant sows: % vulva lesions:

33% best farms		33% worst farms	Your farm on 06.09.2012 (mean based on 70 value(s))
0.0 - 0.0 %	0.0 - 1.4 %	1.4 - 4.3 %	1.4 %

13. pregnant sows: % deformed vulva:

25% best farms			25% worst farms	Your farm on 06.09.2012 (mean based on 70 value(s))
1.4 - 3.4 %	3.4 - 5.4 %	5.4 - 9.1 %	9.1 - 9.1 %	1.4 %

14. pregnant sows: % lame:

25% best farms			25% worst farms	Your farm on 06.09.2012 (mean based on 82 value(s))
2.7 - 3.4 %	3.4 - 4.5 %	4.5 - 7.3 %	7.3 - 7.3 %	7.3 %

15. pregnant sows: sick pigs in group:

50% best farms	50% worst farms	Your farm on 06.09.2012 (mean based on 10 value(s))
0.0 - 0.0 %	0.0 - 10.0 %	10.0 %

16. pregnant sows: % pens respiratory problems:

50% best farms	50% worst farms	Your farm on 06.09.2012 (mean based on 12 value(s))
0.0 - 0.0 %	0.0 - 8.3 %	8.3 %

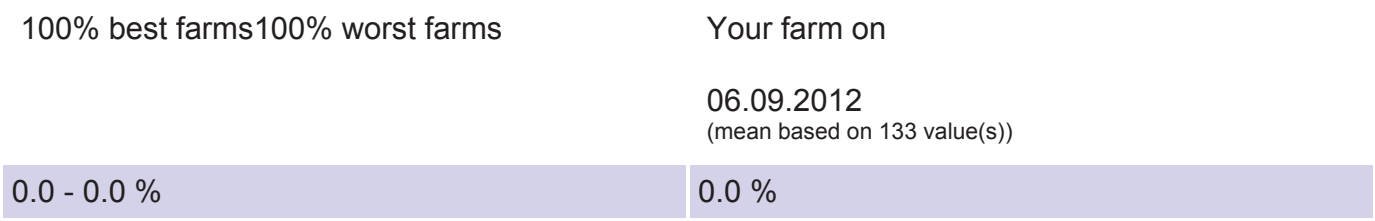
17. weaners: investigating enrichment:

25% best farms			25% worst farms	Your farm on 06.09.2012 (mean based on 133 value(s))
60.9 - 50.0 %	50.0 - 29.2 %	29.2 - 0.0 %	0.0 - 0.0 %	60.9 %

18. weaners: investigating other:

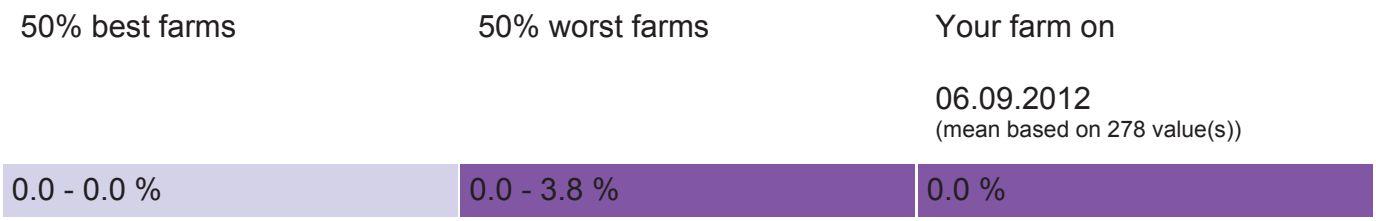
50% best farms	50% worst farms	Your farm on 06.09.2012 (mean based on 133 value(s))
0.0 - 0.0 %	0.0 - 3.0 %	3.0 %

19. weaners: stone chewing:

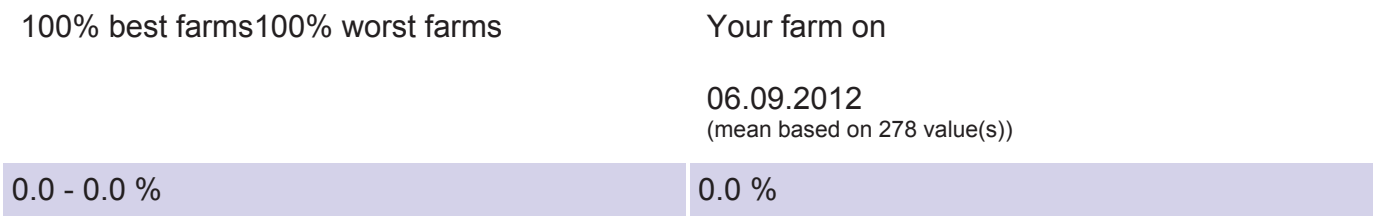


20. weaners: % eye discharge: No benchmarking available: Not enough input values available.

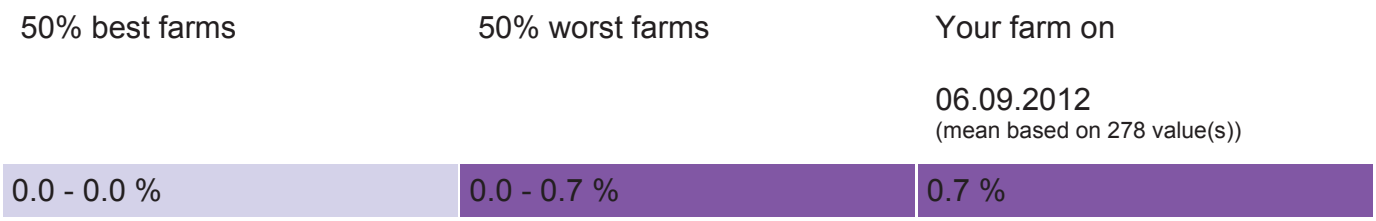
21. weaners: % eye inflammation:



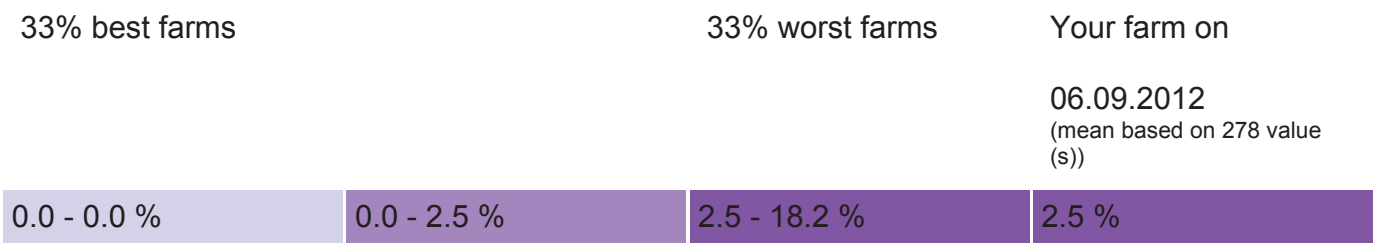
22. weaners: % lame:



23. weaners: % tail lesions:



24. weaners: % short tail:



25. weaners: % runts:

				(mean based on 278 value(s))
1.8 - 2.2 %	2.2 - 5.0 %	5.0 - 5.8 %	5.8 - 5.8 %	2.2 %

26. weaners: sick pigs in group:

50% best farms	50% worst farms	Your farm on 06.09.2012 (mean based on 6 value(s))
0.0 - 0.0 %	0.0 - 66.7 %	0.0 %

27. weaners: % pens respiratory problems:

25% best farms			25% worst farms	Your farm on 06.09.2012 (mean based on 6 value(s))
0.0 - 16.7 %	16.7 - 33.3 %	33.3 - 100.0 %	100.0 - 100.0 %	16.7 %

28. weaners: % pens diarrhoea:

25% best farms			25% worst farms	Your farm on 06.09.2012 (mean based on 6 value(s))
0.0 - 33.3 %	33.3 - 66.7 %	66.7 - 100.0 %	100.0 - 100.0 %	66.7 %

29. fatteners: investigating enrichment:

25% best farms			25% worst farms	Your farm on 06.09.2012 (mean based on 41 value(s))
77.1 - 53.9 %	53.9 - 34.1 %	34.1 - 9.1 %	9.1 - 9.1 %	34.1 %

30. fatteners: investigating other:

25% best farms			25% worst farms	Your farm on 06.09.2012 (mean based on 41 value(s))
0.6 - 1.1 %	1.1 - 4.5 %	4.5 - 7.3 %	7.3 - 7.3 %	7.3 %

31. fatteners: stone chewing:

100% best farms	100% worst farms	Your farm on 06.09.2012 (mean based on 41 value(s))
0.0 - 0.0 %		0.0 %

32. fatteners: % ectoparasites:

100% best farms	100% worst farms	Your farm on 06.09.2012 (mean based on 227 value(s))
0.0 - 0.0 %		0.0 %

33. fatteners: % eye discharge: No benchmarking available: Not enough input values available.

34. fatteners: % eye inflammation:

25% best farms			25% worst farms	Your farm on 06.09.2012 (mean based on 227 value(s))
3.5 - 6.2 %	6.2 - 8.7 %	8.7 - 14.1 %	14.1 - 14.1 %	3.5 %

35. fatteners: % swellings:

25% best farms			25% worst farms	Your farm on 06.09.2012 (mean based on 227 value(s))
0.0 - 0.3 %	0.3 - 0.4 %	0.4 - 2.0 %	2.0 - 2.0 %	0.0 %

36. fatteners: % lesions:

25% best farms			25% worst farms	Your farm on 06.09.2012 (mean based on 227 value(s))
16.0 - 28.5 %	28.5 - 53.6 %	53.6 - 79.3 %	79.3 - 79.3 %	79.3 %

37. fatteners: % lame:

50% best farms	50% worst farms	Your farm on 06.09.2012 (mean based on 227 value(s))
0.0 - 0.0 %	0.0 - 2.4 %	0.0 %

38. fatteners: % tail lesions:

33% best farms		33% worst farms	Your farm on 06.09.2012 (mean based on 227 value(s))
0.0 - 0.0 %	0.0 - 0.4 %	0.4 - 7.2 %	0.0 %

39. fatteners: % short tail:

25% best farms			25% worst farms	Your farm on 06.09.2012 (mean based on 227 value(s))
1.3 - 2.6 %	2.6 - 7.5 %	7.5 - 21.3 %	21.3 - 21.3 %	2.6 %

40. fatteners: % runts:

33% best farms		33% worst farms	Your farm on 06.09.2012 (mean based on 227 value(s))
0.0 - 0.0 %	0.0 - 0.3 %	0.3 - 0.4 %	0.0 %

41. fatteners: sick pigs in group:

33% best farms		33% worst farms	Your farm on 06.09.2012 (mean based on 6 value(s))
0.0 - 0.0 %	0.0 - 8.3 %	8.3 - 20.0 %	0.0 %

42. fatteners: % pens respiratory problems:

25% best farms			25% worst farms	Your farm on 06.09.2012 (mean based on 6 value(s))
77.8 - 80.0 %	80.0 - 83.3 %	83.3 - 100.0 %	100.0 - 100.0 %	100.0 %

43. fatteners: % pens diarrhoea:

25% best farms			25% worst farms	Your farm on 06.09.2012

				(mean based on 6 value(s))
0.0 - 11.1 %	11.1 - 30.0 %	30.0 - 50.0 %	50.0 - 50.0 %	50.0 %

Environment

1. animals / ha:

lactating sows:

50% best farms	50% worst farms	Your farm on 03.09.2012 (mean based on 1 value(s))
5.4 - 7.2 number / ha	7.2 - 7.2 number / ha	7.2 number / ha

group suckling: No benchmarking available: Not enough input values available.

pregnant sows:

33% best farms		33% worst farms	Your farm on 03.09.2012 (mean based on 1 value(s))
4.8 - 5.2 number / ha	5.2 - 6.7 number / ha	6.7 - 6.7 number / ha	6.7 number / ha

weaners:

33% best farms		33% worst farms	Your farm on 03.09.2012 (mean based on 1 value(s))
0.0 - 40.0 number / ha	40.0 - 98.0 number / ha	98.0 - 98.0 number / ha	0.0 number / ha

fatteners:

100% best farms	100% worst farms	Your farm on 03.09.2012 (mean based on 1 value(s))
0.0 - 0.0 number / ha		0.0 number / ha

2. vegetation cover lactating sows:

25% best farms		25% worst farms	Your farm on 07.09.2012 (mean based on 17 value(s))

96.4 - 93.5 %	93.5 - 92.7 %	92.7 - 90.3 %	90.3 - 90.3 %	96.4 %

3. vegetation cover pregnant sows:

25% best farms			25% worst farms	Your farm on 06.09.2012 (mean based on 7 value(s))
95.9 - 93.3 %	93.3 - 93.0 %	93.0 - 92.3 %	92.3 - 92.3 %	95.9 %

4. vegetation cover weaners:

50% best farms	50% worst farms	Your farm on 06.09.2012 (mean based on 0 value(s))
0.0 - 0.0 %	0.0 - 95.0 %	0.0 %

5. vegetation cover fatteners:

100% best farms	100% worst farms	Your farm on 06.09.2012 (mean based on 0 value(s))
0.0 - 0.0 %		0.0 %

6. litter management lactating sows: --- (Not enough input values available.)

7. litter management preganant sows: --- (Not enough input values available.)

8. litter management weaners: poor

9. litter management fatteners: good

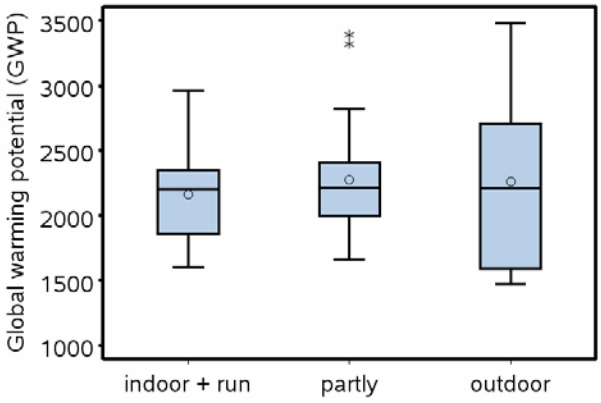
Scope to improve the environmental impact of pork production

- a decision support tool to reduce environmental impact ("EDST")

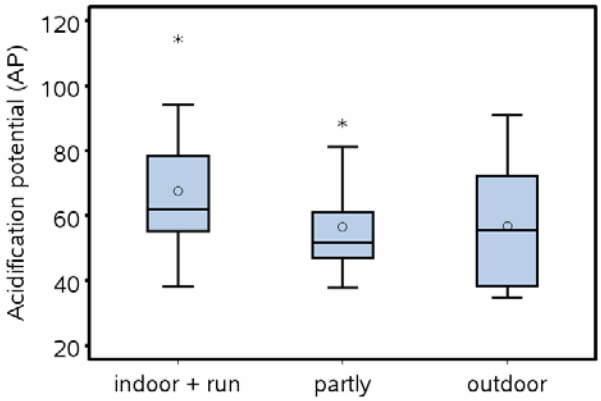
Numerous studies have demonstrated the considerable environmental impact from primary food production; keeping livestock has severe impacts on air, water and soil quality due to related emissions (De Vries and de Boer, 2010). According to FAO (2014) the world´s livestock sector contributes 18 % of global greenhouse gas emissions (global warming potential, GWP). Due to high CH_4 emissions from rumen fermentation, cattle and sheep have mainly been the focus of such scientific research, however, GWP from pork production has also to be considered in the light of high consumption of pork products in the European Union.

Recording performance across 64 supply chains monitored under ProPIG (24 indoor, 30 partly outdoor, 10 outdoor) showed considerable variation in the environmental impact across all production systems – suggesting scope for improvement on some farms.

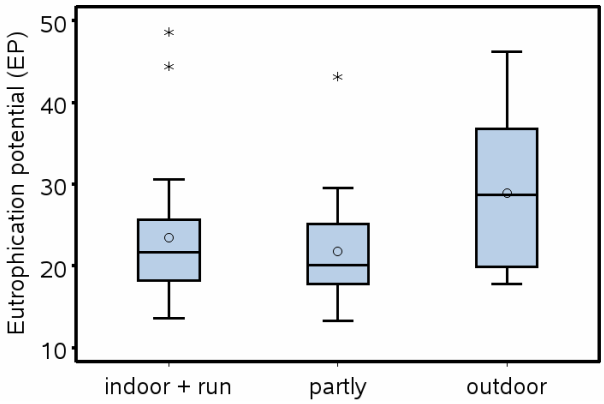
Global warming potential (GWP; in CO_2-eq/1000kg live weight at slaughter) per system



Acidification potential (AP; in SO_2-eq/1000kg live weight at slaughter) per system



Eutrophication potential (EP; in PO_4-eq/1000kg live weight at slaughter) per system



Calculation within ProPIG identified the environmental impact in terms of GWP, AP and EP, which are primarily due to a combination of a) feed supply, b) emissions from the animals themselves

and c) manure management. By far the greatest impact is derived indirectly from the environmental burdens associated with feed supply; on average this was responsible for 59% of GWP, 52% of the acidification (AP) and 66% of eutrophication potentials (EP)

Any action to improve the efficiency of feed use (and possibly feed provenance) will reduce the environmental impact of producing pork, especially if also associated with minimising the negative influence of manure management. This decision support tool was developed to help producers identify strengths and weaknesses in existing production systems and offer suggestions to improve, with links to relevant sources for further information.

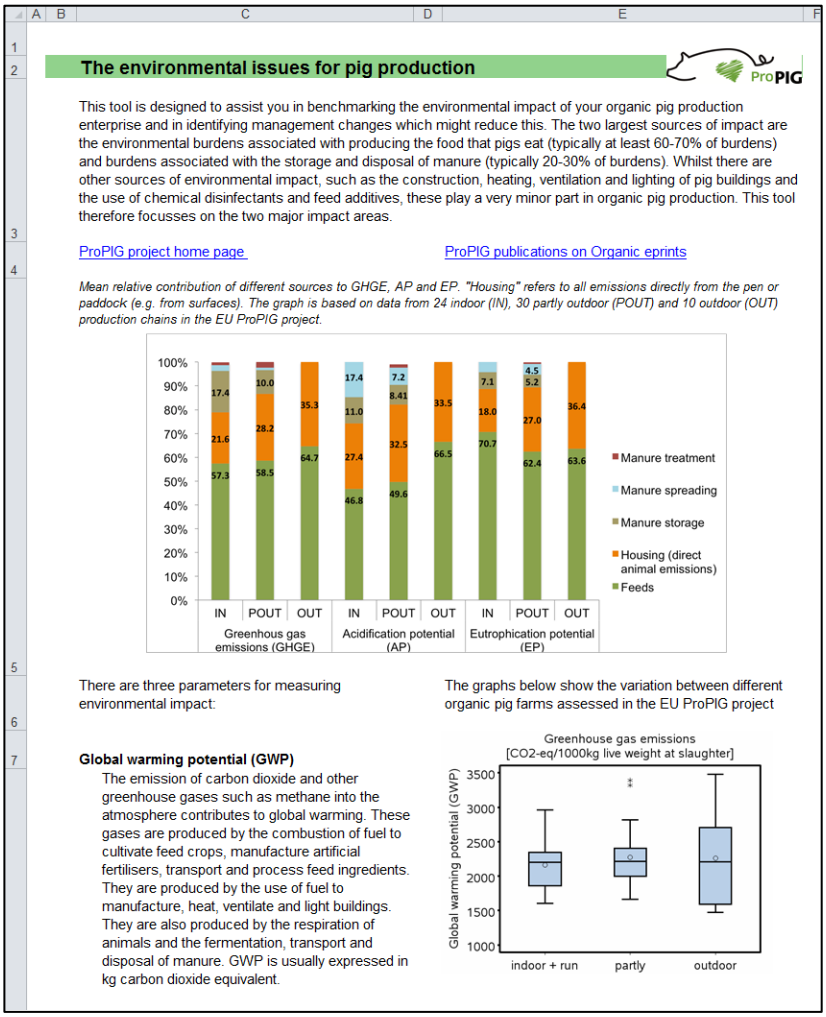
The primary focus of this tool is the numerous factors that influence the efficiency of feed utilisation per kg of pig meat produced, covering both feed use and pig output in the breeding herds as well as finishing pigs. It also considers aspects of manure management leading to nutrient loss or methane emissions that contribute to GWP, AP and EP.

Using the Environmental Decision Support Tool (EDST)

The user initially selects the production stage (breeding or growing pigs) and production system (indoor or outdoor) of interest. The EDST then displays a list of relevant questions which the user answers with a simple Yes or No. To assist with some answers, reference benchmarks for performance or diet specifications are supplied against which the current situation can be compared. On completion of the questions, the EDST displays (i) a list of factors which the farm is currently doing well and an explanation of why these are important for environmental impact and (ii) a list of factors where the farm might do better, with an explanation of their importance and suggestions for actions which might give improvement.

The tool is presented in a series of pages in an Excel application, including:

i) Start page – introductory explanation:



The environmental issues for pig production

This tool is designed to assist you in benchmarking the environmental impact of your organic pig production enterprise and in identifying management changes which might reduce this. The two largest sources of impact are the environmental burdens associated with producing the food that pigs eat (typically at least 60-70% of burdens) and burdens associated with the storage and disposal of manure (typically 20-30% of burdens). Whilst there are other sources of environmental impact, such as the construction, heating, ventilation and lighting of pig buildings and the use of chemical disinfectants and feed additives, these play a very minor part in organic pig production. This tool therefore focusses on the two major impact areas.

ProPIG project home page — ProPIG publications on Organic eprints

Mean relative contribution of different sources to GHGE, AP and EP. "Housing" refers to all emissions directly from the pen or paddock (e.g. from surfaces). The graph is based on data from 24 indoor (IN), 30 partly outdoor (POUT) and 10 outdoor (OUT) production chains in the EU ProPIG project.

There are three parameters for measuring environmental impact:

Global warming potential (GWP)

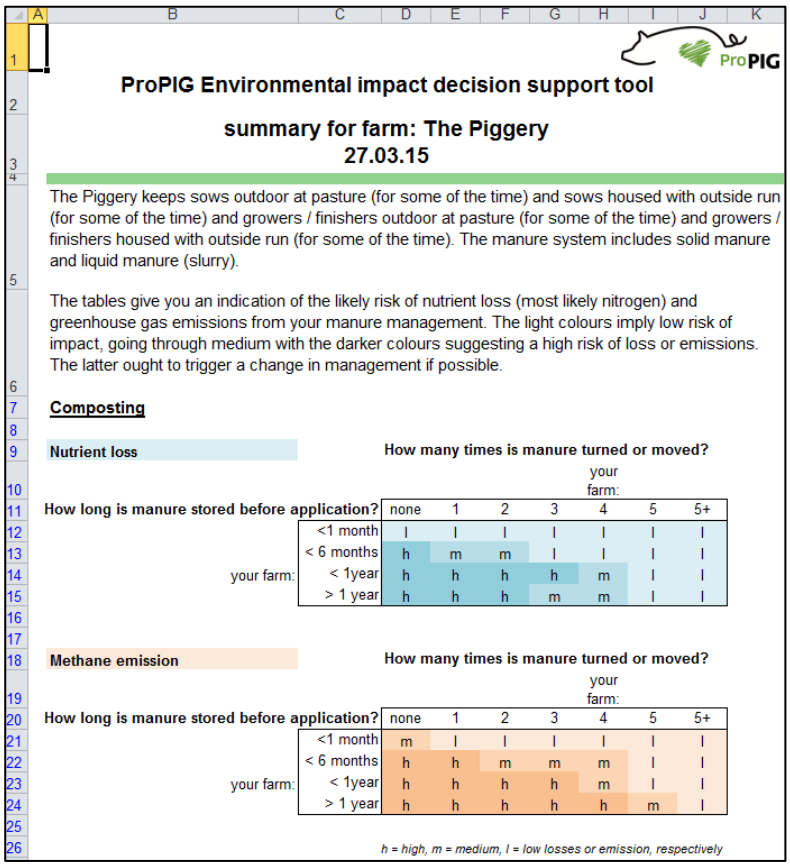
The emission of carbon dioxide and other greenhouse gases such as methane into the atmosphere contributes to global warming. These gases are produced by the combustion of fuel to cultivate feed crops, manufacture artificial fertilisers, transport and process feed ingredients. They are produced by the use of fuel to manufacture, heat, ventilate and light buildings. They are also produced by the respiration of animals and the fermentation, transport and disposal of manure. GWP is usually expressed in kg carbon dioxide equivalent.

The graphs below show the variation between different organic pig farms assessed in the EU ProPIG project

ii) A series of questions identifying feed use, production efficiency and manure management for the production system

	B	D	L	M	N	O
1	**chapter**	**question**	**answers**	**answer no.**	**answer check**	**reference tables** (in this tool)
2	**basic**	farm name	The Piggery			
3		date	27.03.2015			
4	**Benchmarks**	Do you think, your carbon footprint is higher than desirable?	1) no 2) yes / don't know	1	no	if you have a number on GWP you can compare here
5		Is feed conversion ratio poorer than target?	1) no 2) yes	1	no	pig performance
6		Is sow feed per weaned piglet poorer than target?	1) no 2) yes	1	no	pig performance
7	**Feed wastage**	Are birds seen frequently at the feed trough?	1) no 2) yes	1	no	
8		Are rodents present on the unit?	1) no 2) yes	1	no	
9		Is feed storage damp and unprotected?	1) no 2) yes	2	yes	
10		Is there leakage from feed conveyers or feed troughs?	1) no 2) yes	2	yes	
11		Is feed given on the ground rather than in troughs?	1) no 2) yes	2	yes	
12		Is feed visible on the ground in front of troughs?	1) no 2) yes	1	no	
13		Is feed given as dry meal?	1) no 2) yes	2	yes	
14	**Feed utilisation**	Is performance level at farrowing suboptimal (pigs born/year)?	1) no 2) yes	2	yes	pig performance
15		Is performace level at weaning suboptimal (piglets weaned/year)?	1) no 2) yes	2	yes	pig performance
		Is the grower / finisher diet lacking in protein?	1) no 2) yes	1	no	diet specifications

iii) A short overview with manure and slurry management feedback



ProPIG Environmental impact decision support tool

summary for farm: The Piggery
27.03.15

The Piggery keeps sows outdoor at pasture (for some of the time) and sows housed with outside run (for some of the time) and growers / finishers outdoor at pasture (for some of the time) and growers / finishers housed with outside run (for some of the time). The manure system includes solid manure and liquid manure (slurry).

The tables give you an indication of the likely risk of nutrient loss (most likely nitrogen) and greenhouse gas emissions from your manure management. The light colours imply low risk of impact, going through medium with the darker colours suggesting a high risk of loss or emissions. The latter ought to trigger a change in management if possible.

Composting

Nutrient loss

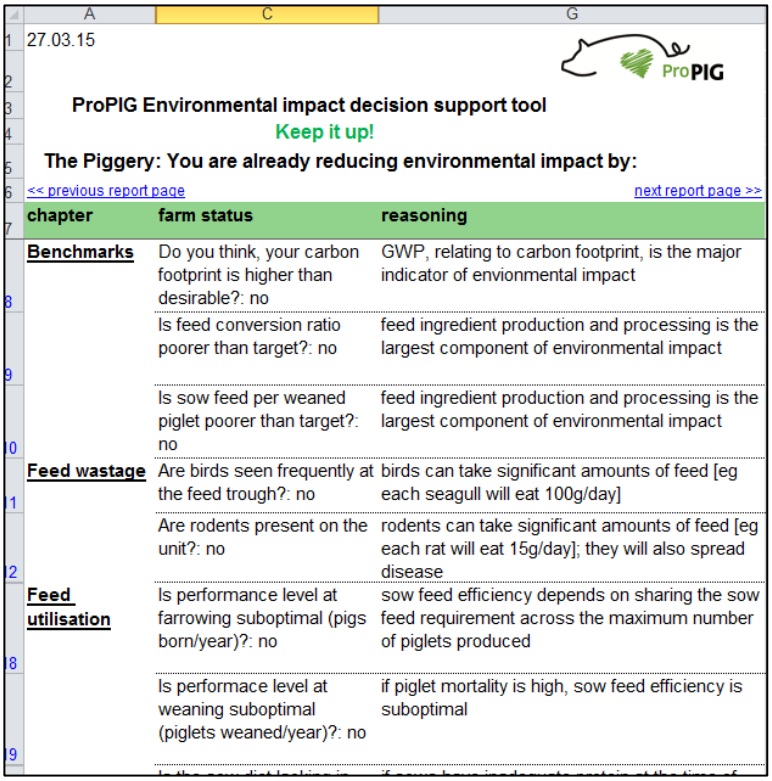
How long is manure stored before application?	How many times is manure turned or moved? your farm: none	1	2	3	4	5	5+
your farm: <1 month	l	l	l	l	l	l	l
< 6 months	h	m	m	l	l	l	l
< 1year	h	h	h	h	m	l	l
> 1 year	h	h	h	m	m	l	l

Methane emission

How long is manure stored before application?	How many times is manure turned or moved? your farm: none	1	2	3	4	5	5+
your farm: <1 month	m	l	l	l	l	l	l
< 6 months	h	h	m	m	m	l	l
< 1year	h	h	h	h	m	l	l
> 1 year	h	h	h	h	h	m	l

h = high, m = medium, l = low losses or emission, respectively

iv) Identifying what the farm is doing well



27.03.15

ProPIG Environmental impact decision support tool

Keep it up!

The Piggery: You are already reducing environmental impact by:

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chapter	farm status	reasoning
Benchmarks	Do you think, your carbon footprint is higher than desirable?: no	GWP, relating to carbon footprint, is the major indicator of envionmental impact
	Is feed conversion ratio poorer than target?: no	feed ingredient production and processing is the largest component of environmental impact
	Is sow feed per weaned piglet poorer than target?: no	feed ingredient production and processing is the largest component of environmental impact
Feed wastage	Are birds seen frequently at the feed trough?: no	birds can take significant amounts of feed [eg each seagull will eat 100g/day]
	Are rodents present on the unit?: no	rodents can take significant amounts of feed [eg each rat will eat 15g/day]; they will also spread disease
Feed utilisation	Is performance level at farrowing suboptimal (pigs born/year)?: no	sow feed efficiency depends on sharing the sow feed requirement across the maximum number of piglets produced
	Is performace level at weaning suboptimal (piglets weaned/year)?: no	if piglet mortality is high, sow feed efficiency is suboptimal

v) Highlighting weaknesses and suggestions for improvement

27.03.15

ProPIG
Environmental impact decision support tool

Suggestions for improvement

The Piggery: You could further reduce environmental impact by improving:

<< previous report page

chapter	farm status	reasoning	improvement suggestions
	Is feed storage damp and unprotected?: yes	moulding and deterioration of feedleads to discard and waste	Store feeds in weatherproof bins or rooms
	Is there leakage from feed conveyers or feed troughs?: yes	feed lost in transfer cannot be utilised by pigs	seal any joints or holes
	Is feed given on the ground rather than in troughs?: yes	wastage with floor feeding can be ~10% compared to troughs	consider purchase of troughs for feeding
	Is feed visible on the ground in front of troughs?: yes	even a small amount of visible feed may indicate 10% wastage	use adjustable slides in hoppers to regulate feed flow; ensure troughs are hygienic so animal do not root out poor feed
	Is feed given as dry meal?: yes	dry meal can be lost as dust and is eaten more wastefully; feed conversion efficiency is reduced by 5-10%	consider using pelleted feed or adding water in the feed trough
	Is the grower / finisher diet lacking in protein?: yes	if pigs have inadequate protein to grow lean meat they use the food for less efficient production of fat	increase the protein content by greater inclusion of protein rich ingredients
	Is the protein quality	some protein sources have poorer digestibility or	use some higher quality proteins

vi) Links to and suggestions for further reading to improve efficiency

Sources of information on feeding organic pigs

Textbook
Nutrition and Feeding of Organic Pigs. By R Blair. Cabi Publications, 2007

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Advisory Booklet for farmers
Feeding organic pigs: a handbook of raw materials and recommendations for feeding practice. University of Newcastle.
http://www.britishpigs.org.uk/Newcastle_handbook_of_raw_materials.pdf

Raw material databases
n.b. if values given are for conventional infredients, it is recommended to reduce crude protein content by 15% (except for legumes)
ALP feeding database (Switzerland)
http://www.feed-alp.admin.ch/

Evapig feed database (INRA, France)
http://www.evapig.com/x-home-en

The following list of resources was produced by the ICOPPs project

Country	Source	Species
Austria*	http://www.gfe-frankfurt.de/publikationen.html	Pigs Poultry

ICOPP page

ICOPP synthesis report with lots of feed values
http://orgprints.org/28078/7/28078.pdf

Information on environmental impact of raw feed materials used in organic pig feeding

The relative environmental impact of different organic feedstuffs used on farms in the ProPIG survey
Colours indicate Higher, Intermediate, or Lower impact relative to the other ingredients
Calculations are based on austrian organic farms (with thanks to Stefan Hörtenhuber)
In all cases home grown feedstuffs have lower environmental impact than purchased equivalents
GWP= Global warming potential, AP=Acidification potential, EP=Eutrophication potential

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	Per unit of metabolisable energy supplied			Per unit of crude protein supplied		
	GWP	AP	EP	GWP	AP	EP
Alfalfa green meal or similar roughage						
Barley (home grown)						
Barley (bought in)						
Brewer's grains (dried)						
Brewer's yeast						