BAM2016
5th Belgian Agroecology Meeting

Bridging gaps between principles and practices in agro-ecology

Gent (UGent - ILVO) — 20th September 2016
5th Belgian Agroecology Meeting (BAM)

Venue

Tuesday 20th September 2016, 9h30 — 18h00
Faculty of Bioscience Engineering
Ghent University, Campus Coupure,
Coupure Links 653 – 9000 Gent (Belgium)

Scientific committee

Prof. Dirk Reheul Ghent University (UGent)
Prof. Pieter De Frenne UGent
Dr Bert Reubens Institute for Agricultural and Fisheries Research (ILVO)
Prof. Fleur Marchand ILVO & University of Antwerp (UAntwerp)
Prof. Pierre M. Stassart Université de Liège (ULg)
Prof Marjolein Visser Université Libre de Bruxelles (ULB)
Prof. Marc Dufrêne ULg
Prof. Denise Van Dam Université de Namur (UNamur)
Dr. Julie Hermesse Université catholique de Louvain (UCL)
Dr. Louis Hautier Centre wallon de Recherches agronomiques (CRA-W)
Corentin Hecquet ULg

Organizing committee

Prof. Dirk Reheul UGent
Prof. Pieter De Frenne UGent
Dr Bert Reubens ILVO
Prof. Fleur Marchand ILVO & UAntwerp
Prof. Pierre M. Stassart ULg
Prof Marjolein Visser ULB
Prof. Marc Dufrêne ULg

Cover picture: © Bert Reubens, Bert.Reubens@ilvo.vlaanderen.be, layout by Fred Vanwin
© Giraf, 2016 for the Bambook – layout in LATEX by Fred Vanwin, f.vanwindekens@cra.wallonie.be
About . . .

. . . GIRAF

The Group of Interdisciplinary Research in Agroecology of the Belgian Fund for Scientific Research (FNRS) GIRAF – Groupe de contact Interdisciplinaire de Recherche en Agroécologie du FNRS - has been founded in 2009 by 9 Belgian academics. This interdisciplinary group brought together researchers from Université de Liège (ULg), Université catholique de Louvain (UCL), Université Libre de Bruxelles (ULB), Universiteit Gent (UGent), and the Walloon Agricultural Research Center “CRA-W.” working in the fields of agronomy, ecology, sociology and economy. In 2012 the group has published a conceptual framework for agroecology : "Agroecology : pathway and potential. For a transition to sustainable food systems*”. Since 2012, GIRAF has extended his membership to young post-doc and phd-students and currently consists of 20 members. GIRAF has created a complementary training course in agroecology that started in 2013.

Chairman of GIRAF : Pierre Stassart (p.stassart@ulg.ac.be)
Secretary of GIRAF : Julie Hermesse (julie.hermesse@uclouvain.be)

. . . Agroecology

GIRAF endorses the fact that agroecology is a polysemic concept. There is therefore not a single way to define and work ‘for’ and ‘on’ agroecology. However, three key dimensions in the history of agroecology can be identified, namely ecology, food systems and interactions between nature, science and society.

Altieri (1983) coined the word agroecology to designate the application of ecology to the study of agriculture. This approach, which focuses on the analysis of stability and resilience of agroecosystems, was aimed at producing knowledge and practices that would make agriculture more sustainable. In that sense, agroecology involves deep interactions between ecology and agricultural sciences.

In a second phase, the field of agroecology has broadened to include socio-ecology in the study, conception and management of food systems. The links between food and on-farm production are now emphasized. The ‘food systems’ concept was especially taken up a few years later by Steven Gliessman and Keith Warner in two seminal works, namely Agroecology of Sustainable Food Systems (Gliessman, 2006) and Agroecology in Action (Warner, 2007). This broader concept gave room to the social dimension. By choosing to address food systems instead of agrifood systems we emphasize the role of the citizens in the building of agroecology, each of them being a food consumer.

In a third phase, agroecology has meant the interaction between science, practices and social movements, which can be represented as the three angles of a triangle (Wezel, Bellon et al., 2009). As a scientific practice, we consider that agroecology can no longer be developed without taking into account the relationships between science and society. Researchers can no longer ignore the fact that practitioners, associations, citizens, consumers, social agents might as well accept or refuse experts’ conclusions, and choose to adapt, adapt or not adopt innovations that research produces. Agroecological issues thus address different audiences, which they themselves help to create, while these groups in turn go on to build agroecological issues. Fully acknowledging the consequences of that triangular setting, we assume that agroecology cannot be defined either from the perspective of scientific fields neither from social movements or practices. It is a federating concept of action filling the triangle. Therefore, agroecology is an interdisciplinary scientific practice and our aim is not
to build agroecology as a science and still less as a "superscience" that should be the umbrella of the different disciplines involved in agroecology.

A new field has arisen on the boundary between the socioeconomic and the sociotechnical, that of the resiliency and adaptability of agroecological systems, in which notions such as the threshold (of irreversibility), social equity, and food sovereignty are explored. In this vast field we propose, more generically, three socioeconomic principles and one methodological principle that help to anchor the definition of agroecology as the ecology of food systems and an interdisciplinary practice that entails a redefinition of scientific and social boundaries and is a major intellectual challenge for research (Buttel, 2003).

### Principles


1. Recycle biomass as much as possible, so as to optimise both energy flows and nutrient cycling and availability.
2. Nurture soil conditions for optimal plant growth, with a keen eye on organic matter and soil life management. Because of the antagonisms with oil-based external inputs and because fossil fuel is going to be outphased anytime soon, this nurturing should be conceived minimising the use of petrochemicals (fertiliser, pesticides, fossil fuels).
3. Minimise resource losses (e.g. energy, nutrients, water and soil) through microclimate management, water harvesting techniques in drylands, increasing soil cover in space and time and the interplay of territorial specificities, especially through mixed farming systems.
4. Favour genetic diversification of agroecosystems, both within and between species, in space and in time.
5. Allow for beneficial interactions and biological synergies between components of agrobiodiversity so as to strengthen the above-mentioned key processes and services.
6. Value agrobiodiversity as an entry point for the redesign of food systems that ensure peasant autonomy and food sovereignty (Machado, Santili et al. 2008; Jackson, Rosenstock et al. 2009).

**B. Methodological principles** – Science in Action Department (SAD), INRA (Tichit, Bellon et al. 2010)

7. Develop multi-criteria guidance of agroecosystems within a long-term transition perspective, taking into account trade-offs between long term and short term benefits, and giving due importance to properties that increase resilience and adaptability.
8. Value spatio-temporal resource variation: exploit local resources when and where they are available rather than trying to get rid of intrinsic variation.
9. Stimulate the exploration of agroecosystems far removed from the already known local optima of today (Weiner, Andersen et al. 2010), e.g. « extreme » systems with very low levels of external inputs both in animal and plant production (Jackson 2002).

---


B. Methodological principles – GIRAF

10. Favour the construction of participatory research frameworks, which allow for action-oriented research while guaranteeing its scientific validity (Hatchuel 2000; Hubert 2002). Designing sustainable food systems is indeed complex because it requires researchers to take into account stakeholder interdependencies and ambiguities as well as the socio-economic uncertainties of technical innovations (Bell and Stassart 2011).

C. Socio-economic principles – GIRAF

11. Create knowledge and a collective capacity to adapt, through networks comprising producers, citizen-consumers, researchers and state-funded technical advisers. These networks promote decision-making fora, public debate and the diffusion of knowledge (Thompson 1997; Pimbert, Boukary et al. 2011).

12. Foster opportunities for peasants to evolve towards greater autonomy with regard to dominant (world) market forces. This fostering happens through the creation of enabling environments for public goods and the development of practices and socio-economic models that strengthen the democratic governance of food issues. Systems would then be (re)localised and co-managed by both producers and citizen-consumers (Ploeg 2008; Wittman, Desmarais et al. 2010).

13. Value the diversity of forms of knowledge: local know-how (Hassanein and Kloppenburg 1995) or Indigenous Technology and Knowledge (ITK, Richards 1993) or empirical knowledge (Wynne 1996), both while constructing problems and the audiences these problems address as during problem solving research.

These thirteen principles call for future developments stemming from the diversity of analyses conducted, experiences, and practices observed. Our aim is not to build a closed framework but rather to provide the main themes of agroecological research. Our last task is thus to set the priorities for the medium term (five to ten years on).
**DETAILED PROGRAMME BELGIAN AGROECOLOGY MEETING 20 SEPT. 2016, GHENT**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>9u30-10u</td>
<td>REGISTRATION and welcome with coffee</td>
</tr>
<tr>
<td>10u-11u</td>
<td><strong>MORNING PLENARY SESSIONS</strong></td>
</tr>
<tr>
<td>10u-11u</td>
<td><strong>Keynotes on topic 1 and 2 — Chair: Prof. dr. ir. Dirk Reheul (UGent)</strong></td>
</tr>
<tr>
<td>10u</td>
<td>Biodiversity and ecosystem services of agricultural landscapes</td>
</tr>
<tr>
<td>10u30</td>
<td>The challenges and opportunities of ‘doing’ co-innovation: integrating different knowledges</td>
</tr>
<tr>
<td>11u-12u</td>
<td><strong>Short presentations on topic 1 and 2 — Chair: Dr. ir. Bert Reubens (ILVO)</strong></td>
</tr>
<tr>
<td>11u00</td>
<td>Productivity impact and ecosystem services delivery of grass strips and wooded strips adjacent to arable land</td>
</tr>
<tr>
<td>11u05</td>
<td>Tall fescue in cut grassland: rooting deeper and higher dry matter and nitrogen yield</td>
</tr>
<tr>
<td>11u10</td>
<td>Silvoarable agroforestry: yield, soil characteristics and agricultural biodiversity</td>
</tr>
<tr>
<td>11u15</td>
<td>Development of a 3-D modelling framework for studying light distribution in agroforestry systems</td>
</tr>
<tr>
<td>11u20</td>
<td>The after-effects of grass-clover green manuring and non-inversion tillage on grain yield and protein content of <em>Triticum aestivum</em>.</td>
</tr>
<tr>
<td>11u25</td>
<td>Opportunities and barriers for different types of plantation in chickens’ free-range areas</td>
</tr>
<tr>
<td>11u30</td>
<td>Co-designing a decision-support tool with farmers as the basis for a participatory approach</td>
</tr>
<tr>
<td>11u35</td>
<td>Gender in Agroecology: unearthing smallholders’ approaches to building resilient food systems</td>
</tr>
<tr>
<td>11u40</td>
<td>Ex-post evaluation of a transdisciplinary approach: a case study of the Flemish agri-food system</td>
</tr>
<tr>
<td>11u45</td>
<td>Functional agrobiodiversity in apple and pear pest management in Belgium</td>
</tr>
<tr>
<td>12u-13u</td>
<td>Meet and greet: All delegates meet presenters of sessions 1 and 2</td>
</tr>
<tr>
<td>13u-14u</td>
<td>LUNCH</td>
</tr>
<tr>
<td>14u-15u</td>
<td><strong>AFTERNOON PLENARY SESSIONS</strong></td>
</tr>
<tr>
<td>14u-15u</td>
<td><strong>Keynotes on topic 3 and 4 — Chair: Prof. dr. ir. Fleur Marchand (ILVO/UA)</strong></td>
</tr>
<tr>
<td>14u</td>
<td>Key features of more resilient agricultural and food systems: some findings from the international RETHINK research programme</td>
</tr>
<tr>
<td>14u30</td>
<td>The role of policy and governance in transitions towards just and sustainable food systems: a global perspective on threats and opportunities for agroecology</td>
</tr>
<tr>
<td>15u -16u</td>
<td>Short presentations on topic 3 and 4 – Chair: Prof. dr. ir. Pieter De Frenne (UGent)</td>
</tr>
<tr>
<td>----------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>15u00</td>
<td>Assessing the capacity of Voedselteams to contribute to a sustainable food system in Flanders</td>
</tr>
<tr>
<td>Zwart, T.A. - KUL</td>
<td></td>
</tr>
<tr>
<td>15u05</td>
<td>Quality of work of vegetable growers, in conventional and agroecological systems, in the Walloon Region (Belgium)</td>
</tr>
<tr>
<td>Dumont, A.M. - UCL</td>
<td></td>
</tr>
<tr>
<td>15u10</td>
<td>Socio-professional paths and identities of ecological farmers</td>
</tr>
<tr>
<td>Pailleux, C. - LARESS</td>
<td></td>
</tr>
<tr>
<td>15u15</td>
<td>How to identify low input(s) dairy farming?</td>
</tr>
<tr>
<td>Bijttebier, J. - ILVO</td>
<td></td>
</tr>
<tr>
<td>15u20</td>
<td>Creation of added value in direct selling microfarms: a quantitative exploration through modelling</td>
</tr>
<tr>
<td>Morel, K. - INRA</td>
<td></td>
</tr>
<tr>
<td>15u25</td>
<td>Collective work in professional market gardening: a resource in suburban agroecological experiments in Brussels.</td>
</tr>
<tr>
<td>Van der Linden, M. - UCL</td>
<td></td>
</tr>
<tr>
<td>15u30</td>
<td>Nurturing agroforestry systems in temperate regions: an analysis of discourses for an enabling environment in Flanders, Belgium</td>
</tr>
<tr>
<td>Borremans, L. – ILVO/ULB</td>
<td></td>
</tr>
<tr>
<td>15u35</td>
<td>Key competencies for an agroecological farmer</td>
</tr>
<tr>
<td>Debruyne, L. - ILVO</td>
<td></td>
</tr>
<tr>
<td>15u40</td>
<td>Agroecology in farmer education in Flanders: a survey.</td>
</tr>
<tr>
<td>Triste, L. - ILVO</td>
<td></td>
</tr>
<tr>
<td>15u45</td>
<td>Exploring the little concern for biodiversity among sustainable food consumers</td>
</tr>
<tr>
<td>Bernardin, C. – LARESS/AgroParisTech</td>
<td></td>
</tr>
<tr>
<td>16u -17u</td>
<td>Meet and greet: All delegates meet presenters of sessions 3 and 4</td>
</tr>
<tr>
<td>17u -18u</td>
<td>NETWORKING with reception</td>
</tr>
</tbody>
</table>

Organising and Scientific committee

The organising committee consists of Prof. Dirk Reheul (UGent), Prof. Pieter De Frenne (UGent), Dr. Bert Reubens (ILVO), Prof. Fleur Marchand (ILVO/UA), Prof. Pierre M. Stassart (ULg), Prof. Marjolein Visser (ULB), Prof. Marc Dufrêne (ULg).

The scientific committee consists of Prof. Dirk Reheul (UGent), Prof. Pieter De Frenne (UGent), Dr. Bert Reubens (ILVO), Prof. Fleur Marchand (ILVO/UA), Prof. Pierre M. Stassart (ULg), Prof. Marjolein Visser (ULB), Prof. Marc Dufrêne (ULg), Prof. Denise Van Dam (UNamur), Dr. Julie Hermesse (UCL), Dr. Louis Hautier (CRAW) and Corentin Hecquet (ULg).
Morning plenary sessions

Topics

1. Inspiring examples and developments within the biophysical system
2. Inspiring examples of transdisciplinary approaches

Keynotes – Chair: Prof. dr. ir. Dirk Reheul (UGent)

Keynote 1

**Biodiversity and ecosystem services of agricultural landscapes**

by Prof. Guillaume Decocq

*Jules Verne University of Picardie, Research unit EDYSAN (FRE 3498 CNRS-UPJV), 1 rue des Louvels, Amiens, France*

State-of-the-art

The increasing demand for food and the promotion of bioenergy crops has led to an increasing demand for new agricultural areas worldwide and increased crop production to the detriment of semi-natural habitats. Yet, the latter are of major importance to human society, since they support an important biodiversity, itself contributing to ecosystem functioning and delivering several crucial ecosystem services, and ultimately increasing agriculture sustainability. Ecosystem services are often categorized as provisioning, regulating, cultural and supporting services or, alternatively, as in situ, local-proximal, directional flow related, global, and user movement related services. Among semi-natural habitats embedded in a more or less intensively managed agricultural landscape matrix, woody elements such as small forest patches and hedgerows are susceptible to deliver a number of overlooked ecosystem services through the biodiversity they host. This is the focus of this presentation.

Methods

First I will present a short overview of the literature about the relationships between forest biodiversity and ecosystem services in agricultural landscapes (1). Then I will present the results of some recent research projects dedicated to the biodiversity of woody habitats in agricultural landscapes and the goods and services they provide to agriculture in particular and to society in general. In the smallFOREST project (BiodivERsA), a European consortium surveyed plant biodiversity and measured a suite of ecosystem services in small forest patches embedded in more or less intensively managed agricultural landscapes, along a macroecological gradient ranging from South France to Central Sweden and Estonia (2). In the FORHAIE project (French government), we extended the study to hedgerows for two several agricultural landscapes of North France and looked at whether hedgerows can act as ecological corridors for forest species and hence, can help in maintaining biodiversity and ecosystem services in small forest patches (3). In the BTGC project (Regional Council of Picardie), we tested whether newly planted hedgerows can improve biodiversity and related ecosystem-services in intensively cultivated open fields.
Main results
As potential biodiversity islets, small forest patches may deliver several crucial ecosystem services to
human society, but they received little attention compared to large forests. Beyond important in
situ (e.g. timber, game, edible plants and mushrooms) and global (e.g. carbon sinks, nutrient cy-
cles) service production, at the landscape scale, they may enhance crop production via physical
(obstacle against wind and floods) and biological (sources of pollinators and natural enemies) regu-
lation. Depending on their geographic location, small forest patches can also greatly influence the
water cycle and contribute to supply high-quality water to agriculture and people. The smallFOREST
project revealed that patch size was the most important driver of biodiversity, when several taxa were
simultaneously considered (i.e. plants, arthropods, mushrooms), and that an increased multidiversity,
together with greater structural heterogeneity of the tree layer, increased the amount of multiple
ecosystem services delivered by the forest patch. However, depending upon the taxon/guild and
service considered, other factors may be influential. For example, local carabid communities are
random assemblages of mostly non-forest species typically patterned by dispersal filters and chance,
which incorporate a number of forest species increasing with fragment size and connectivity. In the
FORHAIE project, we showed that with few exceptions all plant and carabid species found in small
forest patches were retrieved in hedgerow but with a far lower frequency and abundance for forest
specialists. While hedgerows can act as habitat for forest species, their corridor function seems to
be species-specific. Both functions highly depended on the width, height and age of hedgerows,
as well as adjacent land use intensity. Though it takes centuries before a newly created forest patch
or hedgerow accumulates forest specialist species, even young structures can provide a number of
services to agriculture, as revealed by an the BTGC experiment. Biodiversity of several taxa increased
with hedgerow edge, and ecosystem services accumulated with no direct negative impact on crop
production.

Conclusions
The wooded network of agricultural landscapes, including small forest patches and hedgerows, often
represents a local biodiversity hotspot in agricultural landscapes, and has the potential to deliver a
wide range of ecosystem services and thus, may be crucial for the ecological intensification of agro-
ecosystems. These multiple services benefit not only to the owner of the forest patch, but also for the
surrounding community, including farmers and users of the landscape. Cultural services are indeed
related to landscape values more than to forest elements per se, but the latter may contribute to
the construction of rural community identity. Though often overlooked, the maintenance of existing
forest patches, especially bigger ones (> 3 ha), and existing hedgerows is a crucial component of
the ecological intensification of agriculture. Managing forest patches towards a structurally diverse
canopy and preserving sufficiently wide and height hedgerows seems to be the best strategy to meet
both conservation and service delivery objectives for a sustainable agriculture.

References
J, Lindgren J, Naaf T, Paal T, Prokofieva I, Scherer-Lorenzen M, Wulf M, Verheyen K, Decocq
G. 2015 - Local environmental conditions override macroclimatic factors in explaining local
plant species diversity in fragmented forests along a latitudinal gradient. Global Ecology and
Biogeography 24:1094-1105.
F, Prokofieva I, Rosenqvist L, Varela E, Valdés A, Verheyen K, Wulf M. 2016 - Ecosystem services
from small forest patches in agricultural landscapes. Current Forestry Reports 2:30–44.

Biography

Guillaume DECOCQ is a Full Professor of Plant and Fungus Sciences at the Jules Verne University of Picardy in Amiens, and Hospital Practitioner at the University Hospital of Amiens. He is the director of the research unit “Ecology and Dynamics of Human-impacted Ecosystems” from the French CNRS, a group of ca. 70 persons with half of them in a permanent position.

After his graduation in Pharmacy, he got his PharmD diploma in Amiens and a Master degree in Enzymatic, Biotechnological and Microbiological Engineering at the University of Compiègne in 1994. He then conducted his PhD thesis in Botany and Phytosociology at the University of Lille, together with a post-graduation in Clinical Pharmacology at the University Hospital of Amiens; he got the two diplomas in 1997.

He was subsequently recruited at the Jules Verne University of Picardy as an Assistant in 1997 and as an Assistant Professor in 1999. He defended his habilitation in 2004 on the human-induced successions of forest plant communities, formalizing some theoretical aspects of historical ecology. He became a Full Professor in 2005. His personal research interest concerns plant biodiversity and vegetation dynamics in forest ecosystems (temperate and tropical), with a special focus on the historical ecology of forests. He conducted a number of research projects dedicated to forest metacommunity dynamics and plant invasions in forests. So far, he published more than 100 international papers and 20 book chapters; he recently published a book about the mountain reforestation policy of the 19th century in France. In 2016, he received the Award of the French botanical society for his whole career in plant sciences, and was graded at the “classe exceptionnelle” (top level within the Full Professorship corps) by the National Council of the French Universities.
The challenges and opportunities of ‘doing’ co-innovation to enhance translation processes
by Dr Julie Ingram
Countryside and Community Research Institute, University of Gloucestershire, United Kingdom

State-of-the-art
Although innovation is understood to encompass much more than R&D, science continues to be an essential ingredient, as international, EU, and national level policies reiterate (OECD, 2010). These argue that there is a compelling need for research to play a significant role in meeting the innovation challenges of increased demand for food balanced against the need to deliver other ecosystem services. If this role is to be fulfilled, provision needs to be made for outreach and translation of research to enable effective deployment of innovative research, as an essential part of the process. This paper explores approaches to translation utilising a co-innovation approach. This approach regards innovation as an emergent product ‘co-produced’ through interactions between heterogeneous sets of actors (farmers, advisory services, intermediaries supply chain actors etc) as the result of a process of networking and interaction. Although research plays a role in this ‘co-innovation’, the involvement of end-users is central in determining, undertaking and translating research results into technologies and practices (Klerkx & Nettle, 2013). From a theoretical perspective this involves integrating elements of an interactive innovation-driven model, with a linear science-driven model. This approach is particularly relevant to agroecology because the application of scientifically derived ecological concepts and principles is critical for the design, management and implementation of sustainable agroecosystems and innovative practices. Furthermore sharing and integrating different types of knowledge is at the heart of the agroecological movement, as is the use of participatory approaches to encourage co-production Titonell (2014). This paper describes experiences of a co-innovation methodology in the VALERIE project.

Methods
Overall the project’s objective is to translate research outcomes with a special interest in innovative and applicable approaches into end-user content and format (for farmers, advisers and enterprises in the supply chain), and to provide easy access to it. This is through the development of a smart retrieval system (ask-Valerie.eu) for use at a European level. It does this by extracting and summarising knowledge from national, international and EU research projects and studies concerning innovations in agriculture and forestry; with a focus on six selected themes. These outputs are screened, filtered and tested with stakeholders in an iterative process in 10 Case Studies organised around a particular supply chain, a farming / forestry sector, or a landscape. Stakeholders identify innovation issues (research needs) in participatory meetings and the apply, test, refine and screen innovation solutions (scientific knowledge) in local contexts. The series of meetings are monitored using a Dynamic Research Agenda (DRA) tool. This paper specifically looks at results in the arable case studies where stakeholders are interested in agroecologically relevant practices.

Main results
Two main insights are reported here. Firstly with respect to operationalising co-innovation it is clear that working with diverse stakeholder communities requires flexibility and adaptability. Central to this

2VALorising European Research for Innovation in agriculture and forestry www.valerie.eu
is the opportunity for reflection, learning and readjustment. The significance of the role of the Case Study Partners in managing the co-innovation process is clear, in particular in sustaining stakeholder engagement and nurturing a constructive dialogue over several iterations.

Secondly results charting the interplay between innovation issues and solutions reveal a multi-faceted translation process comprising identification, prioritisation, articulation, construction of issues and questions, searching, retrieval, interpretation and evaluation. The diverse Case Studies in terms of their social and technical context shape how these processes unfold. Existing activity and innovation support influences all processes and in particular the stakeholders’ level of understanding of, and expectations from, scientific outputs. Most stakeholders require some form of transformation of scientific information from academic or report style outputs to other formats. The ability to articulate the innovation issue in terms of concrete and manageable questions or topics at an appropriate level of detail was something that varied among stakeholders. In some cases experts reported that “farmer ask global questions but wish to get specific responses”. The assumption that stakeholders can turn issues into scientifically valid questions which can be used to seek and test out knowledge is therefore somewhat simplistic. Producers already have a high degree of experience and complex knowledge which they use for everyday problem identification and solving (Baars, 2011). Asking them to externalise this process and to articulate issues in an explicit way that can be interpreted by researchers is not a straightforward process. Furthermore the relevance of scientific knowledge to their specific contexts is questioned. Dialogue, clarification and a number of iterations allows issues to be clarified and solutions to be interpreted.

Conclusions
Experience to date has shown that involving end users in the translation process provides opportunities to facilitate the uptake of formal scientific knowledge. This methodology understands that solutions derived from research need to be re-built on the farm, with the involvement of relevant actors. This co-innovation methodologies has potential for agroecology contexts where farmers and scientists (and various intermediaries) could translate science together to ensure optimal understanding and application of agroecological principles. As EU research is increasingly advocating co-innovation approaches it is useful to reflect on the methodological challenges and opportunities this brings (SCAR EU, 2012).

References

Biography Dr Julie Ingram Bio is Reader in Sustainable Agri-environmental Systems in Countryside and Community Research Institute, University of Gloucestershire, UK.
Qualifications: BSc (Natural Environmental Science), MSc (Soil Survey and Pedology), PhD (2004 Agricultural advisers and the transition to sustainable soil management in England: an analysis of the role of knowledge and knowledge processes)

After working in international development in Africa and Nepal Julie completed her PhD and joined CCRI in 2004. Her main research interests are concerned with Agricultural Knowledge and Innovation Systems particularly with respect to European policy. She is interested in knowledge processes and learning within the agricultural community in the context of sustainable agriculture and natural resource protection. Her research has also covered the evaluation of agri-environmental schemes examining the influence of farmer knowledge, attitudes and motivations on behaviour. Her recent research has looked at social learning and co-innovation processes; boundaries; and socio-technical regime transition towards sustainable agriculture.

Julie has co-convened two workshops looking at ‘Boundary spanning between agroecological and conventional production systems’ (at 12th European IFSA Symposium and as part of the SOLINSA project). Julie contributes to the Evaluation of Farmer Field Labs (Innovative Farmers) for the UK Soil Association (concerned with organic farming) and has recently led or is leading Work Packages in European FP7 projects: Valorising European Research for Innovation in Agriculture and Forestry (VALERIE); Sustainable farm Management Aimed at Reducing Threats to Soils under climate change (SmartSOIL); Support of Learning and Innovation for Sustainable Agriculture (SOLINSA); SoilCare for profitable and sustainable crop production in Europe (SoilCare) and Preventing and Remediating Degradation of Soils in Europe through Landcare (RECARE).

Recent Achievements: Awarded the ‘best article of the year’ for 2014 and 2015 by the Journal of Agricultural Education and Extension
Productivity impact and ecosystem services delivery of grass strips and wooded strips adjacent to arable land

Laura VAN VOOREN\textsuperscript{1,2,3}, Bert REUBENS\textsuperscript{1}, Steven BROEKX\textsuperscript{2} & Kris VERHEYEN\textsuperscript{3}

\textsuperscript{1}Institute for Agricultural and Fisheries Research. Burgemeester Vangansberghelaan 109, 9820 Merelbeke. BELGIUM
\textsuperscript{2}Flemish Institute for Technological Research NV. Boeretang 200, 2400 Mol. BELGIUM
\textsuperscript{3}Forest & Nature Lab. Ghent University. Geraardbergsesteenweg 267, 9090 Melle. BELGIUM

State-of-the-art

Although it is known that semi-natural vegetation on agricultural land can deliver a broad range of ecosystem services (ES), there have been few quantitative and spatially explicit investigations into the effect relations between semi-natural elements and ES delivery. Existing research is linking regional and national land use to ES delivery, but this is based on large-scale inventories of semi-natural elements on the one hand and modelled ES indicators on the other hand (1). However, very often semi-natural elements are implemented on farm or even on parcel scale, for example as ecological focus areas in the new Common Agricultural Policy, and existing knowledge and models do not allow to estimate small-scale effects on ES delivery. This study seeks to obtain information which will help to address these research gaps. For two types of very common semi-natural elements, hedgerows and wooded strips (HWS) and grass strips (GS) on agricultural field margins, we perform a systematic literature search for empirical studies, data extraction and a meta-analysis to quantify their effect on productivity and ES delivery.

Methods

We performed a systematic literature search for peer-review studies describing the impact of HWS and GS on at least one of the ES we selected. HWS are defined here as unfertilized, perennial, linear, woody structures, implemented on agricultural field margins and consisting of shrubs and/or trees. GS are defined here as unfertilized, unsprayed, not tilled, linear, perennial structures, established on agricultural field borders and consisting of grasses, often in combination with other herbaceous species. Flower strips only consisting of annual species are not included given the focus on perennial elements.

ES we consider are: crop yield (dry matter ha\textsuperscript{-1}), soil carbon stock (kg m\textsuperscript{-2}), removal of nitrogen (mg or mg L\textsuperscript{-1}) and phosphorus (mg or mg L\textsuperscript{-1}) from water flows and erosion reduction (mg or mg L\textsuperscript{-1}). HWS and GS impact is investigated by comparing ES delivery with and without HWS and GS presence. Candidate papers were selected based on their title and abstract, when they met the following criteria: i) the study region has to be situated within the temperate regions of the globe, ii) empirical data of the indicator of interest are available (modelling studies are thus excluded), iii) true controls are present allowing indicator comparison with and without HWS or GS. For crop yield and carbon stock affected by HWS, a comparison is made between yield and carbon close to the HWS and far away from the HWS or on an adjacent parcel. GS effect on the carbon stock consists of the comparison of soil carbon before and after conversion to grassland. Nitrogen and phosphorus removal and erosion reduction is expressed as the ratio of N, P and TSS in the water inflow into the HWS or GS compared to the N, P and TSS in the outflow out of the HWS or GS. The reference lists of the retained papers were used to search for additional papers. Experimental data were extracted
from the 60 retained papers for further analysis. To quantify the effect relation between HWS and GS characteristics and impact on ES delivery, we ran mixed-effects models. “Study” was included in the model as a random factor to account for pseudo-replication. Explanatory variables are included to investigate the effect of HWS and GS characteristics, such as width, age, height. Goodness-of-fit of the models was tested.

Main results

All authors report lower crop yields close to the HWS and a decreasing reduction when H increases. Based on the model, crop yield is negatively affect by the HWS between H=0.0 and H=1.9. At H=0.5, relative crop yield is 63% and at H=1.0, relative crop yield is 84%. Average relative crop yield in this zone is 74%. Between H=1.9 and H=12.6, crop yield is positively affected by the HWS: at H=2.0, relative crop yield is 101% and at H=5.0, relative crop yield is 110%. Average relative crop yield in this area is 106%. Beyond H=12.6, we consider the effect as negligible. The net effect on crop yield is then 102%, meaning that without considering the loss of arable area, HWS have an overall positive effect on crop yield. Between H=0.01 and H=5.69, HWS presence resulted in a higher soil carbon stock: at H=0.5, relative carbon stock is 111% and at H=1, relative carbon stock is 108%. Beyond H=5.7, the observed effect is considered negligible. N removal from the surface flow is positively affected by the HWS: average N removal is 69%. In the model, width is a significant explanatory variable: the wider the HWS, the more N is trapped. For a HWS width of 2m, relative N outflow is 58% and for a width of 5m, relative N outflow is 28%. There is a significant effect of HWS presence on N removal from the subsurface flow (34%), P removal (67%) and erosion reduction (91%). HWS width was not a significant explanatory variable. Nor for N removal, P removal or erosion reduction, HWS type, parcel slope, HWS age or inflow concentration is a significant explanatory variable. Rather than demonstrating the limited influence of these variables, this could indicate a high variability between experimental conditions. Extracted data and quantification of the significant relations can be found in figure 1.

In the GS, average soil carbon stock is increased with 25%. In the model, depth is a significant explanatory variable and within the grass strip, the carbon stock is increased until a depth of 62 cm. Beyond this point, we consider the effect negligible. In the upper 30 cm, total soil carbon stock is increased with 89%. N removal from the surface flow is positively affected by the GS: average N removal is 76%. In the model, width is a significant explanatory variable: the wider the GS, the more N is trapped. For a GS width of 2m, relative N outflow is 71% and for a width of 5m, relative N outflow is 42%. All observations indicate a positive effect of GS on N removal from the subsurface flow and average N removal is 32%. In the model, width is a significant explanatory variable: the wider the GS, the more N is trapped. For a GS width of 2m, relative N outflow is 86% and for a width of 5m, relative N outflow is 71%. Average P removal by the GS is 73%. In the model, GS width is significant explanatory variable: the wider the GS, the more P is trapped. Out of a 2m wide GS, relative P outflow is 77% and out of a 5m wide GS, relative P outflow is 52%. Average erosion reduction by the GS is 90%. In the model, GS width is a significant explanatory variable: the wider the GS, the more erosion is reduced. For a GS width of 2m, relative outflow of TSS is 45% and for a width of 5m, relative outflow of TSS is 16%. Parcel slope and GS age is in any case a significant explanatory variable and inflow concentration is only significant for N removal from the subsurface flow and P removal. Rather than demonstrating the limited influence of these variables, this could indicate a high variability between experimental conditions.

Conclusions

Implementation of HWS and GS causes loss of arable surface area, resulting in reduced agricultural yield. However, this loss can be limited, depending on HWS and GS characteristics, and the delivery of other ES is significantly increased. This indicates that agriculture has the potential to play a multifunctional role in the landscape. This could be an incentive to think about compensation mechanisms linked to ES delivery on agricultural land. If a farmer is rewarded for these ES in the same way
as for the crops he produces, this could benefit the implementation of HWS and GS by the farmers.

References

Tall fescue in cut grassland: rooting deeper and higher dry matter and nitrogen yield

Cougnon, M.¹, Baert, J.², De Frenne, P.¹ and Reheul D.¹

¹Department of Plant Production, Ghent University, Proethoevestraat 22, 9090 Melle, BELGIUM
²ILVO plant, Caritasstraat 39, 9090 Melle, BELGIUM

State-of-the-art

Projected scenarios for European grasslands indicate that increased temperatures and CO₂ concentrations due to climate change have the potential to increase herbage growth. However, summer droughts, wet winters and extreme events like storms are expected to increase in frequency and intensity in the coming decades, and might counteract these benefits, particularly in grassland areas with low total summer rainfall (¹). It is therefore necessary to shift the species composition of our grasslands towards species that are more resilient and resistant to the predicted climatic changes. Given its good drought tolerance and high yield potential, tall fescue (Festuca arundinacea Schreb.; further referred to as ‘Fa’) is often cited to be the best candidate to cope with these changing environmental conditions. However, studies in which the agronomic properties of Fa are compared with other species under temperate climatic conditions in Europe are scarce. The aim of this study was to fill this knowledge gap. We studied the agronomic performance of tall fescue with that of perennial ryegrass (Lolium perenne L.; Lp, the dominant grassland species for the moment), Festulolium (Fl) and meadow fescue (Festuca pratensis L.; Fp).

Methods

A field trial was established in September 2011 on a sandy loam soil in Merelbeke, Belgium comprising of one variety of Lp, Fa and Fp; and two Festulolium varieties (Fl1 and Fl2, each with a different parent species). The trial was a split plot design with three replicates; individual plot size was 7.8 m². N fertilization was the main plot factor with two levels: high (300 kg N ha⁻¹ yr⁻¹) or low N (190 kg N ha⁻¹ yr⁻¹) and the varieties of the different species were the subplot factor. Five cuts per year were harvested in 2012, 2013 and 2014. Dry matter yield (DMY), the nitrogen yield (NY) and the digestibility of the organic matter (DOM) of the harvested herbage were determined. More details on the experimental set-up can be found in (²). After the last cut in 2015, two soil cores with a diameter of 8 cm were taken in each plot at a distance of at least 60 cm from the edge of the plot till a depth of 90 cm over 15-cm (0-15, 15-30, 30-45, 45-60, 60-75, 75-90 cm) intervals to determine belowground biomass. In addition, two separate samples of the stubble (+5 and -5 cm) were taken. Each soil core was rinsed under running tap water on a sieve with mesh size of 425 µm to remove the soil. The collected roots were dried and weighed.

Main results

We detected a positive effect of the N-fertilization on the DMY and the NY in all years (Table 1). Also the species effect on DMY and NY was significant in the three years of the trial. Where tall fescue had a significantly lower DMY in the first year of the trial, it over yielded the other species from the second year onwards. In 2014, the yield of Fa was 1.23 to 1.41 times that of Lp under low and high N fertilization, respectively. This higher DMY of Fa, in combination with a comparable N concentration among the species, resulted in significantly higher NY for Fa compared to the other species: in 2014, NY of Fa was 1.21 to 1.40 times that of Lp under high and low N fertilization, respectively. The DOM of Fa, on the other hand, was substantially lower than that of the other species (Table 1): in 2014, for instance, the DOM was 0.69 in Fa and 0.79 in Lp under high N fertilization.
Table 4: Mean aboveground dry matter yield (Mg DM ha\(^{-1}\) year\(^{-1}\)) and Nitrogen yield (kg N ha\(^{-1}\) year\(^{-1}\)) of five forage grass species receiving high (300 kg N ha\(^{-1}\) year\(^{-1}\)) or low (190 kg N ha\(^{-1}\) year\(^{-1}\)) N fertilisation in three successive years. Fa = Festuca arundinacea, Fl1 = Festulolium ‘Achilles’, Fl2 = Festulolium ‘Lueur’, Fp = Festuca pratensis, Lp = Lolium perenne.

<table>
<thead>
<tr>
<th>Species</th>
<th>Dry matter yield (Mg ha(^{-1}))</th>
<th>Nitrogen yield (kg.ha(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fa</td>
<td>11.8(^a)</td>
<td>14.5(^a)</td>
</tr>
<tr>
<td>Fl1</td>
<td>15.3(^a)</td>
<td>10.9(^b)</td>
</tr>
<tr>
<td>Fl2</td>
<td>14.7(^a)</td>
<td>11.1(^b)</td>
</tr>
<tr>
<td>Fp</td>
<td>10.9(^b)</td>
<td>9.2(^b)</td>
</tr>
<tr>
<td>Lp</td>
<td>13.6(^a)</td>
<td>10.1(^b)</td>
</tr>
<tr>
<td>HIGH N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fa</td>
<td>15.5(^bc)</td>
<td>18.1(^a)</td>
</tr>
<tr>
<td>Fl1</td>
<td>17.7(^a)</td>
<td>13.4(^b)</td>
</tr>
<tr>
<td>Fl2</td>
<td>16.3(^a)</td>
<td>12.9(^b)</td>
</tr>
<tr>
<td>Fp</td>
<td>13.2(^c)</td>
<td>11.3(^c)</td>
</tr>
<tr>
<td>Lp</td>
<td>16.5(^ab)</td>
<td>12.9(^b)</td>
</tr>
</tbody>
</table>

**p-values**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Species</th>
<th>N x species</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>***</td>
<td>***</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td></td>
<td>ns</td>
<td>ns</td>
<td>***</td>
</tr>
</tbody>
</table>

1 ns: non-significant (p>0.05); ***: p<0.001. Different letters within columns denote significant differences.

The effect of N-fertilization on the total root biomass was not significant, while Fa had a significantly higher total root biomass compared to the other species.

The total root biomass (including the aboveground stubble that was below cutting height of 5 cm; mean ± standard deviation) was between 1810 ± 187 g m\(^{-2}\) for Fa and 972 ± 89 g m\(^{-2}\) for Fl2 at low N and between 1908 ± 309g m\(^{-2}\) for Fa and 1054 ± 46 g m\(^{-2}\) for Fl2 at high N. The difference between Fa and the other species increased with the soil depth. At high N, the ratio between the root biomass of Fa and the average root biomass of the other species increased from 1.41 in the layer -5 to -15 cm to 5.82 in the layer -75 to -90 cm.

**Conclusions**

Our results indicate that tall fescue has the right agronomic properties to cope with the future challenges of grasslands in temperate Europe: deep roots resulting in a good drought resistance; a higher N recovery compared to other species, resulting in lower N losses to the environment. A major weakness of the species is, however, its low DOM. Yet, a dedicated breeding and research program is running to improve the digestibility of this species [3]. We conclude that tall fescue could make forage production more sustainable and assure our forage under a changing climate.

**References**


Silvoarable agroforestry: yield, soil characteristics and agricultural biodiversity
Pardon, P.1,2 Reubens, B.2, Reheul, D.1, Mertens, J.1, Coussement, T.3, Verheyen, K.1

1 University of Ghent, St. Pietersnieuwstraat 33, Ghent, BELGIUM
2 Institute for agricultural and fisheries research, Burg. van Gansberghelaan 109, Merelbeke, BELGIUM
3 Soil Service of Belgium, W. de Croylaan 48, Leuven, BELGIUM

State-of-the-art
Farmers and society in Flanders, as elsewhere in northwestern Europe, are currently being confronted with several negative side-effects of present agricultural practices, e.g. lowering of soil C-stocks, soil erosion (5), declining biodiversity (e.g. 4). Though several foreign studies indicate a variety of beneficial effects of agroforestry systems (e.g. 2, 6, 3), in the search for solutions, its implementation appears to be rather limited. Besides bottlenecks of legislative, logistic or economic nature (1), this is partly due to the lack of understanding and particularly quantification of the impact of the trees in an agroforestry system on amongst others the yield and quality of the intercrops, soil conditions (e.g. nutrient status, water content) and functional agrobiodiversity. The goal of the present research is to quantify these impacts as a function of tree age, while focusing on arable alley cropping systems with Populus spp. A species well suited for use in agroforestry because of its fast growth and diverse industrial applications, and with good production potential on arable land in large parts of temperate Europe (7). To allow for a limited extrapolation to other tree species, additionally three experimental fields with Juglans regia are included in the dataset, a species suitable for both production of walnuts or of high quality timber.

Methods
Arable alley cropping systems in Flanders are scarce, and almost exclusively of young age. In order to estimate the effect of trees, as a proxy, a set of conventional arable fields was selected that are bordered by a tree row (Fig. 1). Following criteria were used for selection of the fields: 1) Tree row orientation: (approximately) North-South. 2) Tree species: Populus x canadensis or Juglans regia. 3) Tree row age is homogenous at field level but varies among the different fields (height ranging from 12.5 to 34m, height:diameter ranging from 4.9 to 27.6). 4) Absence of headland next to the tree row. 5) Part of the field is not bordered by the tree row. 6) Soil type: loam or sandy loam.

The resulting set of experimental fields comprises twelve conventional arable fields bordered with Populus x canadensis and three fields bordered with Juglans regia. The differences in tree-age among the fields allows to study the occurring processes throughout the evolution of the tree rows from young to old (space for time). The treeless parts of these fields hereby acts as a reference situation. On each field transects are laid out perpendicularly to both the tree row and the treeless border (three and two transects respectively). Each transect comprises five measuring points, located at distances 2, 5, 10, 20 and 30m away from the field edge. This allows to study possible gradients of the measured parameters as function of distance to the tree row. On each field, at these 25 measuring locations, a combined set of parameters are evaluated:

Soil characteristics: analysis of organic C%, total N, K, Mg, P and pH in upper soil layer (0-23cm).

Crop yield and quality: harvesting of experimental plots at each transect and each distance, determination of quantity and analysis of relevant quality parameters (protein & dry matter content in case of barley & wheat. Supplemented with starch content and organic matter digestibility in case of silage maize, and with ash & cell wall content and organic matter digestibility in case of grass). Measurements started in April 2015 and are to be continued until the fall of 2017.
**Functional agrobiodiversity**: pitfall trapping during June 2015 & 2016 in two transects by the tree row and the two references transects at distances 0, 2, 5 and 30m.

**N-flux**: measuring of mineral N in soil on a subset of six fields bordered with *Populus x canadensis* at time of harvest, in autumn and at the end of winter. Measurements started in March 2015 and are to be continued until March 2017. Sampled depths: 0-30cm; 30-60cm; 60-90cm.

**Outlook**

**Soil characteristics**: Preliminary results using linear mixed modelling show a significant effect of interaction between tree presence and distance into the field on soil C ($p<0.0001$) and N content ($p<0.0001$). Mean % organic carbon and total nitrogen equalled respectively $1.39\pm0.03se$ and $0.14\pm0.003se$, versus $1.17\pm0.02se$ and $0.11\pm0.002se$ where trees are absent. Increasing levels were found when distance to the tree row decreases, with a mean increase between measurements at 30m of tree row and at 2m of tree row equalling $0.34\pm0.06se$ % organic carbon and $0.027\pm0.005se$ % total nitrogen. Moreover, a positive relation between the age (translated into tree height x diameter) of the present tree row and the soil carbon and nitrogen content seemed to be present. Regarding C:N ratio and soil pH, no significant effects of tree presence were found.

**Crop yield and quality**: Based on the crop harvests conducted in 2015, first rough estimates of the crop-dependent relationships have been derived for yield as a function of tree age and distance into the field. The actual goal of these measurements is however to make more detailed estimates of expected yield for complete rotations of tree rows as a function of primarily the arable crops grown, tree row spacing and to a lesser extent also tree species. Simultaneously, estimations of the achievable quality of arable crops in relation to proximity to the tree rows and tree age will be further elaborated.

**N-flux**: Though at current, data gathering is still largely ongoing and no detailed analysis of first results was executed yet, future analysis will focus on N-availability for the arable crop throughout the growing season and on the potential of the tree component to reduce N-leaching during winter.

**Functional agrobiodiversity**: Analysis of this topic is foreseen after completion of the second field campaign (2016). Focus will be on the potential of tree rows in agricultural fields for natural pest control through occurrence of predatory arthropods (Coleoptera: Carabidae and Staphylinidae) and decomposers (Diplopoda & Isopoda).

**Acknowledgments**

Research funded by Flanders Innovation & Entrepreneurship (VLAIO)
References


Development of a 3-D modelling framework for studying light distribution in agroforestry systems

De Swaef T.¹, De Frenne P.² and Roldán-Ruiz I.¹

¹Institute of Agricultural and Fisheries Research (ILVO), Plant – Growth and Development, Caritasstraat 39, 9090 Melle, BELGIUM
²Department of Plant Production, Ghent University, Proeftoestraat 22, 9090 Melle, BELGIUM

State-of-the-art

Field experiments are typically constrained by time (e.g. by the length of the growing season and long generation times of most plants) and space (e.g. availability of sufficiently large fields to simulate realistic conditions). This is especially true for agroforestry research, which is characterized by even longer experiments due to the slow growth of trees and low flexibility to modify or adapt experimental designs. Because of these practical limitations, models are valuable tools to address specific research questions using virtual experiments.

Methods

We have designed a 3-D modelling tool for agroforestry research using the GroIMP software (www.grogra.de), developed for Functional-Structural Plant Modelling (FSPM). This software enables calculation and visualisation of virtual plants in 3-D, and uses the Extended L-systems (XL) language, an extension of Java.

The tool consists of three basic elements: (i) a detailed light distribution model, (ii) a field (i.e. the main crop) at which light incidence is calculated, and (iii) tree rows which block part of the incoming light (Fig. 1). For the light distribution model, 72 individual directional radiation sources were positioned as an evenly distributed half sphere around the scene to enable simulation of diffuse radiation. Additionally, 48 directional light sources were evenly distributed along the path of the sun during the day to simulate direct incoming radiation. This path is automatically adjusted according to the day of the year and the latitude. Light partitioning between direct and diffuse radiation was calculated following [1]. The light sources were attributed with the FluxLightModel included in GroIMP which allows to distinguish between different wavelengths [2]. The light source intensity was calculated using [1], which can use either true meteorological data or using maximum incoming radiation.

The field consists of 1 × 1 m² tiles, for each of which the absorbed radiation can be quantified. Each tile has a row and column identification, to enable recording the spatial light distribution throughout the field. The size and slope of the field can be adjusted as desired by the user.

Tree trunks are modelled as cylinders that are impermeable for light. Tree crown shapes are designed using NURBS (Non-Uniform Rational Basis Spline) to account for a wide variety of crown shapes of different tree species and to account for phenological changes throughout the growing season by means of variable light penetration in deciduous trees. Required inputs are the tree species and the diameter at breast height of the trunks, which is used to calculate tree height and crown dimensions using species-specific allometric relations. Furthermore, azimuthal row orientation and tree spacing can be modified by the user.

Conclusions

Although it should be noted that the development of robust models requires a lot of empirical data, and that models have limitations, as they are always a simplification of reality, the developed frame-
Figure 1: Left: Snapshot of a virtual agroforestry scene in the software GroIMP on day of the year 104 (14 April) at 52 °N. The arc of light sources represents the position of the sun to generate direct light. Other light sources are positioned as a half sphere to mimic diffuse radiation. The trees are in rows with a north-south orientation, with a tree-to-tree distance of 20 m within and 40 m between the rows. Right: Light incidence at the crop level as a function of the distance from the tree rows, for three dates in the season.

This work is a useful tool to perform simulation studies on the light distribution in agroforestry systems throughout the year and throughout the lifespan of the trees.

Different model parameters to be altered include latitude and slope of the field, tree spacing and density, row orientation, tree species, crown shape and trunk and crown size (or age) such that the theoretical most optimal agroforestry situation to minimize light interception can be easily designed. This is important information to support and better inform scientists, policy makers and farmers on how best to develop and establish agroforestry fields.

References


The after-effects of grass-clover green manuring and non-inversion tillage on grain yield and protein content of Triticum aestivum.

Willekens, K.¹, Van Gils, B.¹ and Gofflot, S.²

¹ Institute for Agricultural and Fisheries Research (ILVO), Burg. Van Gansghelaan 109, 9820 Merelbeke, BELGIUM
² Walloon Agricultural Research Centre (CRA-W), Chaussée de Namur 24, 5030 Gembloux, BELGIUM

State-of-the-art

In natural ecosystems, soil fertility is sustained by microbial decomposition and transformation of plant residues rendering nutrients back available to the plants and sustaining soil organic matter content. Nitrogen (N) shortage is counteracted by N fixing leguminous species becoming part of the plant community. Soil is not inverted by tillage practices. Agro-ecosystems might benefit from mimicking these natural mechanisms of soil fertility building. Plant residues can be composted in a controlled microbial way. Vegetative compost may partly replace animal manure in organic cropping systems (3). Rhizobium species can biologically fix N in a symbiotic association with leguminous crops which can be included in the crop rotation. Ley pastures including clover species are often used for soil fertility building in organic cropping systems (1). Grass-clover cuts can also be used as a cut-and-carry fertilizer. Practicing non-inversion tillage accelerates the built-up of SOM in the top layer and is less energy consuming compared to conventional ploughing. In this paper, we present the effect of these agro-ecological agricultural practices on soil fertility as revealed by grain yield and protein content of spring wheat (Triticum aestivum).

Methods

The use of grass-clover for green manuring, compost application and non-inversion tillage were investigated in a multi-year soil management field trial (organic cropping system) at ILVO. A grass-clover ley (Lolium perenne, Trifolium pratense and Trifolium repens) was established in September 2010. The ley was either mown and harvested or mulched during the 2011 growing season. In 2012, three ways of grass-clover ley termination were tested. The ley was destroyed early (March 19) after a single mulching (TS1) or late (May 18). In case of late destruction, grass-clover biomass was either cut and removed (TS0) or mulched three times (TS2). After termination of the grass-clover sward by superficial tillage, the soil was prepared for planting leek (Allium porrum) (June 20) either by conventional tillage with a mouldboard plough or by deep non-inversion tillage with a chisel plough. In case of removal of a full-grown grass-clover cut (TS0), 87 kg N ha⁻¹ was exported. The N input from grass-clover aboveground biomass was 46 kg N ha⁻¹ for TS1 and 133 kg N ha⁻¹ for TS2. In 2013, celeriac (Apium graveolens, var. rapaceum) was grown. On April 10, farm compost was applied on sub-subplots either at zero rate or at 32.9 Mg ha⁻¹ corresponding to 185 kg N ha⁻¹. Grass-clover silage was applied as cut-and-carry fertilizer, on May 2 at zero (BT0), 9.8 (BT1) and 19.6 Mg ha⁻¹ (BT2), corresponding to zero, 96 and 191 kg N ha⁻¹, respectively. The subplots having received the lowest (TS0), intermediate (TS1) and highest (TS2) N input by grass-clover aboveground biomass in 2012 received the lowest (BT0), intermediate (BT1) and highest (BT2) N input by grass-clover biomass transfer in 2013, respectively.

In 2012 the experimental design was a split-plot (main plot factor: tillage; subplot factor: green manuring) with four replicates, which was expanded to a split-split-plot design in 2013 while introducing the compost factor (sub-subplot factor). In 2014, spring wheat (variety LAVETT) was grown. Both tillage types were performed whereas no fertilization variants were imposed in order to perceive the
after-effects of grass-clover green manuring and compost application in 2012 and 2013 on grain yield and protein content of the spring wheat. This crop was just fertilized with 50 kg N ha\(^{-1}\) applied with an organic commercial fertilizer (biomix) just before sowing on April 3.

**Main results**

Spring wheat grain yield (standardized 15% dry matter (DM) content) was significantly higher in case of non-inversion tillage (5.0 Mg ha\(^{-1}\)) compared to mouldboard ploughing (4.3 Mg ha\(^{-1}\)) (split-split-plot ANOVA, p < 0.05). In another multiyear soil management field trial (conventional cropping system), the application of non-inversion tillage resulted in a DM grain yield increase (spring barley, *Hordeum vulgare*) of 21 and 38% in cattle slurry and pig slurry plots, respectively, compared to ploughing (2). No fertilization after-effect was found from compost application or grass-clover green manuring on grain yield. By contrast grass-clover green manuring significantly positively affected spring wheat grain protein content (split-split-plot ANOVA p < 0.01). The protein content of grain harvested on plots with the lowest grass-clover green manure input by mulching and biomass transfer was significantly lower than the protein content of the grain harvested on plots with a higher input (Scheffé, p < 0.01) (Figure 1).

**Conclusions**

Soil fertility building using grass-clover cuts, applied either by mulching in situ or by biomass transfer from one field to another, positively affected protein content of the wheat grain produced in a following growing season. Besides that, grain yield seemed to be positively affected by a repeated non-inversion tillage practice, compared to mouldboard ploughing. These agro-ecological practices reduce the need for animal manure and the energy use in cropping systems and may lower their carbon footprint.

**References**


Opportunities and barriers for different types of plantation in chickens’ free-range areas

Stadig, L.M.1, Tuyttens, F.A.M.1,2, Rodenburg, T.B.3, De Vos, H.1 and Reubens, B.4

1Institute for Agricultural and Fisheries Research, Animal Sciences Unit, Scheldeweg 68, Melle, BELGIUM
2University of Ghent, Faculty of Veterinary Medicine, Salisburylaan 133, Merelbeke, BELGIUM
3Wageningen University, Behavioural Ecology Group, De Elst 1, Wageningen, THE NETHERLANDS
4Institute for Agricultural and Fisheries Research, Plant Sciences Unit, Burgemeester van Gansberghelaan 109, Merelbeke, BELGIUM

State-of-the-art

Chickens’ use of a free-range area is often limited and therefore the benefits of outdoor access, such as better animal welfare, are not fully exploited. Suitable shelter, such as plantation with perennial crops, is a key element for good use of the free-range area (1), with more chickens going outside and distributing themselves more evenly over the area. Plantation could thereby also aid in decreasing point pollution close to the chicken house. In addition, dual land use is an efficient use of space for producing both chickens and e.g. wood chips or fruit. If this vegetation could also provide extra revenue, this may be an extra incentive for the farmer to plant them. The aims of this study were (1) to investigate chicken farmers’ opinion about combining free-range chicken production with three types of plantation: short rotation coppice with willow (Salix spp.), miscanthus and fruit trees, and (2) to make a cost-benefit analysis for one of these options, i.e. the implementation of short rotation coppice with willow on a free-range chicken farm.

Methods

Eighteen free-range or organic farmers (17 laying hen and 1 broiler farmer) from Belgium and the Netherlands were interviewed using a semi-structured interview, four of whom already had a substantial amount of woody vegetation in the free-range area. The farmers first received a short explanation about the three coppices. The topic list for the interview included general farm characteristics, current plantation in the free-range area, influence of plantation on the chickens, the environment, farm management and economic results, influence of the chickens on the plantation, and ways in which plantations in the free-range area could be encouraged.

For the cost-benefit analysis, data from literature and practical experience were used to make an overview of the average costs and revenues of implementing short rotation coppice on a free-range laying hen farm. Four different scenarios were taken into account: private use of the wood chips (for heat production for e.g. the farmer’s house or other barns) vs. selling them, combined with either yearly or three-yearly harvest. This was done for a farm with a 5-ha free-range area, which was the average free range size of the interviewed farmers. The net value after 21 years (the average lifespan of a short rotation coppice plantation) was used as the outcome parameter.

Main results

Benefits of the tree types of plantation in the free-range area that were most commonly mentioned by the farmers were that chickens would prefer either of these 3 perennial crop types over open grassland (17 farmers), that chickens would range more in the presence of shelter(15), and would distribute themselves better over the area (12). They also expected that weed pressure would decrease because the chickens would forage on the weeds (14), and that the public image of the farm would improve (12). Perceived downsides of the plantations were that chickens would damage the plants.
and that it is not possible to install the plantation while the chickens are outside. Farmers also thought that maintenance would be labour-intensive, and were afraid of increased predation by foxes. Farmers who already had a similar plantation in the free-range area answered correspondingly to those who had not, except that they did not perceive the predation by foxes to be increased.

Of the four studied scenarios for the cost-benefit analysis, only one had a positive net value after 21 years; when the wood chips were used for private heat production, and the coppice was harvested every year, the total profit would be €12,000. However, this outcome depends on many factors, such as whether or not a place where the chips can be dried is already available or that this needs to be built, the market price of dried wood chips, and the yield of the short rotation coppice.

Conclusions

Most farmers believed that having woody vegetation in the free-range area would be beneficial for their chickens. However, they also perceived it to be too labour-intensive and difficult to plant because the chickens would damage them. Nevertheless, farmers with experience with these types of plantations have a positive attitude towards them, especially regarding chicken welfare, and on-farm trials could aid in developing a sustainable crop-livestock production system for free-range poultry.

References

Co-designing a decision-support tool with farmers as the basis for a participatory approach

Guillaume M.¹, Houben P.¹, Stilmant D.¹, Van Damme J.¹

¹ Walloon Agricultural Research Centre, Rue du Liroux, 9, Gembloux, Belgium

State-of-the-art

Over the past decade, the participatory approach has been promoted in agricultural research. Agricultural innovation is recognized as a complex and interactive learning process in which farmers should play an active role (1). Farmer participation is particularly critical in organic agriculture. This type of agriculture is characterized by a diversity of practices that need to be understood through a systemic approach that draws on both scientist and farmer knowledge (2).

Farmers’ and researchers’ concerns, however, diverge in terms of temporality. Farmers call for short-term results, whereas scientific research tends to have a mid- to long-term perspective. Therefore, the challenge is not only to ensure the active participation of farmers in agricultural innovation, but also to maintain their interest throughout the research process.

In order to establish a participatory process aimed at characterizing practices and performances in a range of farming systems, we worked with farmers to co-design a decision-support tool. This user-friendly financial management tool, aimed at both farmers and scientists, can be used to catalyze discussions between the various participants in the research.

Method

Our method was divided into two main stages and was applied in our work with 11 farmers in Walloon, Belgium who represented various organic cattle management systems.

Co-designing the decision-support tool

The first stage of the method involved the co-creation of a tool by farmers and researchers (Figure 1). The aims of this stage were to: (1) stimulate the interest of the farmers by developing a tool that met their needs and (2) collect useful quantitative data to assess the economic efficiency of the farms.

Through individual and joint sessions, we were able to identify the type of tool that would suit the farmers. A prototype was then developed and tested with some of the farmers, using their own data. These farmers gave us feedback on functionality, design and data-encoding issues. Once the tool was functional, we deployed it among the other farmers.

Participatory meeting

The second stage involved organizing a participatory focus group with the farmers in order to discuss the economic outcomes of the first stage (Figure 1). The qualitative data obtained was used to enrich the quantitative data, thus providing a comprehensive analysis of the economic performance of the cattle management systems.

Main results

Co-designing the decision-support tool: galvanizing farmers by meeting their expectations

The farmers had expressed the wish to make better use of their economic data. We therefore designed a user-friendly financial management tool adapted to a variety of farming systems. It is based on farmers inputting their cash inflow and outflow data on spreadsheets (Excel and LibreOffice) in order to calculate the costs of agricultural products and assess a farm’s overall financial performance.
This gives farmers the information they need to meet their annual cash obligations and to help them in negotiations (e.g., fixing a fair price for their products).

**Participatory workshop: catalyzing the discussions on innovative practices**

At the participatory meeting, we revealed the financial performance information obtained by the tool. This encouraged the farmers to exchange views on their performance and practices, which had several benefits. First, we collected useful information for the overall assessment. Second, the farmers provided information on marginal and innovative practices. And finally, it gave us an opportunity to identify farmer needs that could be addressed in future research.

**Conclusion**

Co-creating a management tool is not the fastest way to collect economic data, but it is a good way to establish a useful relationship between farmers and researchers. This iterative and participatory approach enabled us to gain the farmers’ confidence and stimulate their interest in the decision-support tool performance. It also put all the farmers on an equal footing, which encouraged them to engage in a practical and genuine exchange of views. This made our task of collecting key qualitative data far easier. Coupling these data with quantitative data gathered using the decision-support tool could offer useful insight for a comprehensive analysis of the technical and economic performances of a range of farming systems.

**References**


Gender in Agroecology: unearthing smallholders’ approaches to building resilient food systems

Sarrouy Kay, C.1,2, Lemke, S.1 and Pimbert, M.1

1 Coventry University, Priory Street, Coventry, UNITED KINGDOM
2 Université Libre de Bruxelles, Avenue Franklin Roosevelt 50, Brussels, BELGIUM

State-of-the-art

One in eight people go to bed hungry every day in the world and most of these people are farmers (1). Women, despite being the main producers of food – equating to 60-90% of food grown globally (2) –, are also the first victims of hunger.

Climate change further exacerbates vulnerabilities in food systems. Changes in rainfall, temperature and sea level have a direct impact on food production, but also at all other stages of the food chain (3). Climate change’s environmental, social and politico-economic repercussions may hinder food and nutrition security for both women and men.

Agroecology is a science, practice, and movement aiming to build resilient food systems (4), by adopting holistic approaches based on local knowledge, needs and practices that enable smallholders to mitigate and adapt to climate change.

This paper addresses the void between the acknowledged importance of gender-sensitive principles in agroecology and its overwhelming gender-blind research, development and extension, by highlighting women’s crucial role in building resilient food systems worldwide.

Methods

The theoretical frame of reference for this research is the Social Relations Framework, developed by Naila Kabeer (5), and adapted to the field of agroecology. A literature review was conducted on smallholders’ perception, mitigation and adaptation to climate change, with a focus on agroecological practices, gender and the specific position of women smallholders. This research adopts a transdisciplinary and Participatory Action Research approach that stems from local initiatives, driven by local actors. The research will be based within the female farmers organisation Convergence des Femmes Rurales pour la Souveraineté Alimentaire (Convergence of Rural Women for Food Sovereignty) in Mali, West Africa.

A mixed-methods and gender-sensitive approach will be adopted to take into account and be sensitive towards barriers for participation female farmers might face due to social norms and time constraints. Exploratory and informal interviews will be conducted with key informants from the farmer associations and the community to highlight the priority issues that need addressing. Facilitation events with both women and men, together and separately, will be organised to explore through creative means how community members perceive the various impacts of climate change and which measures/activities they regard as appropriate for social and environmental resilience. The Visualisation in Participatory Programmes method will be used to overcome gender, language, literacy, status and power barriers (Fig. 1). Additional methods selected include Community and Participatory Video, and autoethnography.

Main results

The expected outcomes of this project are to collectively explore and better understand perceptions and adaptation strategies of female farmers organised in a grassroots initiative, as well as perceptions of men in this community, with regard to the impact of climate change.
The Participatory Action Research approach will enable participants to reflect on key issues such as gender and resilient food systems. It will further contribute to empower women both at the decision-making stage and the application stage of each selected initiative. The increased sense of ownership and empowerment will further enhance women’s work towards agroecology and food sovereignty. Further to this, by including both women and men, this project aims to discuss, reassess and challenge social constructions of gender roles and bring new recognition of both women’s and men’s active roles in sustainable food systems.

Finally, this project will also support bridging knowledge and skills within and beyond the community. The Visualisation in Participatory Programme workshops culminate with the participants presenting their work to the wider community, thus creating an opportunity to share outcomes and further widen discussions, with the hope that this could be extended beyond the local community, linking national or international farmer associations, in the Global South and North.

Conclusions

Although agroecology acknowledges the importance of gender-sensitive approaches, research, development and extension so far have been predominantly gender-blind, both in the Global South and North. This project addresses this issue by working directly with a female farmers’ association and also male community members, and by conducting research that is co-created and co-designed by them. By using Participatory Action Research and visual, creative expression tools, the project brings new insights on gender, agroecology, climate change and food sovereignty perceptions and practices. It is essential to adapt thinking and methodologies to address socially constructed gender roles and celebrate women’s extensive knowledge of and role in shaping resilient food systems.

References


Ex-post evaluation of a transdisciplinary approach: a case study of the Flemish agri-food system

Hubeau, M. 1, Marchand, F. 1,2, Van Huylenbroeck, G. 3

1 Institute for agricultural and Fisheries Research, Burg. Van Gansberghelaan 115, 9820 Merelbeke, BELGIUM
2 University of Antwerp, Universiteitsplein 1, Wilrijk, BELGIUM
3 Ghent University, Coupure links 653, 9000 Gent, BELGIUM

State-of-the-art

The food system is urged to transform towards sustainability due to various socio-economic and environmental pressures. As sustainability is a normative and ambiguous concept, it requires a transdisciplinary research (TR) approach that involves societal stakeholders (1). Although stakeholder involvement has long been neglected, at present, transdisciplinary approaches arise and are increasingly applied. Transdisciplinary research allows to produce knowledge between researchers and non-academic actors. It allows to handle complex real-world problems (2).

Different assumptions of TR exist. The first assumption (A1) claims to take different perspectives into account while dealing with the transformation towards a sustainable agri-food chain (normative claim). The second assumption (A2) claims to grasp the true complexity of a problem as stakeholders of the agri-food chain are best positioned to identify and analyse the problem, increasing systems understanding (cognitive claim) (3). The third assumption (A3) states to initiate a mutual learning process which increases the implementation in practice (instrumental claim) (2). Although various studies on TR exist, its specific effects are understudied since evaluation is limited or lacking (4). Therefore, an evaluation of TR is essential for generating insights to ensure that future TR effectively co-create knowledge and engender its assumptions.

We implemented and evaluated TR in Flanders. The Flemish research, policy, and industry actors acknowledge the urge and have requested a transformation towards sustainability. A TR approach was implemented to initiate action. The transdisciplinary process took place from May 2013 until May 2015 and was a co-funded project by the Flemish government, several agri-food industry partners and a research institute. The approach consists of five iterative phases, i.e. (i) description of the sustainability state, (ii) visioning, (iii) identification of sustainability initiatives, (iv) formulation of shared transformation pathways, and (iv) development of strategic action plan.

Methods

To evaluate the impact of the transdisciplinary process, we performed nine in-depth semi-structured interviews with key stakeholders and conducted an online questionnaire addressing the entire group of stakeholders (n=58) one year after the process and completed by 35 stakeholders which corresponds to a response rate of 60%. The evaluation is based on the framework of Blackstock et al. (4). As our goal is to explore the effects of the transdisciplinary process, the interview and the survey consisted of four parts, i.e. (i) biographical information, (ii) knowledge generation and exchange (perceived learning, sustainability attitude, actions), (iii) impact on and relationships with other participations, and (iv) perceived process outcomes and its strengths and barriers. We identified strengths and pitfalls related to criteria which were selected from the framework of Blackstock et al. (4) with reference to the type and objective of the evaluation. Furthermore, results were related to the three assumptions (A1-A3) of transdisciplinary research.
Table 13: Evaluation criteria with its results, strengths and pitfalls and the corresponding insight for a assumption of transdisciplinary research

<table>
<thead>
<tr>
<th>Evaluation criteria</th>
<th>Evaluation results, strengths (S) and pitfalls (P)</th>
<th>Insight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity building: Relations and skills to improve future participations</td>
<td>S: Improved confidence and stronger persuasiveness</td>
<td>A3</td>
</tr>
<tr>
<td></td>
<td>S: Knowledge exchange and networking are evaluated as most positive aspect</td>
<td>A2</td>
</tr>
<tr>
<td>Leadership: Both internal leadership but also the role of the critical outsider</td>
<td>P: Strong influence of coordinators on project outcomes</td>
<td>A1</td>
</tr>
<tr>
<td></td>
<td>S: Impartial research institute as facilitator</td>
<td>A1</td>
</tr>
<tr>
<td>Emergent knowledge: The influence of local knowledge on the outcome</td>
<td>S: Open discussion arena where all opinions and views are welcome</td>
<td>A1</td>
</tr>
<tr>
<td></td>
<td>P: Transparency between input stakeholders and outcome is inadequate</td>
<td>A1</td>
</tr>
<tr>
<td>Relationships: Issues of social capital through new and existing social networks developed during the process e.g. trust, reciprocity and collaboration</td>
<td>S: Increased trust between stakeholders</td>
<td>A1</td>
</tr>
<tr>
<td></td>
<td>S: Increased willingness to collaborate</td>
<td>A3</td>
</tr>
<tr>
<td></td>
<td>P: Conflict between civil society and other stakeholders</td>
<td>A1</td>
</tr>
<tr>
<td></td>
<td>P: Power dynamics need to be tackled</td>
<td>A1</td>
</tr>
<tr>
<td>Capacity to participate: The individual's ability to value different points of view and willingness to learn as well as their competence</td>
<td>S: Different opinions are seen as added value of process</td>
<td>A1</td>
</tr>
<tr>
<td></td>
<td>S: Strong mutual respect between stakeholders</td>
<td>A1</td>
</tr>
<tr>
<td></td>
<td>P: The ability of an open attitude is a requirement to participate</td>
<td>A1</td>
</tr>
<tr>
<td>Capacity to influence: Participant's ability to influence the process Ownership of outcomes: Whether there is widely supported outcomes</td>
<td>P: Divergence between capacity to influence stakeholders (professional e.g. lobbyist) vs. non-professional (e.g. farmer) discussants</td>
<td>A2</td>
</tr>
<tr>
<td></td>
<td>P: Difficulty to motivate broad support base about sustainability</td>
<td>A3</td>
</tr>
<tr>
<td></td>
<td>S: Sound support of project outcomes</td>
<td>A3</td>
</tr>
<tr>
<td>Recognized impacts: Whether participants perceive that changes occur as a result of the participatory process</td>
<td>S: Strong motivation to apply outcomes into practice (e.g. action plan)</td>
<td>A3</td>
</tr>
<tr>
<td></td>
<td>S: Importance of chain-wide collaboration is recognized</td>
<td>A3</td>
</tr>
<tr>
<td></td>
<td>P: Communication of outcomes is too weak</td>
<td>A3</td>
</tr>
<tr>
<td>Legitimacy: Whether the outcomes and process are accepted as authoritative and valid</td>
<td>S: Multi-actor group effort make outcomes more valid</td>
<td>A3</td>
</tr>
<tr>
<td></td>
<td>P: NGO's dropped out without validating final outcomes</td>
<td>A1</td>
</tr>
<tr>
<td>Quality of process: Experience of stakeholders in process participation</td>
<td>S: Alternation between different stakeholder groups is strong element</td>
<td>A1</td>
</tr>
<tr>
<td></td>
<td>S: Good time management and adequate amount of meetings</td>
<td>A2</td>
</tr>
</tbody>
</table>

Main results

The focus of the evaluation is strategic, i.e. to investigate whether the process achieves its intended results in line with the overall objective focusing on relationships, perceptions and experiences. Moreover, the evaluation is ex-post summative and reflects on the strengths and barriers of a transdisciplinary process with a strong emphasis on learning and knowledge co-creation. Lastly, the purpose of the evaluation is learning, i.e. transforming the individual participant and improving the transdisciplinary process. The evaluation results based on the analysis of the semi-structured interviews are represented in Table 1.

Conclusions

Related to A1, the results show that the different perspectives of stakeholders are taken into account. An open discussion environment was created and the different opinions were seen as an added value. Although different opinions are expressed, some important constraints are observed such as the lack of transparency between the input of the stakeholders and the final result as well as the presence of power dynamics. Second, knowledge is co-created between societal and academic actor (A2). During the process, a shift from a theoretical part towards a more practical part is observed. Moreover, the exchange of knowledge and collaboration between different sectors is highly positive evaluated. Lastly, most stakeholders say that at least some outcomes are implemented (A3). To stronger motivate the support base, a strong internal communication and emphasis on “What’s in it for me?” is required. This emphasis can even more increase the action into practice. To conclude, based on these preliminary results, we see that transdisciplinary research can fulfill its assumptions if various prerequisites such as choice of stakeholders, open attitude and mutual respect are addressed. Future research could evaluate the effective impact in practice.
References


Functional agrobiodiversity in apple and pear pest management in Belgium

Jamar, L.¹, Janghoon, S.², Lambert, K.¹, Pahaut, B.¹, Fauche, F.¹, Rondia, A.¹, Choi, J² and Lateur, M.¹

¹ Walloon Agricultural Research Centre, Bât. Marchal, rue de Liroux, 4, 5030 Gembloux, Belgium
² Pear research Institute, RDA, ByeokRyu-Gil 121, Naju-Si Jeon Nam, South Korea

State-of-the-art

Functional AgroBiodiversity (FAB) including beneficial animals, mainly arthropods but not only, such as natural enemies (predator and parasitoid) which support agricultural production by regulating pests and diseases, becomes more and more important in agriculture to get sustainable ecosystem services. Specific techniques and managements are needed to favour FAB (FAB techniques). Perennial crops are very suitable for implementation of sustainable FAB techniques (Simon et al, 2010). The need to reduce agricultural inputs (particularly pesticides) without significant productivity loss may require a fundamental re-design of orchard systems (Smith et al., 2014; Jamar et al, 2015). In the framework of both ‘Eco-Orchard’ CORE Organic+ FP7 ERA NET project, and a research project with financial support of the Rural Development Administration (RDA) of the Republic of Korea, a study started two years ago with as first aim to compare during two growing seasons, the type and abundance of beneficials in Belgium orchards under conventional and organic production systems applying different FAB techniques. The second aim of this study is to collect the existing information about FAB and its management techniques to improve knowledge and practical experience between scientists, advisors and owners of the fruit orchards. The final aim of this study focus on the co-design and establishment of innovative fruit-based agroforestry cropping systems, including the best registered FAB techniques, in order to conduct a long-term sustainability study of such systems.

Methods

For the first study, the field assessments of beneficials are conducted inside a network of fourteen pome fruit orchards, seven orchards under conventional production systems and seven orchards under organic. Insect sampling is done by the classical branches beating system used at random three times a year and during two growing season. Such method is completed by placing specific shelters for monitoring specific beneficials. Concerning FAB techniques, advisors and farmers have been interviewed in Belgium as well as in nine European countries. The structured interviews have been conducted face-to-face, with advisors and with mainly organic farmers (n=15 for Belgium). The sample covers a variety of farming contexts to describe as much as possible bottlenecks for FAB-techniques adoption or implementation. Concerning the co-design and establishment of innovative fruit-based agroforestry cropping system, that combine pome fruit trees and vegetables, various spatial arrangements and prototypes were proposed and evaluated through participatory discussions involving scientists, advisors and farmers. During the participatory design process, several meetings were organized in order to discuss how to (i) develop a multidimensional project via a multi-actor design process, (ii) increase the intra- and interspecific diversification to enhance the food supply and habitat opportunities for natural enemies and pollinators in orchards, (iii) optimize the various ecological processes associated with adapted biodiversity (e.g., microclimate regulation, protection against erosion, biological control, soil life processes, allelopathy and pollination), and finally (iv) deal with genetic innovations for rootstocks and cultivars. A literature review, as well as visits to current agroforestry system experiments, gave us an insight into the prospects and limits of system designs and the basic ecological processes to be optimized.
Main results

The first results concerning relationship between beneficial’s and FAB techniques, show that (i) beneficial’s are more abundant (x 3.1) in organic compared to conventional orchards and (ii) the diversity of beneficial are significantly higher (x 2.2) in organic compared to conventional orchards. Several FAB techniques are used for pest management in orchards in Belgium, some of them are natural elements in the orchards or implemented because of other aims. For almost all used FAB techniques, farmers do not relate with FAB and do not evaluate their efficacy. The implemented FAB-techniques differ according to growers’ personal knowledge and experiences. A total of 34 techniques have been described and can be divided into 3 categories: long-term ecological infrastructures, dynamic agricultural practices adaptable from a season to another (e.g.: to adapt inter-row mowing) and deeper system redesign requiring strong interactions with the production system (e.g.: crop diversification) (Fernique et al., 2016). In particular, concerning innovative fruit-based agroforestry cropping system, an experimental agroforestry orchard was planted in 2014 at Gembloux, Belgium with the aim of testing three hypotheses: (i) a mixture of selected robust fruit and vegetable cultivars creates a functional biodiversity that significantly reduces the risk of pest and disease damages; (ii) the useful impact on soil functions and biological processes; and (iii) where distances between vegetables and trees in intensified alley-cropping systems are optimized, tree shading does not reduce light levels below the threshold of light saturation. Two other on-farm fruit-based agroforestry cropping prototypes, designed by our team and located on two pilot farms in Belgium, are being developed in Belgium.

Conclusions

The implemented FAB-techniques differ according to growers’ personal knowledge and experiences. A total of 34 techniques have been described. The most Functional Agro-Biodiversity techniques, as ranked by farmers, are (i) flower strip, (ii) hedgerows, (iii) to reduce pesticides uses and (iv) to adapt interrow mowing. However, there is a lack of correct and easy to use monitoring/evaluation techniques available to farmers. The innovative fruit-based agroforestry cropping system, still need to determine if the interactions between perennial and annual crops has a positive impact on biodiversity and on the presence of some natural enemies, which could improve the resilience and health balance of fruit agroecosystems. The authors acknowledge the Belgium advisors and farmers interviewed for sharing their precious time and competence; the financial support of ‘EcoOrchard’ project, provided by transnational funding bodies being partners of the FP7 ERA NET project, CORE Organic Plus and the cofund from the European Commission; the Pear Research Institute (PRI) of the National Institute of Horticultural & Herbal Sciences (NIHHS) and the financial support of the Rural Development Administration (RDA) of the Republic of Korea.

References


Meet and greet: all delegates meet presenters of sessions 1 and 2
Afternoon plenary sessions

Topics

3. Transitions of our food system and the use of system approaches
4. Effects of present and future threats (e.g., climate, globalization,...) or existing drawbacks (policy issues, legal questions, knowledge exchange system)

Keynotes – Chair: Prof. dr. ir. Fleur Marchand (ILVO/UA)

Keynote 3

Key features of more resilient agricultural and food systems: some findings from the international RETHINK research programme

by Dr. Karlheinz Knickel

Research Associate at Instituto de Ciencias Agrarias e Ambientais Mediterranicas (ICAAM) at Universidade de Evora, Centre for Rural Research (CRR) Trondheim and Institute for Rural Development Research (IfLS) Frankfurt/M, Germany

Why more resilient agricultural and food systems?

Contemporary food production is now largely decoupled from natural processes and much more dependent on industrially produced inputs and fossil fuels. The negative social and environmental outcomes of these developments have been widely analysed and documented (EEA 2013; OECD, 2012). The risks associated with intensive farming systems, including their path-dependency and limited buffering capacities, are increasingly becoming apparent (EEA, 2010, 2013; European Commission, 2011).

On the whole, it is becoming increasingly clear that a systemic change in agricultural and food systems is needed. The RETHINK project explored how policy, research and practice can ad-dress these challenges and what more integrated, sustainable and resilient farms, food systems and rural areas might look like. The aim has been to identify and better understand the conflict-ing goals and potential synergies facing rural areas, while explicitly recognising the complexity of the challenges and the diversity of different rural localities.

Methods

This paper builds on evidence from substantial case studies carried out in 14 countries in 2014-16. The research used a systems perspective to explore interdependencies and to understand the interrelated dynamics of change. In each case study, the connections between farm modernisation, rural development and the resilience of agricultural and rural systems were explored, and the particular strategies and potential synergies between farm modernisation and the prosperity and resilience of rural people highlighted.
Some key results

Our findings are presented in 14 case study reports and a set of eight scientific papers, four of them explore cross-cutting themes: the resilience of farms and of rural areas (Calvão Chebach et al., 2016), prosperity and well-being (Rivera et al., 2016), the role of knowledge in driving the systemic changes that are needed (Šumane et al., 2016) and the governance structures and practices needed to harmonise agricultural modernisation and rural development (Koopmans et al., 2016). A concluding paper synthesises the key findings from each theme, and identifies the strategic frameworks and types of policies needed to induce the required systemic changes (Knickel et al., 2016). This last paper relates findings to the ‘Europe 2020’ strategy, the further development of the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI), the first discussions about the strategic agenda and direction of the next CAP (2021-2027) and the implementation of UN’s 2030 Agenda for Sustainable Development (UN, 2015).

In this abstract, I will only highlight some key results from the cross-cutting analyses on resilience and knowledge and learning as they could be of particular relevance to this conference.

Building resilience in agricultural households and rural regions

Calvão Chebach et al. (2016) arrive at two fundamental questions when concluding their comparative analysis on rural resilience and its relation to grassroots initiatives and policy strategies: “What is rural resilience, and what precisely do we actually want to preserve? Does the resilience of farm households equal rural resilience equal societal resilience? . . . While identifying resilience strategies is crucial as evidence and inspiration to what is possible, these potential trade-offs further emphasise that resilience should not be perceived as an objective but rather a means to achieve livelihoods and wellbeing and that trade-offs within a broader context must be considered when policy decisions are to be made.”

In our case studies we can see multiple individual and collective strategies being deployed by farmers, rural residents and those in leadership positions, to try to ensure their resilience. Most of those strategies reflect the need to create a sufficient (or desired) level of income, both at household and regional level. This satisficing behaviour is in contrast to conventional economic thinking, which emphasises growth and income maximisation. Also in contrast with the, often narrow, scope of conventional economic thinking, farmers and rural regions apply a wide range of strategies. Redesigning supply chains is one commonly chosen strategy for enhancing resilience. Alternative supply chains decrease dependency on retailers and attract more value added along the chain as a whole, which is a more evenly shared along the chain.

Rural resilience is also strengthened through new forms of cooperation (Koopmans et al., 2016). In addition to producer organisations, which can lower costs and create new possibilities for a ‘sharing economy’, rural residents are coming together in efforts to protect key landscape elements and enhance a region’s natural capital. Examples include the Danish case study, where a new multi-stakeholder group was established to enhance a local stream system and the surrounding landscape (Pears et al., 2015); and the Belgian case study, where farmers were encouraged to plant trees after joint deliberations between them farmers and non-farmers (Koopmans et al., 2015).

Local and farmers’ knowledge matters!

The current agricultural knowledge and innovation system, particularly national level agricultural institutions, including higher education, is deeply attached to the technologically-driven agricultural industrialisation model. The third SCAR Foresight report (EU SCAR, 2012) stresses the necessity of making Europe’s agricultural knowledge systems “more responsive in providing integrated answers that combine ecological and social concerns with economic aspects.” Šumane et al. (2016) stresses that “existing agricultural knowledge institutions and networks do not pay equal attention to all knowledge needs: while they are good at providing technical knowledge, they have little competence in
helping farmers looking to engage in social innovations or to establish and manage innovative supply chains.”

The case studies confirm that technological innovation cannot readily be separated from organisational or social changes at the farm, food-chain or community level. They also show that social and organisational innovations play a particularly vital role in renewal at farm level and within rural economies as a whole. When innovation takes into account social and environmental considerations it can advance economic development, social welfare and resilience and improve natural resource management.

Şümane et al. (2016) emphasises the pivotal role of farmers’ knowledge in both their daily operations and when creating novel solutions or adopting their practices: farmers rely heavily on their own experiential knowledge and place a high value on exchanging experiences with other farmers. “Local and informal knowledge is often more attuned to the values, needs and resources of farmers and rural communities. This informal knowledge, interactions, exchanges and learning form a foundation for developing practices that make best use of local natural and social resources and possibilities and enhancing livelihoods in the long-term.”

The findings obtained from the comparative analysis by Şümane et al. (2016) are fully in line with the European Commission’s (2016) most recent research strategy discussion paper: “Dealing with complexity requires the harnessing of all available knowledge sources, including tacit knowledge at farm and business level and requires the involvement of all relevant actors (farmers, foresters, cooperative and industry, advisors and knowledge brokers, etc.) in a process of knowledge co-creation and appropriation.”

Conclusions

The insights gained from the 14 case studies and the comparative analyses can be grouped into four main areas.

• First, it is almost impossible for farmers to cope with the reduction and volatility of producer prices on global markets whilst using more environmentally sustainable practices. Alternative food networks and initiatives that explicitly target resource-efficient, resilient, low-carbon solutions, based on assessments of farm performance that extend beyond economic performance play an increasing role. Policy needs to acknowledge the effectiveness of different scales, types and styles of farming in addressing wider societal demands.

• Second, the concentration of production in some regions or some farms is directly linked to the marginalisation of others. More support needs to be provided to the very large number of small farms in Europe, enabling them to remain or engage in trajectories that are resilient, balanced, equitable and inclusive. The current one-sided emphasis on economic performance, competitiveness and growth is counter–productive.

• Third, there is much to be learned from local farmer-driven innovations. Many farmers focus on efficiently using the resources available to them and build on location-specific experiential knowledge. Yet, their initiatives and this knowledge are not sufficiently taken into account by agricultural (knowledge) institutions. Policy needs to encourage networks that facilitate inclusive modes of knowledge generation, integration and sharing.

• And fourthly, informal networks can balance different interests and approaches, which is essential for integrated rural development strategies and projects. This requires strengthening the capacity of local government agencies and stakeholders to adapt and transform. Grassroots initiatives and pilot programmes are already generating a wealth of experiences and knowledge which could be fruitfully used to inform higher-level strategies.
References


2. EU SCAR (2015) Agricultural knowledge and innovation systems towards the future – a foresight paper, Standing Committee on Agricultural Research (SCAR), Brussels


Complete references are available upon request.

Biography

Karlheinz Knickel is an independent analyst and consultant, and a research associate at Instituto de Ciencias Agrarias e Ambientais Mediterrânicas (ICAAM) at Universidade de Evora, Portugal, the Centre for Rural Research (CRR) Trondheim, Norway, and the Institute for Rural Development Research (IfLS) Frankfurt/M, Germany.

Karlheinz has an agricultural, environmental and economics background and more than twenty-five years of experience in the area of sustainable development of agriculture and rural areas. His experience comprises applied research, policy analysis and evaluation for the Food and Agriculture Organization (FAO), the European Commission and government agencies. The projects he is involved in tend to be multidisciplinary, international, comparative and policy-oriented. From 2008 to 2011, he was Senior Economist in the New Zealand Ministry for the Environment.

Karlheinz has a particular interest in the establishment of effective research-policy-practice linkages in his work and the translation of scientific concepts into practical solutions. He coordinated the FP7 INSIGHT project on innovation processes in agriculture and rural areas, the ERA-Net project ‘RETHINK - Rethinking the links between farm modernization, rural development and resilience in a world of increasing demands and finite resources’, is a co-author of the European Parliament study ‘Sustainable competitiveness and innovation in EU agriculture’ and currently is the scientific coordinator of
Reflexive governance for environmentally sustainable food security policies: A case study of the Committee on World Food Security
by Prof. Jessica Duncan
Wageningen University, PO Box 8130, 6700 EW, Wageningen, The Netherlands

State-of-the-art
Achieving food security and environmental sustainability necessitates structural changes to the practices, rules, and institutions currently organizing the world’s food systems. While governance plays a key role in empowering or disempowering structural transformations, few governance processes have proven capable of meaningfully addressing the complexity of contemporary social-ecological problems across the science-policy-participation interface. Given this, it is not surprising that intergovernmental policies have, on the whole, failed to meaningfully address or integrate the connected goals of ‘food security’ and ‘environmental sustainability’.

In the face of increasingly complex sustainable development challenges, there have been increasing proposals for developing more reflexive governance processes. Reflexive governance processes acknowledge multiple perspectives, expectations, power dynamics, and strategies. They reject quests for a single framing of the problem, a single prognosis of consequences, and a single way forward.

The United Nations Committee on World Food Security (CFS) presents an example of an international policy forum where reflexive governance practices have been implemented as part of a widespread organization reform. A review of the mechanisms, processes, and outcomes of the CFS sheds light on the potential of reflexive governance processes for advancing sustainable food security policies and in turn pathways for reconciling food security and environmental sustainability.

Methods
This paper is based on ethnographic research and sociological analysis that has been ongoing since 2010. Data have been collected through participant observation (2010-2013), observation (2010-present), and interviews (between 2010-present). Relevant documents (including reports, policies, and regulations) have also been included into the data set. Data have been analysed through an application of theories of reflexivity, and evaluation of strategies for reflexive governance of sustainable development.

Main results
For food security policies to achieve their objective of eradicating hunger in the medium to long term, they need to be coupled with environmentally sustainable food provisioning practices. To date, discussions on sustainable food and agriculture practices have been largely absent from international food security policy negotiations. Efforts to develop sustainable food security policies intergovernmentally have been weak, and often disappointing. Recently however there has been an observable uptake of terms denoting more sustainable production in international food security policy spaces (e.g. sustainable intensification, eco intensification, climate smart agriculture, and agroecology). Growing recognition of the links between sustainable agriculture and food security is welcome. Yet food security and environmental sustainability are contentious, complex and contested concepts, and related policies are informed as much by science as they are by values and norms. These concepts refer to problems for which there is no neutral diagnosis and no single-bullet
solution, and in turn, governance mechanisms that can address complexity and contestation, and diversity are needed.

Towards this end, six strategies for reflexive governance have been proposed to address the "interconnected issues of complexity, uncertainty, path dependence, ambivalence and distributed control" in sustainable development governance.

These strategies are: 1) integrated knowledge production; 2) experiments and adaptivity of strategies and institutions; 3) iterative, participatory goals formulation; 4) anticipation of long-term systemic effects of measures (developments); 5) interactive strategy development; and 6) creating congruence between problem space and governance.

When the UN Committee on World Food Security adopted wide sweeping reforms in 2009, they initiated a move towards more reflexive governance processes. By studying the post-reform activities of the CFS through an analytic framework of reflexive governance strategies, the relationships between these strategies and the advancement of sustainable food security policies can be assessed.

Conclusions

The analysis found that in implementing reflexive governance strategies the CFS has fostered political dynamics that can lead to more engaged and open political negotiations around environmentally sustainable food security policies, and thereby advance more sustainable food security policies. However, the analysis also suggests that caution is needed. Successfully implementing principles and practices of reflexive governance requires not only adaptive and iterative forms of participation and decision-making, but also acknowledgement of the complex political landscapes and distribution of power, a governance culture that accepts to learn from failures, and longer term funding strategies. Further, we cannot assume that policies resulting from reflexive processes are translated into programmes and practice. There is not currently enough evidence to be able to make claims as to the adoption of CFS policies. However, other, non-policy, outcomes of the CFS policy negotiation processes (i.e. enhanced quality of debate, strengthened networks, improved communication and openness in negotiations, challenging traditional power dynamics) could serve equally important non-policy functions in the quest for environmentally sustainable food security policies.

There is increasing traction around the development of sustainable food security policies at the global level. However, it is argued that for this traction to lead to social-ecological and social-political transformation it is important that governance organizations be able to address the complexity and diversity of positions across the science-policy-participation interface. Drawing on the CFS as a case study in reflexive governance at the global level, this research suggests that reflexive strategies are one way of supporting such a transition.

References

Biography

Jessica Duncan is Assistant Professor in Rural Sociology at Wageningen University (The Netherlands). She holds a PhD in Food Policy from City University London. Her research areas include: food policy; food security; global governance; environmental policy; and participation. She works as an associate editor for the journal Food Security, co-convener of the Food Policy and Governance Research Network of the European Consortium for Political Research, and advisor and researcher with Traditional Cultures Project (USA). Jessica’s most recent book is Global Food Security Governance: Civil society engagement in the reformed Committee on World Food Security (Routledge 2015). When not working she is likely to be reading, riding her bike, climbing rocks, tweeting (@foodgovernance or blogging at www.foodgovernance.com).

Main research work: I research the science-policy-participation interface by studying the relationships between global governance organizations, systems of food provisioning, the environment, and the actors engage in and across these spaces. More specifically, I am interested in better understanding ways in which non-state actors participate in supra-national policy making processes and analysing how the resulting policies are shaped, implemented, challenged and resisted and what this means for societal transformation.

Key Publication: Perhaps not the most important, but I am most excited about the recent publication of a special issues of the magazine Solutions on Sustainable Food Futures that I guest edited with Megan Bailey (Dalhousie University, Canada). The objective of the Special Issue was to give space to younger scholars to propose radical solutions to food security problems.

The creation of a space for younger scholars to publish innovative proposals and reflections was itself part of a solution to start to address at least two reasons why we felt effective food security solutions have been slow to surface. The first reason relates to limited diversity, both within the academy and in terms of what is consider expertise. The second challenge relates to the ongoing barriers to multidisciplinary research. The contributions, which have been written for a general audience, are all available online or in newsstands. We are in the process of translating these solutions into a book (Future Solutions for a Food Secure World, Routledge 2017) that we hope will inspire students to think about and engage critically with future food security solutions.
Assessing the capacity of Voedselteams to contribute to a sustainable food system in Flanders
Tjitske Anna Zwart, Tessa Avermaete, Erik Mathijs
KU Leuven, Celestijnenlaan 200E, Leuven

State-of-the-art
Is our food system ready for future challenges? As the impact of global drivers of change becomes more apparent, the resilience of our food system is increasingly debated. It is thereby often argued that systemic changes are indispensable to meet the needs of the future. The key objective of this research is to assess the transformative capacity of Voedselteams (Food Teams) both currently and in the future to contribute to such a transition towards a more sustainable food system in Flanders. Voedselteams are consumer teams that organize their purchase and delivery of local produce together and was established in 1996.

To assess the transformative capacity of Voedselteams we assess the way in which the functions from the marketing framework are performed from a combined perspective of Social Practice Theory (SPT) and the Multi-Level Perspective (MLP). The nine functions of the marketing framework are: buying and selling, storing, transportation, processing, standardization, financing, risk bearing and marketing intelligence (Beierlein et al., 2008). We thus look both at horizontal (SPT) as well as vertical (MLP) processes (Hargreaves et al., 2013) as the assessment of transformative capacity includes different levels, actors and factors, both internal as well as external to the initiative. In other words, it does not only depend on the practices within the initiative itself, but also on exogenous factors on the level of regimes and landscape. External pressures on the agro-food regime may create windows of opportunity for the niche to emerge. The internal factors determine whether the organization has the capacity to respond and smartly connect to these windows of opportunity (Verbong & Geels, 2010).

Methods
Semi-structured interviews were conducted in order to describe the way in which the nine marketing functions are fulfilled by Voedselteams from a combined MLP/SPT perspective. This allowed us to analyse where the strengths and weaknesses of Voedselteams practices lie. Moreover, in this way we were able to identify gaps in the attention that Voedselteams pays to certain practices. The semi-structured interviews also served as a basis for the organisation of two scenario workshops. In these workshops the strategic plans of Voedselteams were tested through the usage of scenarios.

Scenario thinking acknowledges that the future is uncertain and therefore advocates the development of robust future strategies or “transition pathways”. In other words, during the participatory workshops, sets of actions were developed that would enable Voedselteams to preserve and increase its transformative capacity, over a wide range of different possible futures.

Main results
With the approach that we described above we were able to show that Voedselteams has contributed to a more sustainable food system in Flanders by being one of the forerunners showing the importance of local food and SFSCs. It could be argued that this has fostered the rise of new initiatives that offer similar services. Also, conventional players are starting to offer local and organic food. Also, Voedselteams offers a raised income for some of its farmers.
On the other hand, the approach shows how, in real numbers, the organization has a small impact. For example, approximately 2000 families order their food through a food team per week. This is negligible. Moreover, only 200 farmers out of 25,000 in the whole of Flanders deliver to Voedselteams.

Using the Social Practice Framework to assess the different marketing functions as practices shows us that the way in which VT organizes its marketing functions is strongly guided by the value of social cohesion and the provision of local food, which is supposed to be reached by the application of a relatively strict model. Nevertheless, Voedselteams’ members may have other goals and values that are not connected to social cohesion around food.

Finally, applying different possible future developments to the current activities and plans of Voedselteams shows that the rise of similar alternatives, disappearance of subsidies or a stricter application of food safety regulations may compromise the future transformative capacity of the organization. This, then, emphasizes the importance for Voedselteams to adapt its strategy for the coming years to be able to keep up its transformative capacity.

Conclusions
Assessing the way in which Voedselteams fulfils the nine marketing functions through a combined MLP/SPT perspective and later on testing these to different future scenarios shows that until now the organization has been transformative in some ways (e.g. showing the importance of SFSCs, creating awareness on agricultural issues), while it has had low transformative capacity in others (e.g. absolute numbers of ordering families).

Second, the approach shows how underlying values and goals may be highly divergent within one organization. VT applies one strict model. The results of this research indicate that there is a potential to apply other models to reach the organization’s mission.

This research shows us the added value of looking at the nine marketing functions through a combined MLP and SPT framework. First, the usage of the marketing framework allows us to look at the whole process of marketing between production and consumption. Taking such an approach will allow us in the future to apply a similar framework to other initiatives, and thereby make comparisons between initiatives.

Acknowledgments
This abstract is an output of TRANSMANGO, which is a project granted by the EU under 7th Framework Programme, theme KBBE.2013.2.5-01 (Assessment of the impact of global drivers of change on Europe’s food security), Grant agreement no: 613532

References
State-of-the-art

Europe has been facing a significant socio-economic and environmental crisis since 2008. In this context, the question of whether « green jobs » could be a trail to develop more and better jobs is a great concern for governments. In agriculture, some scientists and associations defend that organic and/or agroecological agriculture could simultaneously offer better jobs and avoid some negative externalities on environment, compared to conventional agriculture (2, 4, 5).

Nevertheless, concerning vegetable production, the quality of work in agroecological systems remains quite unexplored. Many articles on the subject focus on organic agriculture or are more normative than based on empirical studies (2, 4). The present study explores the quality of work of vegetable growers in the Walloon Region (Belgium), in a diversity of farming orientations (agroecological or conventional) and farming models. The goal is to answer the following two questions, in our specific context: (1) to what extent do agroecological types of production systems offer or not better jobs than conventional types ? (2) more generally, to what extent are the types of production systems different in terms of quality of work ?

Methods

No definition on the quality of work has sofar been unanimously accepted (3). To address our research question, we looked at the sociological, economic and agronomic literature. We identified nine dimensions determining the quality of work : autonomy and control level, income and social benefits, work (in)security, political experience at work, time at work, job intrinsic benefits, job painfulness, health safety and competence.

Based on an exploratory phase, we identified four main models for producing vegetables in the Walloon Region, from market gardeners on a few hectares to cereal farmers who include some vegetables to their crop rotation. They are referred to as: market gardeners on small area, market gardeners on medium area, market gardeners on large area and vegetable growers in field crops. Each of these four models of production was examined and studied in both agroecological and conventional agriculture. We then conducted 41 semi-directed interviews with vegetable producers of the different types of production systems. In addition to the evaluation of the dimensions of quality of work, production and commercialisation systems, professional path, history, orientation to work and perception of the future were addressed.

The producers were selected, first because (1) they are considered as key players in their type of production by the experts in vegetable production in the Walloon Region, then because (2) they have special features that distinguish them from the other producers of their group. As no consensual definition of an agroecological system is available, we assigned a producer a posteriori to the agroecological orientation when he/she met two conditions: compliance with the organic farming regulations (alternative regulation as Nature & Progrès or conventional regulation) and embeddedness in the socio-economic principles of agroecology, as defined in Dumont et al. (1).
Main results

We identified mainly two types of production systems oriented to an agroecological approach: market gardeners on small area and market gardeners on medium area. To illustrate the results we get for each type of production system we briefly summarize the situation for market gardeners on small area producers in conventional and in agroecology.

Most agroecological market gardeners on small area producers have chosen to work in this type of production systems because it corresponds to their social and ecological values. Given such initial motivations, they actually feel limited on most of the dimensions of work quality studied. They particularly suffer from a low level of security of work.

In conventional agriculture, most market gardeners on small area producers developed their system because it was the only possibility for them to develop their passion - vegetable farming. Most of them developed a market gardeners on small area system in parallel to another professional activity because they consider it is quite impossible to live only from their vegetable production. They particularly suffer from a very hard pace of work and a too important level of work.

Conclusions

Our analysis shows that we cannot simply consider that agroecological vegetable production systems offer better jobs to producers than conventional ones.

Firstly, for most of the dimension studied on the quality of work, the results show specificities and trade-offs which impact the well-being of each group of vegetable growers, both in agroecological and in conventional systems. Depending on the dimension considered, the quality of work is better in a type of production or another. None of the type of production is fulfilling perfectly all dimensions. This is mainly due to the socio-economic and political context, the professional path, the orientation to work and the socio-cultural heritage.

Secondly, implementation of agroecological principles in vegetable systems is diverse. The quality of work is differently determined in the different agroecological systems.

In the Walloon Region context, divergent trends can be observed for market gardeners on small area and mechanised market gardeners agroecological types of production. Most market gardeners on small area producers have difficulties to achieve a satisfactory situation relatively to the different dimensions of quality of work. Most mechanised market gardeners producers achieve a satisfactory situation for the three following dimensions: level of autonomy and control, work security and political experience at work. While their situation is still delicate relatively to their income and the time spent at work.

References

Socio-professional paths and identities of ecological farmers

Pailleux, C.¹, Thareau, B.¹ and Anzalone, G.¹

¹LARESS-Ecole Supérieure d’Agricultures, 55 rue Rabelais, Angers, France

State-of-the-art

The disintegration of the family farm model created new opportunities for individuals with no agricultural background and/or previously involved in another career-path to access farming (1). These evolutions lead researchers to question changes in farmers’ professional identities, based on the study of socio-professional networks (2) – following the traditional of an interactionist sociology of professions (3). These studies show how professional identities split up around issues such as the societal call for a greener agriculture (4), which remains claimed by a minority in agricultural spheres. We hereby propose a micro-sociological analysis of the transitions towards agro-ecology. What socio-professional paths lead farmers to the pathway of agro-ecology? How do these paths lead them to compose their professional identities differently?

Methods

We studied ecological farmers, known to collaborate with an environmentalist NGO on specific actions reconciling agriculture and biodiversity. They were found in three French areas of the Loire valley: the Marais Breton (Breton Marsh), the bocage vendéen and around the city of Angers. We conducted fourteen semi-structured qualitative interviews following a life course approach. Beyond biographic telling, the interviews tackled the watersheds that occurred in the career paths and for each, tried to determine type (economic, social, local) and nature (institutional or not) of resources mobilized. Finally, we adopt a comprehensive method to access to these ecological farmers’ representations and determine their professional identities.

Main results

If institutional support (professional formation, young farmer premium, subsidies) is common to all pathway categories, farmers make different uses of socio-territorial resources. We show how it contributes to determine their professional identities that we choose to decline by the sense their occupation makes for ecological farmers, their relations to institutions and the perception they have of biodiversity. This leads us to propose a typology of four types of ecological farmers.

- "Naturalist experts using their professional networks “ (3 out of 14)

The ecological farmers who belong to this category have no agricultural background, a higher education degree in life sciences and started their careers as environmental organisations employees. To gain access to land, they use the local networks they made at that time (public bodies and/or environmental associations). They also have close relationships to local consumers, whom may have supported them since the beginning of their activity (2015s). The existence of such pathways is closely linked to socio-territorial dynamics taking place in the Marais Breton, where the predominant farmers’ union controls access to agricultural land and is radically opposed to the packages of Agri-Environmental Measures (AEM). From their previous career, they keep an advanced ecological knowledge and farming activity makes sense to them around the perspective of maintaining the ecological value of the milieus and then saving wildlife. They say not believing in institutional process to protect biodiversity but, paradoxically, their farming system is depending on AEM.
- "Neo-peasants using hybrid networks" (2 out 14)

They have no agricultural background and, at the difference of the first category, no network they could use to remove farm-settling barriers. They find in local dynamics—sets of local farmers, institutions, citizens and environmentalists—a support for their recent settling (2015s) in terms of farming learning, access to land and relieve economic burdens. These local configurations are determinant for their professional identities, in the way they consider farming as a meeting of civic stakes. They are novices both in agriculture and ecology and seek allies to help them to anchor in the territory.

- "Farming heirs with mixt networks " (6 out of 15)

This profile has been found in all three regions. These ecological farmers have agricultural background and education. They have had a variety of previous farming-related work experience before starting off their farming activity in the 90s. Most are not natives of the area where they farm. When their beginnings do not match the agro-ecological principles, path is initiated in particular by a close-ness to transversal activist spheres. Biodiversity is effectively taken into account through aspects more significantly linked to production (culture auxiliar). They fight against “productivist” and “rationalist” modern farming that would be supported by institutions, to propose a idealized figure of the traditional peasant. One out of the six ecological farmers belonging to this category lead us to consider a generational effect: i.e. the sons and daughters of the former – then “inherit” agro-ecology and fall into a logic of carrying on with the family work as they take over the farm (2010s).

- "Farmers seeking to link economic gain and environmental context" (3 out of 14)

These farmers originally took over their family farming business (before the 2000s) after following agricultural studies. They historically have agro-ecological practices pressured by “environmentally dis-advantaged areas”. Collective action between those ecological farmers mainly consists of economically highlighting their practices through labels, which sometimes fall into standard distribution through local mass-market retailers. Local institutions also play a part by offering them outlets in school or business catering. Their relation to biodiversity is characterized by the presence of intermediaries (labels, scientific reports of environmental experts). Despite their participation to mixt networks, they remain convinced of the prevalence of farmers’ point of view in natural areas management. In comparison to the previous groups, they express confidence to main farmers’ union and to agricultural organisations. This profile of ecological farmers in exclusively found in the low valleys of Angers where there exists a tradition of dialogue between agricultural and environmentalist organisations.

Conclusions

Our work participates in the reflection about the dynamics of transition to agro-ecology by presenting four pathways that farmers may follow to become involved in ecological farming: through a career change from environmentalism (1) or “outside” (2) to farming, a process of distancing themselves from the “productivist” legacy of industrial farming (3) or a commitment to AEM to add value to farming practices made necessary by their agroecosystem (4). We show how such categories may mobilize for different purposes either institutional or not-institutional resources such as local agricultural organisations, consumers and public bodies. This diversity may lead to shape distinct professional identities of ecological farmers—notably based on different representations of biodiversity.

References

How to identify low input(s) dairy farming?

Bijttebier, J.1, Hamerlinck, J.1,2, Tessier, L.2, Van Meensel, J.1, and Lauwers, L.1,2

1: Institute for Agricultural and Fisheries Research, Burg. Van Gansberghelaan 115, 9820 Merelbeke, Belgium
2: Ghent University, Department of Agricultural Economics, Coupure Links 653, 9000 Ghent

This work was supported by the European Commission project Sustainable Organic and LI Dairying (SOLID) funded Framework 7 Contract no. 266367.

State-of-the-art

Sustainable agro-ecosystems are characterized as self-sustaining, low input (LI) agricultural systems. In our search for a pragmatic approach to select LI dairy holdings across Europe, a discriminatory indicator based on the ratio of total farm expenditure (€/GLU) on concentrates, feeds, fertilizers, crop protection products, fuel and electricity, and the number of grazing livestock units (GLU) on the farm, was used (Bijttebier et al., 2016). Since LI, as an alternative to high input use, can only be defined with reference to a specific context, LI is perceived as a relative notion by comparing the quartile of lowest input users with the quartile of highest input users on the country level. Moreover, to deal with price differences of inputs across countries and over the years, cut-off values were created from the data. This pragmatic identification method already proved a useful tool for subsequent profitability and competitiveness analyses. However, the ecological and economic impact of reducing external inputs is not only depending on the level of the input reduction but also on the nature of the inputs reduced and of management strategies towards optimal crop/animal assemblage. As such, this prior classification of LI does not reveal any information on the nature of input reducing strategies that differentiates LI farms from the HI farms. This study therefore investigates whether our prior categorizing indicator identifies LI farms with reduction of inputs at the whole farm level or with a reduction merely or substantially attributed to only part of the agricultural system (milk production versus crop production). With these insights, we reflect on refinement of the categorizing indicator in view of better analysing LI farming’s environmental and economic outcomes.

Methods

FADN was used as data source (EU-FADN – DG AGRI/2011). European conventional dairy holdings were classified into low, medium and high input, based upon their 1) expenditures for fertilizers, crop protection, energy (electricity and fuel) and purchased feeds per ‘grazing livestock unit’ (GLU) (INDfarm); 2) expenditures for fertilizers and crop protection/ ‘utilised agricultural area’ (UAA) (INDroughage) or by 3) expenditures for concentrates/GLU (INDanimal). Using this approach, 25% of holdings with lowest ‘external input costs’ (EIC)/GLU or EIC/UAA values at the member state level (8 EU Member states), were defined as LI holdings, whereas HI farms are the 25% farms with the highest value of EIC/GLU. The 50% of farms with in-between values, were considered as MI (see Bijttebier et al., 2016). Comparison of ratios of single input use between HI and LI farms was done at the country level. Statistical differences between HI and LI farms were identified with the Mann-Whitney test.

Main results

Comparison of HI and LI specialised dairy farms (as defined by FADN), as defined by use of the prior categorizing indicator (INDfarm), including all inputs, showed that purchases of all inputs per GLU (for feed inputs) and per UAA (for crop protection, energy and fertilizers) are higher on HI farms (results not shown). Only in Austria and Finland, there was no difference (P<0.05) in the purchases on crop protection/UAA between HI and LI specialised dairy farms. However, this categorization
Table 22: Percentage of HI and LI farms categorized by INDfarm, that are similarly categorized by focusing on concentrate use (INDanimal) or on the use of fertilizers and crop (INDroughage).

<table>
<thead>
<tr>
<th>Country</th>
<th>N</th>
<th>INDanimal Hi</th>
<th>INDanimal LI</th>
<th>INDroughage Hi</th>
<th>INDroughage LI</th>
<th>HI-LI</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEL</td>
<td>284</td>
<td>66%</td>
<td>66%</td>
<td>52%</td>
<td>46%</td>
<td>9%</td>
</tr>
<tr>
<td>DAN</td>
<td>341</td>
<td>59%</td>
<td>66%</td>
<td>44%</td>
<td>35%</td>
<td>13%</td>
</tr>
<tr>
<td>DEU</td>
<td>2359</td>
<td>56%</td>
<td>64%</td>
<td>50%</td>
<td>51%</td>
<td>9%</td>
</tr>
<tr>
<td>FRA</td>
<td>1535</td>
<td>69%</td>
<td>69%</td>
<td>57%</td>
<td>54%</td>
<td>7%</td>
</tr>
<tr>
<td>NED</td>
<td>318</td>
<td>58%</td>
<td>62%</td>
<td>49%</td>
<td>37%</td>
<td>9%</td>
</tr>
<tr>
<td>OST</td>
<td>553</td>
<td>74%</td>
<td>77%</td>
<td>36%</td>
<td>29%</td>
<td>12%</td>
</tr>
<tr>
<td>SUO</td>
<td>312</td>
<td>73%</td>
<td>69%</td>
<td>36%</td>
<td>46%</td>
<td>7%</td>
</tr>
<tr>
<td>UKI</td>
<td>481</td>
<td>82%</td>
<td>83%</td>
<td>40%</td>
<td>42%</td>
<td>9%</td>
</tr>
</tbody>
</table>

Based on the prior categorizing indicator (INDfarm) seems to reflect mainly differences in purchases of concentrates (Table 1). About 56% to 83% of the farms remains HI/LI if they are categorised by concentrates/GLU (INDanimal), whereas only 35% to 57% of the farms falls in the same category if we categorize farms based on their use of fertilizers and crop protection per UAA (INDroughage). About 10% (9-13%) of HI farms based on concentrate use/GLU is defined as LI if categorized based on the use of fertilizers and crop protection/UAA and vice versa (final column in Table 1).

Conclusions

The prior categorizing indicator INDfarm differentiates between LI and HI farms with respect to all inputs considered. However, low input dairy farms focusing on lowering external inputs for roughage production are not necessarily the same ones as those lowering concentrate use to produce milk. So, depending on the environmental impact to be addressed, or low input strategies that need to be studied, it might be interesting to further specify the original indicator to identify low input farms based on roughage or on milk production. Combining these different categorizing indicators might be useful in further description of low input dairy systems, their productivity, characteristics and their economic and environmental sustainability.

References

3. EU- Farm accountancy data network (FADN) – DG AGRI/2011.
Creation of added value in direct selling microfarms: a quantitative exploration through modelling

Morel, K.\(^1\), and Léger F.\(^2\)

\(^1\) UMR SADAPT, INRA, AgroParisTech, Université Paris-Saclay, 16, rue Claude Bernard, 75 231 Paris Cedex, France
\(^2\) UMR SADAPT, AgroParisTech, INRA, Université Paris-Saclay, 16, rue Claude Bernard, 75 231 Paris Cedex, France

State-of-the-art

Within the agroecological social movement claiming for agricultural systems contributing to ecosystems health and social welfare, microfarms are arousing growing interest in industrialised countries. The term “microfarms” denotes small-sized organic commercial farms sharing some important characteristics: cultivated acreage smaller than official recommendations for market gardening; marketing through short supply chains; wide diversity of plants cultivated; and low level of motorization and investment \(^1\). Compared to classic forms of organic market gardening, microfarms aim to create more added value per unit surface area through ecological intensification and a higher level of human care. The impact of these intensification strategies on incomes and workload has been illustrated in a few emblematic, sometimes controversial, examples \(^2,3\) but the ability of microfarms to be financially viable needs to be further examined in a wider range of contexts.

Methods

Based on quantitative data collected on a sample of 10 microfarms in northern France, we developed a modelling tool to explore the creation of added value per unit surface area and per hour workload. This tool combined two models. The first model was a mixed model which estimated the workload and yield per m\(^2\) according to vegetable type and growing practices. The variability between farms was integrated as a random effect. The second model was a linear program which generated crop planning to match the criteria of a CSA (Community Supported Agriculture) box scheme selling from 30 to 50 vegetables: sufficient quantity and satisfying diversity of different types of vegetables each week throughout the year. We used this tool on 3 contrasted technical scenarios which were designed based on a previous qualitative analysis of semi-directive interviews carried out on 20 microfarms in northern France:

- Manual microagriculture (Mi): no motorisation, superficial tillage, high cropping density, intercropping, as many crops as possible were grown each year on one plot (from 2 to 6 cropping cycles) limiting the possibility of growing green manures.
- Biointensive market gardening (Bi): small motorisation for superficial tillage, high cropping density, no intercropping, as many crops as possible were grown each year on one plot but green manures were integrated in the rotation (from 1 to 4 cropping cycles in average on a plot).
- Classic small-scale diversified organic market gardening (Cl): motorisation for most cropping activities (except hand harvest), low cropping density, no intercropping, it was not aimed to optimise land use and only 1 or 2 cropping cycles took place in average on a plot.

Scenarios Mi and Bi implemented ecological practices for managing soil fertility and sanitary disorders whereas scenario Cl relied mainly on commercial inputs. For each scenario, 1000 simulations were ran. For each simulation, we estimated the sales generated by an annual workload of 2000 hours from which 80% was spent working on field and 20% dedicated to commercial and administrative
tasks. We considered the hypothesis of a farm managed by only one single farmer with no subsidy and used variable and fixed costs according to each scenario based on the 10 microfarms from our sample and market gardening references (4).

Main results

For a yearly workload of 2000 hours, the average utilised agricultural area (including footpaths) of Mi (1889 m² sd: 685) was smaller than Bi’s (4010 m² sd: 1422), which was smaller than C’s (7899 m² sd: 2662). These figures reflected the logic of scenario Mi to focus human care on a smaller acreage with time consuming ecological practices whereas Cl aimed to decrease human workload per unit area through motorisation and commercial inputs. Scenario Bi stood in between as a trade-off between both approaches. The mean added value created per unit area was linked to the level of labour invested per m² as shown in Figure 1: Mi (5.2 € per m² sd: 1.8); Bi (3.6 € per m² sd: 1.3); C (0.8 € per m² sd: 0.5). However, in terms of added value per h labour, Bi (7.5 € per h sd: 3.9) outperformed Mi (5.4 € per h sd: 2.8) which outperformed Cl (3.6 € per h sd: 2.7). Each scenario showed a high level of variability in the result as illustrated by the boxplots and which will be discussed.

Conclusions

This quantitative exploration showed that microfarming practices based on ecological intensification and higher level of human care per unit surface area tended to create more added value per m² and per h labour than classic organic market gardening. In this aspect, the political and philosophical claims of microfarms that “small is beautiful” looks to be grounded in empirical reality. However, added value is just one piece of the accountancy puzzle and other financial considerations such as level of investment and taxes have to be factored in. Other marketing strategies also have to be investigated as microfarms often combine CSA box schemes with more profitable channels. For each scenario, the high variability in the results resulted from the variability of farmer’s efficiency (random farm effect) and from crop planning. This illustrates the central importance of farmer’s skills (and their transfer) both in cropping practices and planning which is a major issue in the viability of agroecological farms.

References


Figure 1: Added value (€) per m² (a) and per hour of labour (b)

Collective work in professional market gardening: a resource in suburban agroecological experiments in Brussels
Van der Linden M. 1 and Hermesse J. 2

1 Innoviris  
2 Catholic University of Louvain, Collège Jacques Leclercq, Place Montesquieu 1, bte L2.08.01 - 1348 Louvain-la-Neuve – Belgium.

State-of-the-art
For the last few years, an increasing amount of innovative and alternative projects offering new ways of producing, consuming and distributing food resources are being developed in our cities. These projects have increased in popularity [1] and have attracted the interest of communal, regional and political powers. For instance, recently new opportunities supported by the authorities have been developed in France and Belgium that aim to help producers try their professional market gardening project. These programs, mostly known under the name of Espaces test agricoles (Agricultural land test, ETA), offer material, human and logistical support to their users to help them launch their activities. Land for gardening in the suburbs of the cities is a rare commodity and is difficult to get for new farmers. However, a recent unpublished cultivable land registry shows that a significant amount of small land parcels are still uncultivated in the suburbs of Brussels [2]. These fallow lands meet the needs of producers who chose to set up intensive agroecological practices which can be fruitful in a small area. Part of choosing these practices involves a greater need for labor force per acre than conventional farming. One of the characteristics of urban agriculture is its proximity to various human resources. Population density and increased mobility facilitated by proximity to urban resources such as public transport make it easy to bring together multiple stakeholders to participate in urban agriculture projects. This paper aims to expose the benefit of collective work that takes place in a specific sub-urban Belgian ETA during the first year of farming activities.

Methods
The data and analysis presented below are part of an interdisciplinary and transdisciplinary participatory action research project which started in December 2015 and were collected in a living lab: the ETA of Anderlecht (suburb of Brussels). For the socio-anthropological dimension of the project, which focuses on the social aspects of the research, we use conventional tools of ethnographic research (weekly participant observation and non-directive interviews) as well as daily data collected by producers that documents several aspects of their market gardening activities (production, time work, collective work, processing, distribution, welfare at work, etc.). Data is coded and analyzed on Nvivo, a qualitative data analysis software. This agroecological experimental project was initiated in spring of 2016 in the area of Neerpede in Anderlecht and is supported by municipal, regional and European funding. The ETA includes two market-oriented gardens that cover 60 acres each and are managed by seven gardeners who are undergoing professionalization.

Main results
The seven market gardeners of the ETA quickly felt the need to work in teams or to surround themselves with people willing to assist their new professional adventures. Our analysis shows that this human support can impact farmers’ activities on two levels: hiring of labor force and, less expected, personal welfare.

Starting their professional activity, these new producers had a difficult time handling the huge amount of work arising from their start-up project. Therefore, they rapidly turned to their social network for
occasional support and even for partnership. To this date, to the hours worked by market gardeners must be added the reinforcement hours offered by volunteers enabling them to reach their initial objectives. This being said, the need for labor force isn’t sufficient to explain the fact that professional market gardeners decided to turn to volunteers to accomplish their work. As a matter of fact, not all volunteers can be considered as productive for the producer. Though always evolving, the level of volunteer gardening is variable across volunteers making it sometimes difficult for farmers to focus on anything other than the traineeship of their volunteers. Despite the sometimes complicated nature of managing volunteer labor, collective work contributes to the mental and physical well-being of the individuals who engage in productive agricultural activities (3, 4). Therefore, collective work provided by the presence of these volunteers appears to drive the welfare of market gardeners.

For those new to the craft, launching agricultural activities would have been much more difficult without human support. In the end, all the ETA gardeners have benefited from their associates or volunteers, who, in some cases, have now become true partners.

Conclusions

The strength of this research is its focus on the role played by human factors in an agroecological professional market gardening project. Our data attests that collective work is essential when starting a new agroecological activity. This research will allowed us to test the hypotheses that collective work is a major component of agroecological sustainability (5). This being said, it must be emphasized that the character of urban agriculture ensures proximity between voluntary and market gardeners which stimulates collective dynamics.

References

Nurturing agroforestry systems in temperate regions: an analysis of discourses for an enabling environment in Flanders, Belgium

Borremans, L.1,2, Visser, M.2 & Wauters, E.1,3

1 ILVO, Burg. Van Gansberghelaan 115 box 2, Merelbeke, BELGIUM
2 ULB, Avenue F.D. Roosevelt 50, Brussels, BELGIUM
3 University of Antwerp, Universiteitsplein 1, Wilrijk, BELGIUM

State-of-the-art

Although the interest in agroecological practices is growing among researchers, educators and policymakers, a large-scale shift of farmers from applying conventional practices to more diversified and sustainable practices is lagging behind in Flanders. This is also true for agroforestry systems, even though farmers in Flanders are able to benefit of several adoption incentives, such as a subsidy program and the eligibility of agroforestry plots as Ecological Focus Area [1]. Hence, it is necessary to look a bit closer to the different requirements necessary for the transition to more agroecological practices. According to Rotmans [2] transition implies changes in the functioning of farming systems at three different levels, i.e. structures, cultures and practices. He considers structures and cultures as system level parameters describing the functioning of the societal systems, whereas practices mediate between them and the underlying level of the actors. In this paper we focus on the cultures-level with respect to agroforestry. Cultures are considered here as the cognitive, discursive, normative and ideological aspects of functioning, involved in the sense-making of practices. Also discourses, perspectives, narratives and viewpoints relate to the same thing, i.e. the way people are seeing or talking about something and which reflects underlying worldviews and paradigms [3].

In this paper we elaborate on a study design to investigate the different discourses with respect to agroforestry. Previous research suggested that between different actors indeed a range of different viewpoints exists on the different aspects of agroforestry [4]. This could be one of the reasons that current incentives schemes are not very effective, i.e. since they focus on and address only one perspective on agroforestry, whereas a wide range of existing viewpoints or discourses may exist. Furthermore we hypothesize that the different discourses on agroforestry are also linked with general opinions about agricultural food production and policy. We differentiate here between two narratives on agricultural food production (productivity and sufficiency narrative) and three discourses on agricultural policy (neoliberal, neo-mercantilist and multi-functionality policy discourse). The rationale behind this is that these general narratives and paradigms on agriculture contain a certain rhetoric that will result in different meanings and interpretations of agricultural practices. As such general narratives on agriculture shape how people evaluate what is seen as a desirable evolution of agricultural production systems, and what types of research, technology, markets and policy should surround and facilitate this evolution. In order to bring more clarity about the discourses on agroforestry and how the more general narratives on agriculture are guiding and steering this discourses, we will perform a Q-method.

Methods

Q-methodology or shorter Q-method, was primary invented and developed by William Stephenson in the 1930s to assist in the examination of human subjectivity. Today Q-method usually implies factor analysis, and this to unravel different perspectives on a particular subject and to measure the overlap and difference between them [5]. A Q-method exists of six general steps. Here the two first steps in executing a Q-method are explained more in detail.
Step 1: The first step in a Q-study is to identify the concourse, which refers to the communication about a certain issue, here agroforestry. In general the concourse takes the form of a collection of statements which should capture the full range of viewpoints and perspectives that different stakeholders might have (5). In this study, the concourse was created using a combination of several sources. First, we consulted the literature about (1) agroforestry adoption and its wider framing as an agro-ecological farming practice and (2) discourses about farming and agricultural policy. Second, we undertook an extensive stakeholder analysis, including 25 interviews and 2 focus groups, to identify a diverse range of opinions on agroforestry. These two sources resulted in a communication concourse of about 350 statements.

Step 2: Since a concourse of hundreds of statements is too large to present to participants in the Q-study, a group of 30-60 statements has to be chosen from the concourse, which is considered sufficient to elicit the different existing point of views (5). In this study design an inductive approach was used to select statements relating to agroforestry, its definition and different forms, its feasibility and the factors and actors influencing its breakthrough. On the other hand a deductive approach was used to add statements that related to the diverse narratives held about agriculture (productivity, sufficiency) and agricultural policy and markets (neo-liberalism, neomercantilism, multifunctionality).

Further steps: The third step consists of selecting the respondents. In the fourth step the selected respondents will be asked to rank-order the statements according to a forced normal distribution, with different positions ranging from least to most ‘according to my point of view’. The fifth step encompasses a principal component analysis to rearrange the data by identifying and ordering components. The sixth and last step consists of an interpretation of the factor scores. In the end a number of ‘ideal Q-sorts’ are produced, which will represent the different perspectives or discourses.

Expected results
The expected results of this study are the identification of – idealized – Q-sorts, which represent a model discourse indicating the perspectives held regarding agroforestry and how they are related with broader perspectives concerning agriculture and agricultural policy. Further, the results can potentially indicate which perspectives are more common among which stakeholder groups. Using this, implications can be drawn regarding the feasibility of agroforestry, its barriers and drivers and how they relate to broader narratives about agriculture and policy. We expect to identify different perspectives regarding agroforestry – and thus different pathways to transform farming systems into agroforestry systems, depending on peoples’ perspectives regarding agriculture and policy.

References
Key competencies for an agroecological farmer
Debruyn, L.\(^1\), Triste, L.\(^1\) and Marchand, F.\(^{1,2}\)

\(^1\)Institute for Agricultural and Fisheries Research, Burg. van Gansberghelaan 115 box 2, Merelbeke, BELGIUM
\(^2\)University of Antwerp, Universiteitsplein 1, Wilrijk, BELGIUM

State-of-the-art
Agroecological agriculture follows a systemic approach where ecological and socio-economic aspects of a farm are considered as strongly interconnected. As a result, agroecology requires the development of and access to different types of knowledge, skills and attitudes when compared to conventional agriculture. Two main sources of literature offer us clues on what kind of knowledge, skills, attitudes and competencies (i.e. the ability to apply knowledge, skills and attitudes in day-to-day (farming) practices) are at stake. First, there is a body of literature on an Agroecology M.Sc program at the Norwegian University of Life Sciences (1). When graduating, students are expected to have sufficient knowledge on farming and food systems, to have obtained adequate skills to handle change and complexity, to link theory to practice, to communicate and facilitate effectively and to learn autonomously (2). Also, in relation to this program, a set of key competencies has been defined, including skills in observation, in participation, in dialoguing with stakeholders and team colleagues, in visioning possible future scenarios, and in reflection on both own experiences as well as on processes. Secondly, various authors have defined competencies for students to cope with the complexity and uncertainty associated with sustainability challenges. Examples include the VESTIA+D model (3) and a consensus list on competencies for sustainable development (4). These include competencies such as responsibility, emotional intelligence, interdisciplinary cooperation and anticipatory thinking. However, while the aforementioned competencies are defined from a (university-level) student’s perspective, we aim to focus rather on the agroecological farmer, and on the competencies required by the farmer to successfully realize this agroecological approach. This issue is tackled within the research project ‘Agroecology as a leverage for education in sustainable agri- and horticulture.’ In this project, we screen the current educational package on the incorporation of agroecological principles, practices and competencies for the case of Flanders.

Methods
Data were collected using a qualitative research approach. First, the aforementioned literature sources and more general literature on agroecology were screened for competencies, knowledge, skills and attitudes, associated with agroecology, resulting in a list of 75 items, divided over 7 themes. This list was discussed and further elaborated during two separate focus group meetings, with experts from both the field of agroecology and education. To further refine and clarify this list, we conducted 8 in-depth interviews with agroecology experts on agroecological farming/farmers and if/how they differ from conventional farming/farmers. Interviews were transcribed and were analysed, together with the focus group reports, using open coding (5). Coding was done independently by three researchers in NVivo9. The identified concepts were discussed and grouped into 6 categories, by the same researchers.

Main results
We have identified 6 key competencies for an agroecological farmer. Associated with these 6 competencies, we also propose a list of necessary knowledge, skills and attitudes (Table 1).
Table 28: Knowledge, skills, attitudes associated with the 6 key competencies

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Skills</th>
<th>Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>General knowledge on different components of the farming and food system, technical know-how, systems knowledge, actor knowledge, methodological knowledge</td>
<td>Holistic thinking, analytical thinking, responsibility, communicative, eager to learn, critical thinking, visioning, decisive, networking, creative, self-knowledge, emphatic</td>
<td>Environmentally aware, resilient, open, flexible, respectful, assertive, courageous</td>
</tr>
</tbody>
</table>

To think and act with a systems perspective. To obtain a truly sustainable system, all components of the system have to be sustainable. An agroecological farmer should be able to shift between an analytic and holistic view, and should be able to see the connections between different system components. Systems thinking also has to be time- and place-dependent, to fully grasp path dependencies and lock-ins, and to assess both short and long term consequences.

Commitment. An agroecological farmer must be committed to respecting the ecological boundaries of the system within which he operates. He should form a conscious relationship with the environment, in its broadest sense, i.e. soil, plants, animals, fellow men, and society. His main incentive is a sustainable behaviour towards this environment.

Observation and creativity. Agroecological farming is context specific, and cannot rely on standard designs or best practices. An agroecological farmer rather should observe the environment, not only on sight, but also using other senses (touch, smell, ...). He looks for creative solutions to challenges and problems, based on these observations, thereby strengthening his problem-solving skills.

Critical reflection. An agroecological farmer is able to reflect critically on his own actions and on the actions of his environment. He tries to move away from a priori judgments, and acts consistently in line with the vision for the farm.

Emancipation/autonomy. An agroecological farmer should not associate himself exclusively with a certain business model, prescribed techniques, or actors over which he has little or no control, but rather should strive for maximal autonomy in his decision-making process.

Social openness. An agroecological farmer communicates openly about his practices, values and vision, and he can make efficient use of the knowledge, skills and criticisms in his environment.

Conclusions

Although the identified competencies (and associated knowledge, skills and attitudes) are likely not exclusive for agroecological farmers, and may be equally expected from other “educated” people, we do propose that developing the key competencies is equally important as knowledge on agroecological principles and practices, in developing truly agroecological farmers. In the next step of our research, we will screen the educational package for (future) farmers in Flanders on the 6 key competencies in conjunction with agro-ecological principles and practices, to assess the explicit and implicit inclusion of agro-ecology.

References


Agroecology in farmer education in Flanders: a survey
Triste, L.¹, Debruyne, L.¹ and Marchand, F.¹,²

¹Institute for Agricultural and Fisheries Research, Burgemeester Van Gansberghelaan 115/2, Merelbeke, BELGIUM
²University of Antwerp, Universiteitsplein 1, Wilrijk, BELGIUM

State-of-the-art
Agroecology is put forward as an alternative way of looking at current sustainability issues in the agricultural system. UNESCO (1) emphasizes the importance of education in the transition towards more sustainable development. However, little information is available on the required elements for incorporation of agroecology in farmer education and the extent to which agroecology is currently incorporated in farmer education. Therefore the project “Agroecology as a leverage for education in sustainable agri- and horticulture in Flanders” was initiated. In an earlier stage of the project we developed a reference and assessment framework. This framework includes: (i) agroecological principles and practices; (ii) key competences for agroecological farmers (2,3) and the methods needed to teach them (2). These teaching methods focus on a.o. experiential, action and collaborative learning, student-centered teaching, competency focussed teaching, self-evaluation, peer assessment, reflection, and the use of different types of knowledge. At the current stage of the project we use this framework to assess educational programs for (future) farmers on their incorporation of agroecology. This paper reports on the results of a survey we disseminated amongst all Flemish formal, such as secondary and higher agricultural education, and non-formal educational centres, such as specialised training courses for (future) farmers.

Methods
Based on the reference and assessment framework (3), we constructed a survey which was spread amongst 3 target groups: i) secondary schools, ii) high schools and universities, and iii) non-formal education centers. According to the target group, the same questions but different wordings were used to improve the comprehension. The survey consisted of a part for teachers and a part for program coordinators or school directors. The survey consisted of 6 parts: (1) general questions on the respondent; (2) his educational approach; (3) his evaluation methods; (4) his course content; (5) his vision on alternative agricultural systems; (6) his familiarity with agroecology. In parts 2 until 4, we probed for the implicit presence of agroecology in the respondent’s courses, by asking questions on teaching methods, sources of course material, teaching approach, interdisciplinary teaching, evaluation methods, and course content. In part 6 we explicitly probed for their familiarity with agroecology.

Before dissemination, the survey was tested by 6 persons, with expertise either in surveys or in education. In February 2016, the surveys were disseminated amongst secretariats or directors of all (n=24) secondary schools with agricultural curricula, all (n=8) providers of agricultural higher education and 24 non-formal providers of agricultural education in Flanders. We received answers from 71 (50 completed) respondents from 15 secondary schools, 51 (37 completed) respondents from 8 providers for higher education, and 29 (20 completed) respondents from 9 providers of non-formal education. We performed descriptive statistics using Microsoft Excel.

Main results
Regarding our indicators for implicit implementation of agroecology in the educational programs, we found that there is some room for experiential, action, and collaborative learning, but main focus still lies on theory- and teacher- centered approaches, both in teaching and evaluation.
Table 1: Findings on the familiarity of teachers with agroecology and the explicit incorporation of agroecology in education programs for (future) farmers.

<table>
<thead>
<tr>
<th></th>
<th>Secondary education</th>
<th>Higher education</th>
<th>Non-formal education</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. To what extent is agroecology included explicitly in education programs for (future) farmers?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Familiar with “agroecology”?</td>
<td>37% (n=49)</td>
<td>62% (n=34)</td>
<td>50% (n=10)</td>
</tr>
<tr>
<td>b. Mention agroecology in their courses</td>
<td>87% (n=18)</td>
<td>82% (n=21)</td>
<td>80% (n=5)</td>
</tr>
<tr>
<td>c. Would like to teach more about agroecology</td>
<td>81% (n=16)</td>
<td>56% (n=20)</td>
<td>25% (n=4)</td>
</tr>
<tr>
<td><strong>2. What are barriers for teachers to incorporate agroecology in their courses?</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Too little time or room to indulge in agroecology</td>
<td>29% (n=18)</td>
<td>40% (n=20)</td>
<td>20% (n=5)</td>
</tr>
<tr>
<td>Little knowledge about agroecology</td>
<td>24% (n=18)</td>
<td>15% (n=20)</td>
<td>0% (n=5)</td>
</tr>
<tr>
<td>Too little course material available</td>
<td>24% (n=18)</td>
<td>15% (n=20)</td>
<td>0% (n=5)</td>
</tr>
<tr>
<td>Too rigid official final learning objectives</td>
<td>10% (n=18)</td>
<td>N.A.</td>
<td>N.A.</td>
</tr>
<tr>
<td>The school vision does not allow it</td>
<td>5% (n=18)</td>
<td>0% (n=20)</td>
<td>20% (n=5)</td>
</tr>
</tbody>
</table>

Other (according to the number of citations)
- Skepticism of fellow teachers regarding the subject;
- Students are not receptive towards the subject (mainly because of family norms and values);
- This should be taught after secondary school (e.g. in specialized courses and high schools);
- Not clear how to integrate it in technical courses;
- Agroecology does not fit with the subject of my courses.

Table 1 shows that, within our response group, teachers in secondary education are less familiar with agroecology than teachers in higher education or non-formal education (1a. in Table 1). But the major part of those who are familiar mention agroecology in their courses (1b. in Table 1). Furthermore, particularly in secondary education, they would like to teach more about it (1c. in Table 1). A possible explanation might be that secondary teachers feel less free to fill in their course content because they have to comply with official fixed learning goals defined by higher administrative levels. Barriers to implement agroecology (2. in Table 1) are mainly lacking time or room to indulge in the concept. Another interesting barrier mentioned relates to the negative attitude of fellow teachers and students towards agroecology and other alternative farming systems.

For dissemination of the survey amongst the teachers, we were dependent on the goodwill of secretaries and directors of the educational programs. Since we did not receive response from all teachers and educational programs, our results cannot be generalized for Flanders.

Conclusions
Our survey gives an interesting first impression on the incorporation of agroecology in Flemish agricultural education. However, further thorough research is needed, based on school visits and interviews with teachers and students, to clarify actual incorporation of agroecology in the curricula, barriers and possible educational instruments and methods to incorporate agroecology.

References

3. Debruyne, L. et al. (2016). Key competencies for an agroecological farmer (proceedings of the 5th Belgian Agroecology Meeting)
Exploring the little concern for biodiversity among sustainable food consumers

Bernardin, C.¹,²,³, Anzalone, G.¹ and Thareau, B.¹

¹LARESS, Ecole Supérieure d’Agricultures, 55 rue Rabelais, Angers, FRANCE
²AgroParisTech, 16 rue Claude Bernard, Paris, FRANCE
³Muséum National d’Histoire Naturelle, 57 rue Cuvier, Paris, FRANCE

State-of-the-art

Motivations for eating organic and/or local food in France are well studied: for its health benefits, to support farmers, to protect the environment, for a better taste, etc. (1). Among all environmental issues, whereas the current biodiversity loss rate has been argued to be highly unsustainable (2), its preservation is not mentioned as a specific goal, as opposed to the reduction of GHG emissions (1). While many farmers aim to preserve biodiversity – if only the one that impacts their production (3) through agroecology that at once requires it and enhances it (3), the connection between food and biodiversity does not seem to be made by consumers.

The aim of this sociological research is then to understand reasons why consumers get involved in dynamics that reconcile agriculture and biodiversity. Are they even conscious of such fact? How does it matter to them? Is a direct relationship with biodiversity protectors necessary for consumers to be aware of the urgency of preserving it and of the role played by agriculture?

Methods

We consider “sustainable diets” – for instance unprocessed, organic, local or more plant-based – whose production de facto benefits biodiversity directly or indirectly (4), in order to grasp to what extent consumers are conscious of the benefits produced by such food choices. The study focuses on 3 different French regions of the Loire valley: the Marais Breton (Breton Marsh), the Bocage Vendéen and around the city of Angers. They are characterised by different agricultural contexts and furthermore, by distinct dynamics involving farmers, consumers and environmentalists at more or less collective levels, yet all being bottom up approaches, apart from those undertaken by institutions.

214 sustainable food consumers were studied (fourteen through semi-structured interviews and 200 through an online survey). They were organic shoppers, members of local food associations, or direct customers of farmers known for protecting biodiversity via their agricultural techniques. In situ observations during farm visits involving consumers were also conducted, to witness how they were told about biodiversity. In this manner, the added value regarding biodiversity brought by a direct relationship with those farmers could be studied.

The interviews and survey tackled food practices (what gets eaten, where it comes from) and their evolution over time. They also dealt with the motivations to eat that way and the role that the media and relationships with producers or other consumers may play in developing sustainable food habits and a possible awareness of biodiversity-related issues.

Main results

Regarding profiles and motivations, the findings bear out the literature: the aforementioned reasons for eating sustainable food (eg. health, environment or farmers’ support) were variously encountered among the customers. “Supporting producers” may take the shape of mere purchases, sometimes associated with deeds of active solidarity, for instance providing help with the harvests or helping buy land or cattle. Nevertheless, no difference was found between consumers close to them and the others, suggesting that such cases of close relationships with biodiversity protectors do not lead
to a special awareness or interest in biodiversity and its connection to sustainable diets. Biodiversity preservation does not directly appear as a motivation for eating sustainable food, contrary to the reduction of GHG emissions. Yet, most consumers are aware of the link between agriculture and biodiversity and it is important to most consumers, even though this complex and technical concept of “biodiversity” is seldom used as such: when asked what sustainable agriculture may preserve, consumers generally evoke for example animal life, soil life or the equilibrium of the ecosystems. In addition, plant diversity proves to be important to most interviewees in an eating perspective through the discoveries and surprises brought by seasonal vegetable boxes.

This awareness may raise thanks to either personal networks or the media of all sorts relaying information. The various motivations and matters of concern indeed prove to be closely related to the news: the will to reduce carbon footprint is for instance evoked together with the Paris COP21 or the concern for animal welfare together with recent cases of ill-treatment in some French slaughterhouses. We notice a deep loss of trust in the food industry, which translates into a will to “know where the food is from” and often, distrust even towards the EU organic label, then distinguished from “actual organics”. This distrust brings many anxious consumers to turn to local dynamics directly involving farmers. Being close to those producers, they may indeed check on the production systems themselves rather than relying on labels, thus reclaiming the food systems. They do obtain a better understanding of the realities of farming and food as well as of their connections to the environment. However, the mere fact of knowing the producers help restore trust and consumers then do not claim to know everything about their farming practices: they trust them for providing them with healthy food that preserves biodiversity as well, without being absolutely certain about it, which may explain why it does not appear as a primary motivation.

Conclusions

Sustainable food consumers appear to feel concerned about biodiversity depletion and to be aware of the role farming practices may play in this loss. Yet preserving biodiversity does not primarily come to their mind when they justify their food choices.

This may be due to the notion that sustainable food is good for “the environment” as a whole, especially among consumers who are not in contact with producers. Biodiversity-related issues may also remain eclipsed by other more media-friendly ones such as climate change, which has been argued to detract attention from all the other environmental issues (5).

Furthermore, local food for example is a concrete fact, one knows about its low carbon footprint. It is not so for biodiversity preservation as one has to trust the producers about their farming practices and the benefits of the latter for biodiversity. Thus, connecting producers and consumers may at once restore trust among agri-food systems and raise consciousness among consumers about social and environmental issues related to food and its production. But then again, even if farmers strive to preserve biodiversity, sustainable food consumers possibly do not make this goal their own as they do not play an active part in it.

References


Meet and greet : all delegates meet presenters of sessions 3 and 4

Networking with reception