

November 5 and 6, 2022

*by Paul Schmit of Schaff mat Pærd, Luxembourg*

Within the EU-funded Leader project “Horsepower – Innovation in small-scale agriculture and gardening” an on-line symposium took place on November 5 and 6. Hosted by Jeanette Junge, business manager of the Swedish Leader LAG PH, a total of 63 participants from 17 countries followed 14 presentations with current reports from research all-around the world, background knowledge and best-practice examples from European smallholdings.

## Horsepower – Innovation in small-scale agriculture and gardening

As a first presentation on both days, Sarah Mathieu, business manager of the Leader LAG Lëtzebuerg-West, and Paul Schmit, Chair of the NGO Schaff mat Päerd, both from Luxembourg, presented the Leader program and the project itself. Leader is a European program supporting rural areas by funding innovative projects through so-called LAG's (Local Action Groups) consisting of public and private actors. To get accepted by the local Leader committee and the National Ministry of Agriculture as a Leader project, the project must not only be innovative, but also have a local or regional impact and be developed by the bottom-up principle.

The transnational project “Horsepower – Innovation in small-scale agriculture and gardening” has been initiated by the NGO Schaff mat Päerd from Luxembourg with Hälde Hästkraft and Uppsala University as Swedish partners. After a project preparation from 2020 to 2021, it is planned to be run from 2022 to 2024 and consists of three phases, starting with a study and conception phase in 2022. Here, a workshop with practitioners, an online survey, field trials with modern horse-drawn implements on different farms, castles, and open-air museums as well as a CAD modelling of entire machinery were completed.

During the following development and completion phase in 2023 and 2024 four new implements will be designed, manufactured, and tested. In the final outreach phase end of 2024, all the information, including the engineering drawings of the machinery, will be shared as open-source documents.

Luxembourg's part of the Leader project is embedded in a multidisciplinary project, supported by the University of Luxembourg and several public administrations and foundations, with aims of designing, implementing, and testing several agroforestry plots. New mulching technologies, low-input farming, and minimum tillage systems, as well as eco-friendly landscape maintenance, are to be developed by using animal traction to improve the climate resilience, especially in facing the recurring and pronounced summer droughts in many European regions.

## Permaculture Design - Possibilities and Limits for Localising Production

Katy Fox from Luxembourg is a social anthropologist and eco-social designer. During her PhD thesis from 2006 to 2010, she studied the impacts of EU agriculture policy on the lives of subsistence farmers in Romania. Later, besides the Centre for Ecological Learning Luxembourg, she also founded the Mycelium as an eco-social design agency. Her follow-up research in Romania in 2009 brought her to the fore environmental questions and she has since worked with permaculturists.



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Agroecology is a key sector for regeneration, which is more than just a science, it's also a social movement. Permaculture and biointensive micro-gardening practices aim to optimize the interactions in the soil-plant system for an efficient use of their ecological functions and ecosystem services, while realizing high yields from a small area and sustaining soil fertility. Micro-farms and forest gardens are truly biodiversity oases.

These practices contrast with conventional agriculture systems that rely mainly on monospecific production, the use of mineral fertilizers and pesticides, and mechanized tillage. Permaculture systems have largely been overlooked by soil scientists and have generally been ignored in scientific studies.

Being now at a crossroads of uncertainty: the end of fossil fuel abundance, climate breakdown, extinction and social crisis, deep changes in farming are required, polycultures and low-tech, rethinking the yields, but also the farm inputs, localising the diets.

## Going back to horses? Farming for post-fossil fuel societies

Wijnand J. Boonstra from Sweden is associate professor in Natural Resources and Sustainable Development at the Department of Earth Sciences of Uppsala University. After his MSc and PhD studies at Wageningen University in the Netherlands, he worked at the Swedish University of Agricultural Sciences, the Stockholm Resilience Centre and is currently also working as associate editor of different journals within the field of Sustainability Science.

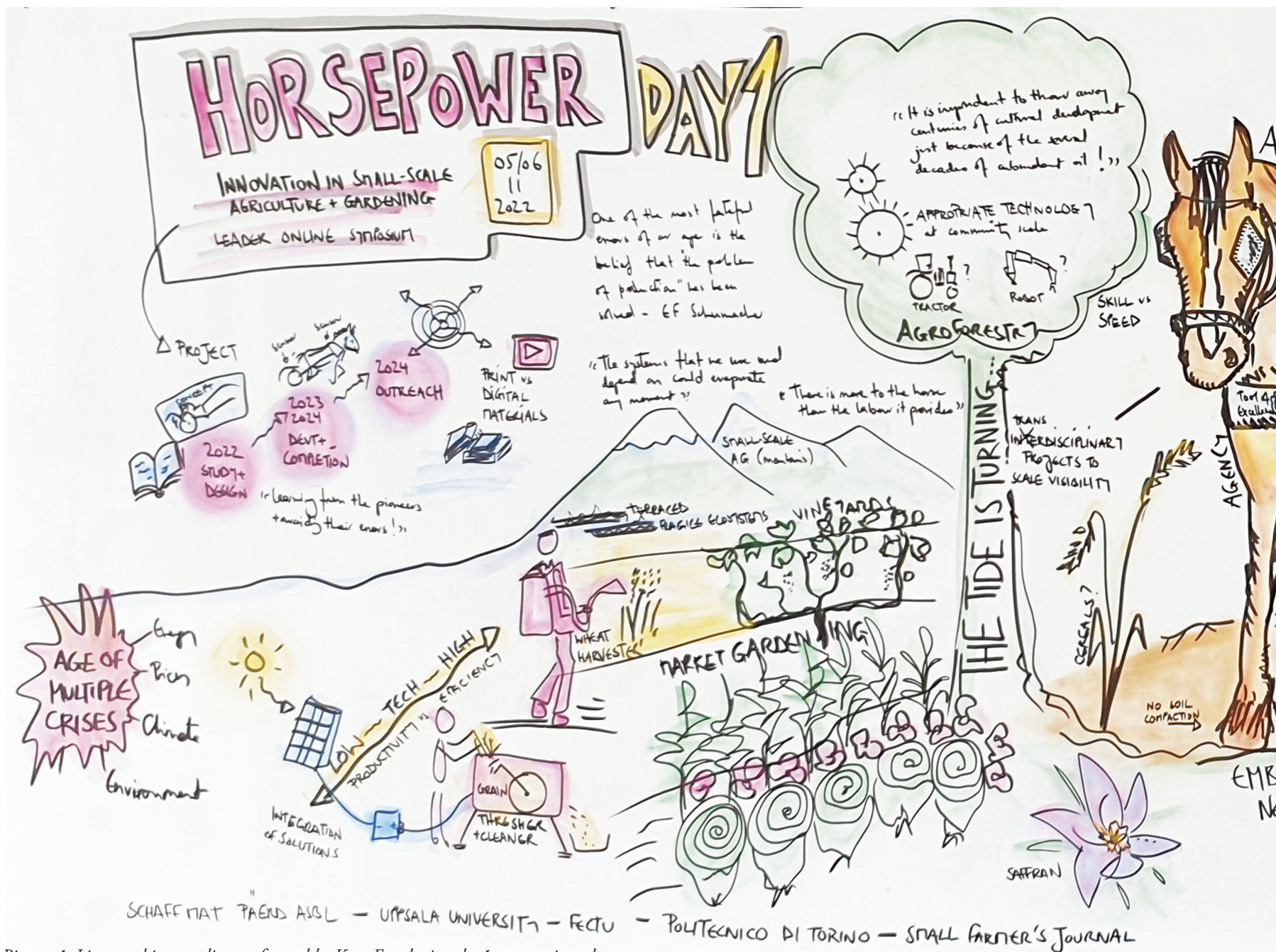
The question that Wijnand considered in his presentation is why farmers still continue to use horses in farming. During the 2nd half of the 20th century, governments and industries actively promoted the uptake of agriculture that is driven by fossil fuels in combination with high financial investments and chemicals. As we now know this model of agriculture also came with rural depopulation, high levels of debts for farmers, increase of the scale of farming, environmental degradation, and loss of biodiversity.

A small group of farmers nevertheless goes against this trend through the use of horses for farming. Admittedly it is a very small group. One could theorise they form a subagriculture, equivalent to a subculture, a particular group of people in society that are different from those of most people.

Using a number of different sources of evidence, there can be 5 reasons discerned for why farmers turn to horses to do farming. These reasons have to do with environmental sustainability; economic viability; autonomy; limiting the scale of farming; and performing meaningful and satisfying work.

More attention to these reasons and the work horse farmers do with their animals is warranted because they point to a viable and tested alternative to modern agriculture development. Or, in the words of a horse farmer: "it is irresponsible, not prudent, not wise at all, to dismiss and throw away that hundreds of years





Picture 1: Live graphic recording performed by Katy Fox during the 1st symposium day.

of cultural development just because of the presence of cheap, intensive energy in the sense of oil for the last 75 years" (taken from "Somehow Hopeful", Kooks Entertainment, Film by Jerry McNutt 2022).

### Animal traction in the Iberian Peninsula – good examples to follow

João Brandão Rodrigues from Portugal is a veterinarian with a specialization in donkeys and is currently working for the Donkey Sanctuary from the UK, chairs the Portuguese Animal Traction Association APTRAN as well as the European Draught Horse Federation FECTU.

In 2022, the FECTU had 22 member associations from 16 European countries representing several thousands of individuals related to animal traction and is a member of the European Horse Network.

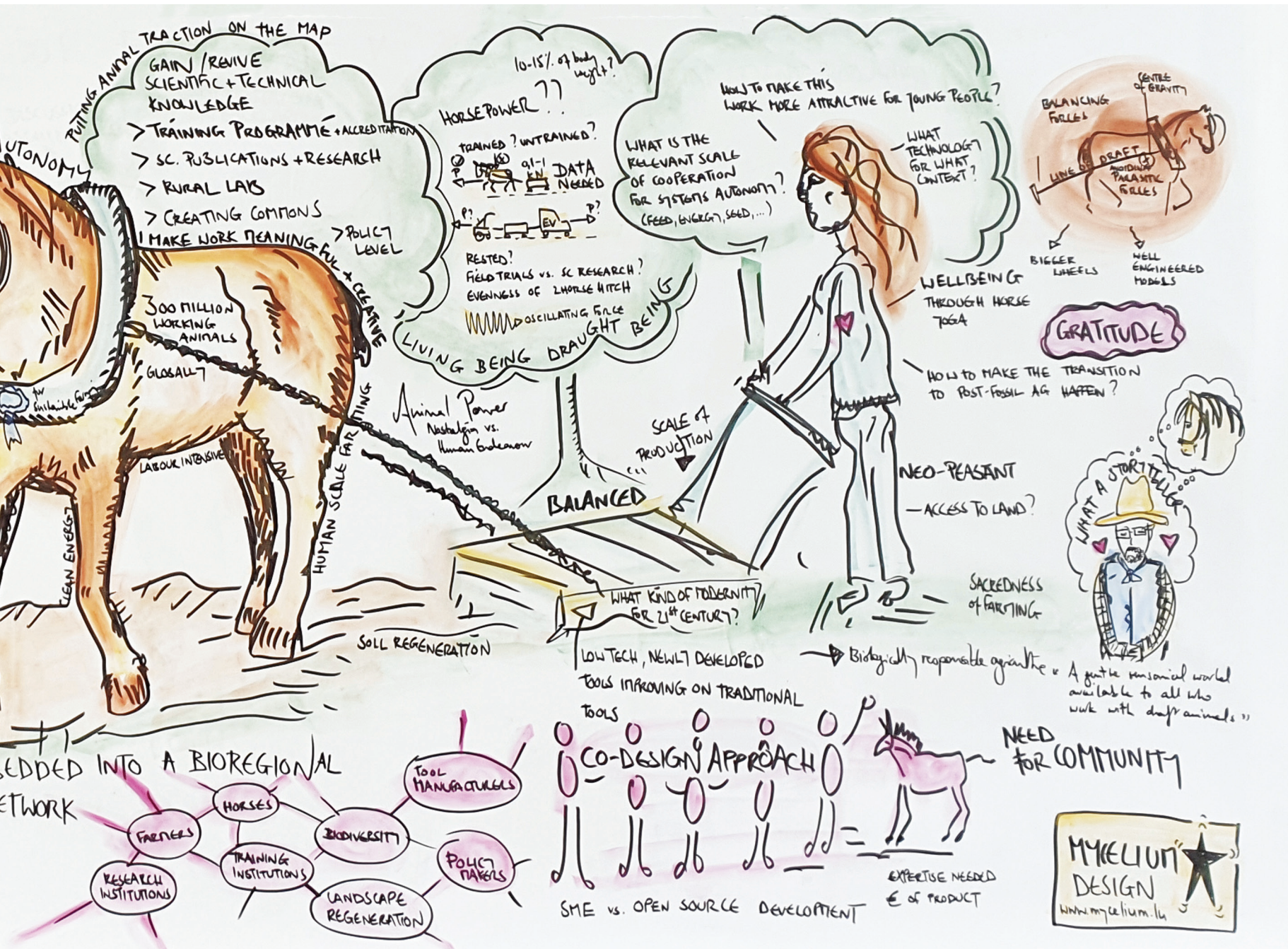
On the Iberian Peninsula, animal traction is represented at national level by

APTRAN in Portugal and ANTA LA ESTEVA in Spain. Back in 2012, when both associations were created and started to cooperate, many professional farmers and gardeners in Spain had already adapted and modernized their harness and implements, whereas in Portugal it was still very common to use traditional equipment. Founding members of the APTRAN were mainly professors and researchers, who saw in animal traction a common factor for their areas of expertise.

Both associations started in 2013 a successful training program about working with draft animals. Herein, a crucial aspect is that the important role of traditional farmers has never been forgotten. It's only by passing their rich knowledge from generation to generation and still sharing it today, that animal traction is still alive in the 21st century.

Among many training courses and workshops developed over the last 10 years, a key event was the Mountains 2016 conference at the Polytechnic Insti-





tute of Bragança in Portugal where animal traction was one of the main topics. Following this international conference, a paper titled "The XXI century mountains, sustainable management of mountainous areas based on animal traction" was published.

### Small is still beautiful - Developing appropriate machines for mountain peasant farming

Walter Franco from Italy is associate professor at the Department of Mechanical and Aerospace Engineering of the Politecnico di Torino. After his MSc degree in Mechanical Engineering and his PhD in Applied Mechanics, he has been a lecturer of Applied Mechanics and Mechatronics. Currently, he is lecturer in Humanitarian Engineering, Technologies for Sustainable Development, Mechanics for Design, Automatic Machines Mechanics. His main research fields are Appropriate Devices and Machines and History of Mechanisms and Machines.

An appropriate technology is defined as a technology tailored to fit the psychosocial and biophysical context prevailing in a particular location and period. The agricultural machines on the market do not always meet the needs of mountain peasant agriculture, characterized by sloping and terraced land on fragile soils. In recent research, a participatory design method was developed that involves mountain communities in the development of new machines.

The new machines thus conceived have the characteristics of appropriateness, among which they are controlled by the reference communities, and are small size. Being low power machines, they have high specific productivity, up to ten times higher than that of high power machines. To limit energy consumption, based on this analysis, it seems that a way forward consists in the development of intermediate solutions, capable of combining productivity and energy efficiency.



An intermediate technology would be immensely more productive than the indigenous technology, but it would also be immensely cheaper than the sophisticated, highly capital-intensive technology of modern industry. The applicability of intermediate technology is, of course, not universal. There are products which are themselves the typical outcome of highly sophisticated modern industry and cannot be produced except by such an industry.

**Living horsepower - Animal welfare and draught efficiency  
in modern implement design**

Paul Schmit from Luxembourg has an MSc in Mechanical Engineering with specialization in engines and machines and runs besides his work as high-school teacher for mechanics and environmental sciences at the Lycée Technique d'Ettelbruck, a 20 hectare farm, where draft horses are used since 25 years in vegetable growing, landscape maintenance and forestry.

The often quoted rule that a draft horse can pull a load of 10 to 15% of its own body weight should be questioned critically. Here, the training condition of the horse and the duration of the tractive effort are not considered. These rules only are based on assumptions and practical experiences from the bygone time, where the horses had much higher daily work rates. However, at the present time, scientifically reliable research results are required and therefore data that are collected according to scientific methods.

Hitching a draft animal to an implement means combining a biological with a mechanical system. Here, it is essential that the hitch is correctly balanced. This can only be achieved in simple equipment where the animal's draft line can be superimposed on the load centre of the implement. Three-point or tongue hitches on forecarts, both technologies which were adopted from tractors, create what is known as an instantaneous pole, resulting in so-called parasitic forces, laterally and vertically, which only put additional strain on the draft animal, without contributing to the work itself.

Equipment derived from the tractor or ATV market is usually oversized as designed for higher working speeds and run on wheels that are far too small, which unnecessarily increases the required pulling power of the animals.

**Animal Power, Regenerative Agriculture, and  
the Responsibility of Community Journalism**

Lynn R. Miller from the US got a Bachelor of Fine Arts from San Francisco Art Institute and his Master's degree in Fine Arts from the University of Oregon. For half a century, he is both a small farmer employing animal power and an agrarian publisher.

There is a direct correlation between the disenfranchisement of billions of people and climate change, hunger, war, even disease. Small scale, labour and culture-intensive farming give people privileges they can hold close as it displaces harmful industrial agriculture, reduces pollution, decentralizes food production and food access, slows out-migration, and improves overall health. Simply put, a billion more small farms will create better health, a respite for the planet, wellbeing, full bellies, less war and a resounding pride of place. But for such a grand and enormous evolution to succeed it requires that farming technologies and methodology follow the inferences of scale and means.

Community today, as defined by its culture, its watershed, its history, its biological imperatives, requires its own honest journalism if it is to hold true to its identity, understand its place in the wider world, and survive with elan and requisite humility.

Community journalism must build upon a foundation of respect for the

individual and community voice as a manifestation of unique cultures rooted in indigenous agriculture. The vitality and attraction of community journalism derives from an abiding effort to allow all voices. In our case this targeted journalism must provide strong and consistent support and endorsement for the community of small farmers and for horse farmers and loggers, just as we have done for half a century.

Targeting the communities of specific need, publication of anecdotal and technical articles pertaining to Horsepower, and Organic Farming has resulted in the astounding advances increasing viability. Publication, beyond providing some modicum of legitimacy, more importantly encourages further innovations in appropriate farming technologies especially as regards animal power.

Community journalism presupposes an active involvement in and management of workshops, market events and lectures. Localized publishing endeavours can provide constant effort to protect the future progress of these efforts. While we have long been clearly advocating for appropriate technologies (in this case, animal power) and sustainable methods (in our case, long-lived natural indigenous farming methods in closest harmony with local micro-climates) we have also insisted on arming ourselves with a useful understanding of industrial agriculture's motives, values, and ambitions.

**Day 2**

**Farming with Draft Animals - Using Retro Innovations for  
Sustainable Agrarian Development - A Case study of organic  
small-scale farming in Northern Italy**

Anna Garré from Sweden, got after her BSc in Human Geography at the University of Paris-Nanterre in France, an MSc degree in Social-Ecological Resilience for Sustainable Development at the Stockholm Resilience Centre of Stockholm University.

Retro-innovation is a different approach to innovation and consists in developing knowledge and expertise that combine elements and practices from the past and the present and configures these elements for new and future purposes.

In general, small-scale farms in Northern Italy can be characterized by a pluractivity, wherein organic vegetable cultivation or cheese production are of particular importance. A peasant approach to farming is adopted, as an individual decision, wherein draft horses substitute tractors in some tasks for increasing the farm autonomy and sustainability.

Draft animals are considered as work companions that collaborate in the work and with whom farmers develop a strong relationship. Working with draft animals is part of a reflexion that convokes retro innovation to enable farmers to accomplish their roles as local stewards. The motivation for this approach emerges from a dissatisfaction with the current system and a rethinking of the role of non-humans in sustainable transitions.

**Integration of green manuring with animal traction  
can contribute to sustainability of agriculture**

Ranko Gantner from Croatia is associate professor at the Faculty of Agrobiotechnical Sciences of the Josip Juraj Strossmayer University of Osijek. With a specialization in forage crops, he is currently preparing a research project using animal traction in cover cropping, to be run in Požega. Six different variants are planned, all in the randomized block design with four replications, to achieve a satisfactory reliability of average values of cash crop yields and of soil quality indicators. All field operations are to be carried out exclusively with draft horses.

Regardless the farming system, soil fertility is crucial for achieving the desired yields of field crops. Building soil fertility in organic farming systems



relies mainly on the application of organic fertilizers like farmyard manure and composts, and green manuring as well. When the farmyard manure production is not sufficient to fertilize the fields, organic farmers are required to build their soil fertility by using another possibility, like green manuring.

Such a situation is found in Croatia, where the average stocking rate is 0.51 livestock units (LU) per hectare of the used agricultural land. Under the rough assumption that 1 LU generally produces somewhat less than 100 kg of nitrogen in its excreta annually, we come to less than 50 kg of nitrogen being produced per the hectare of farmed land in Croatia. This indicates the necessity of using green manure on organic farms.

Incorporating cover crops into the soil appears as the most acceptable option for small and low input farms since it doesn't require the use of expensive and power-demanding no-till seeding machines. Retro-innovations of horse-drawn roller-cutters and roller-crimpers are required to ease the incorporation of herbage of green manure crops into the soil.

### **From international horse farming experiences to starting a small commercial farm**

Jelmer Albada from the Netherlands grew up on a conventional dairy farm in the Friesland province. With an interest in small-scale intensive agriculture, he went to study at the biodynamic agricultural school of Warmonderhof and here he came for the first time in contact with draft horses.

After having worked five years on a biodynamic herb farm in the Netherlands, he crossed the Atlantic to get first-hand experience on successful vegetable growing and dairy farms, where draft horses are professionally used. He also worked for several months on Amish farms and visited all the equipment manufacturers in the US. Here, he learned the value of family run farms within a farming society with a lot of helping hands.

Following this experience, Jelmer went to South America and worked for several months in Colombia, Peru and Ecuador and even shipped European implements to South America, where experiences could be gained under all year around growing season. After another employment at a bigger CSA farm in the US from 2013 to 2014, he finally returned to Friesland, where he started working on a cauliflower farm before later switching to a tree nursery, which is his current side job.

Starting with half a hectare, it was in 2015, when Jelmer started growing asparagus and using a Frisian work horse for weed control in the permanent paths between the tall ridges. He enjoys working with a draft horse and minimizing by that the soil compaction. Today, he grows with his wife Jetske a total of one hectare of asparagus. Last year, they added strawberries to the products, which are sold locally. Currently, Jelmer is experimenting with compost layers on the top of the rows to reduce weeding by hand.

### **Draft cattle powered small scale farming and market gardening**

Claus Kropp from Germany is the Scientific Manager of the Lauresham Open-Air Laboratory for Experimental Archaeology in Lorsch. During his PhD thesis, he studied the use of draft-cattle in the Early Middle Ages.

Besides the production of organically grown, locally sold and processed crops, the Lauresham Open-Air Laboratory runs an educational and research field for animal traction in the 21st century with Raetian Gray and Vosgues cattle.

The smaller and more complex the operation, the more efficient draft cattle become. Specifics to draft cattle use in agriculture and market gardening are low costs, possibility to work in closed cycles combined with a positive outreach as part of the marketing strategy.

Harnessed with a three-pad collar, draft cattle prove to have a high efficiency if used all year around.

### **Draft Relationships for Animal-Drawn Tools and Implements**

Tim Harrigan from the US has a PhD in Biosystems and Agricultural Engineering and leads an integrated research, teaching and extension program for building sustainable agro-ecosystems and for appropriate scale mechanization at Michigan State University. As an executive board-member, he has served Tillers International for more than 20 years.

In recent years, he has used spatial technologies to refine our understanding of the pulling forces generated by working animals. If we lack an understanding of what we ask of our working animals, we may not know why they act up in particular ways. If a teamster mistakenly thinks a load is light, he may become frustrated and overly demanding, causing the animals to become nervous and unpredictable. Repeatedly overloading a team will discourage them and reduce their willingness to pull.

The pulling force for tillage tools is largely resistance from soil and crop residues. The effort animals exert is proportional to the volume of soil shattered, lifted, and turned. Reducing the plow depth by one-half will reduce the animal burden by one-half. Often, tillage tools are set deeper and more aggressively than necessary to prepare a proper seedbed. Conserve your animals' energy by selecting, adjusting, and managing tillage implements for less intensive tillage. Conserve your team's energy and ease their burden by 'going light and going often.' Two light tillage passes are less taxing than a single, heavy pass.

The moldboard plow draft can be highly variable in different soils and moisture conditions. Draft in silty clay soil may be two times greater than in sandy loam soil. A 60% increase in plow draft in dry soil compared to moist soil in the same field was recorded. When weed control is a key objective, reduce plowing depth to two or three inches, reducing the volume of soil disturbed and the animal burden. The draft of a single-bottom riding plow is typically 100-150 lbf (45-70 kgf) greater than the same-size walking plow due to the weight and rolling resistance of the implement.

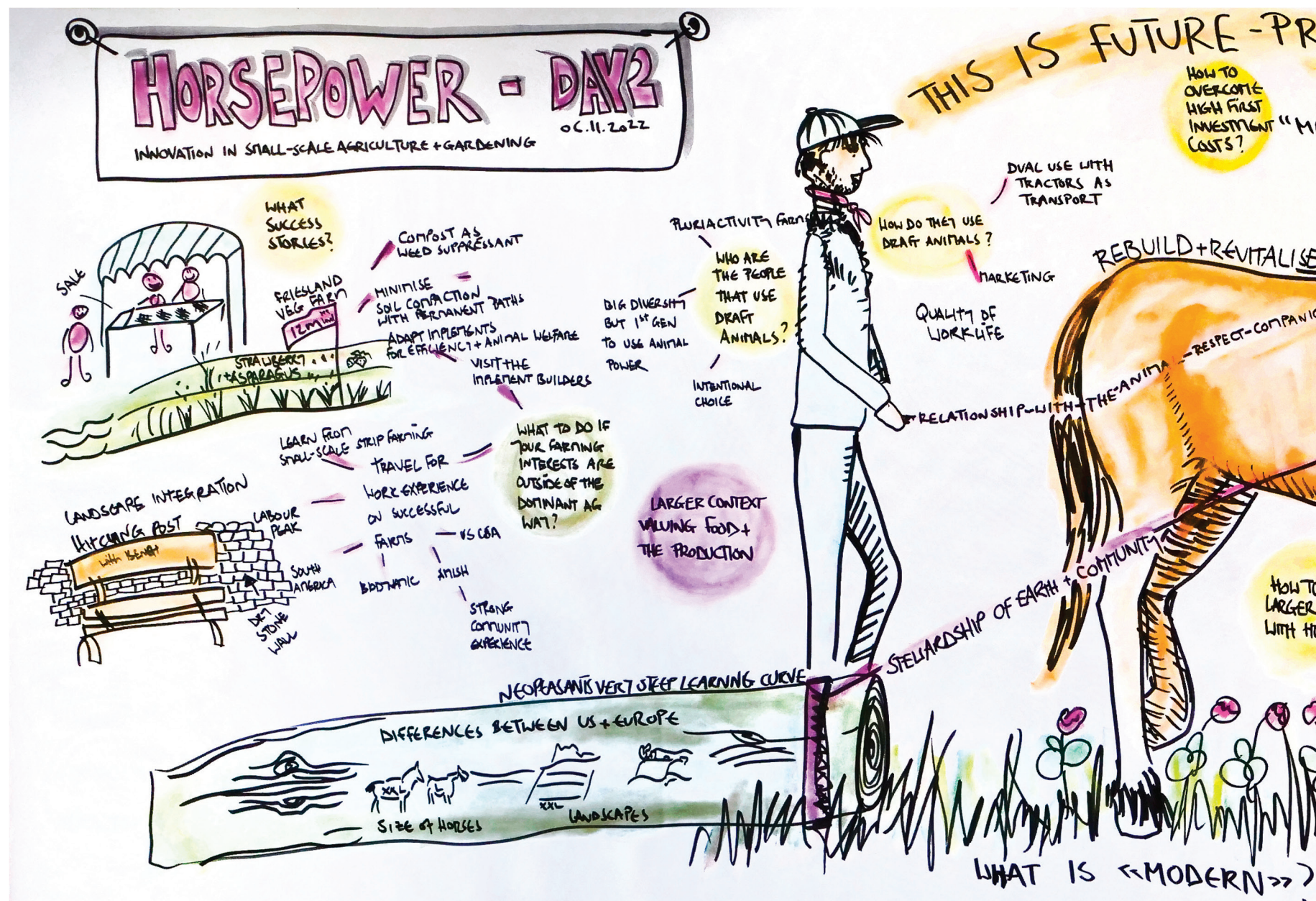
An in-line ripper for zone tillage can replace a moldboard plow. It disturbs a zone of soil about 6-8 inches wide, leaving the inter-row area undisturbed. Zone tillage improves water infiltration and soil health by reducing tillage intensity and conserving protective crop residues. The average ripper draft was one-half of the draft of the moldboard plow. Pre-tillage with a combination tillage tool at a shallow two-inch depth decreased the ripper draft by about 17%.

A low-crown, low-pitch sweeps for full-row root cuts at a shallow depth to improve weed control and ease the animal burden. The sweeps undercut weeds about two inches deep while lifting and shattering less soil than the old-style shovels. The new sweeps increased the effective root-cutting width by 20% while reducing the draft and the animal burden by 22%.

A spring tooth harrow breaks crusted soil, uproots small weeds and levels, and freshens a seedbed. We measured the pulling forces of a 23-tine harrow at two-inch and three-inch depths in sandy loam soil. The draft at two inches averaged 416 lbf and 625 lbf at the three-inch depth, a 50% increase in animal burden with no noticeable improvement in the quality of the seedbed.

Conserve your animals' energy by selecting, adjusting, and managing tillage implements for less intensive tillage. Ease their burden by 'going light and going often.' With empathy and attention to detail, they can accomplish a task with less effort or accomplish more work with the same effort.





Picture 2: Live graphic recording performed by Katy Fox during the 2nd symposium day.

### Assessing the adaptability and use of work horses to local environmental conditions in Colombia

Hugo S. Sanhueza Leal from Colombia has an MSc degree as Agronomist and is a member of the animal traction R&D group of the National University of Colombia in Medellin.

The role of draft horses is to provide power for agricultural production activities. A draft horse is an excellent source of power and a locally produced energy source for mechanizing the local small farming economy. Historically, the draft horse has a short presence in the region, since it was introduced approximately in the early 1920's in Chile. Very possibly, these horses were also introduced in the early 1900's in various countries of the Southern Cone, due to the influx of European colonists. The Andean region has limited experience in raising draft horses for farming.

Since the early 1980's, Chile has initiated a workhorse national breeding program, to support "traditional" small farming systems. At present, the program is being managed by the Chilean Ministry of Agriculture and the Army.

Horses are exposed to the demanding local environmental and geographical conditions. Poor quality soils mean poor quality pastures in the Andean region. The strategy calls for a breeding program to improve local "criollo" horses for light and medium heavy draft. Local mares can provide rusticity and heavy imported purebred stallions can provide size and temperament. A locally produced and reasonably sized draft animal is of approximately 600 to 700 kg and stands 1,60 m height. Local mares are selected for the best draft characteristics and rusticity. F1 and F2 horses are the most economical for small farmers. At some point in the breeding program, "criollo" blood is re-injected in selected F3/F4 mares.



