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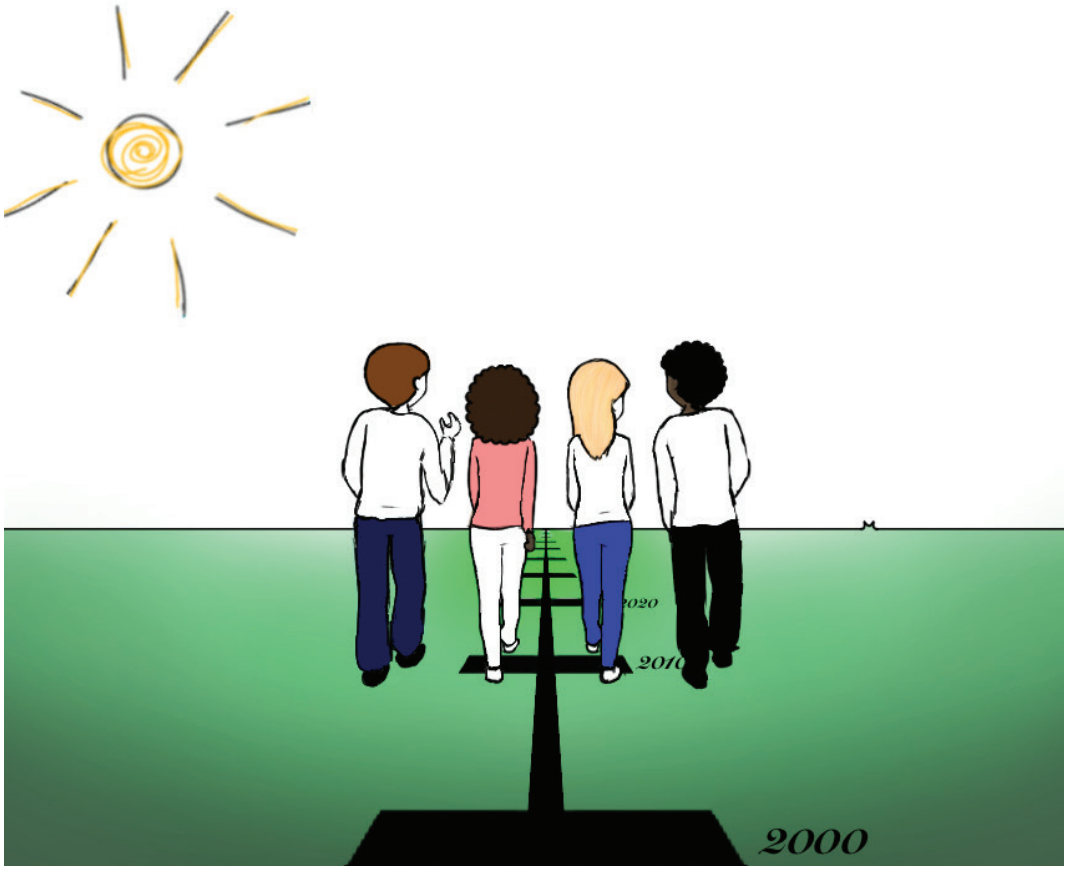

Agroecology in practice
Walking the talk

KARIN EKSVÄRD • GABRIELLA LÖNNGREN • MARGARITA CUADRA • CHARLES FRANCIS
BÖRJE JOHANSSON • STELLA NAMANJI • TORBJÖRN RYDBERG • CHARLES SSEKYEWA
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Reports Department of Urban and Rural Development • No. 1/2014

Rural**Development** Landscape**Architecture** Environmental**Communication** Nature**Interpretation**

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SLU

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Börje Johansson is an organic farmer running a small-scale dairy production together with his wife Helen. They have been widely involved in creating solutions for the farm to be part of a viable local community (www.hultabygden.se) in Sweden, and engaged in issues of developing a sustainable society. More on the farm and Hultabygden can be found in section 4 chapter 1.

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Stella is an economist with double Master of Economic Policy and Planning as well as Development Evaluation and Management. She is The Executive Director of the Centre for Ecosystems Research and Development (www.cerdug.org) as well as a Lecturer on Economics and Research methods and Facilitator of Agroecology educations at Uganda Martyrs University (www.umu.ac.ug). Her contribution is on coordination, collaboration, participation and implementation in the framework of a systemic approach to sustainable agro-ecosystems. Together with Charles, Stella will present thoughts on institutions in section 4 chapter 4.

Torbjörn Rydberg

Torbjörn is a PhD and Associate Professor in Crop production Science. He has been involved for almost 20 years in research and education in the field of Agroecology, Environmental Sciences, and Systems Ecology. The research approach is holistic interdisciplinary with the aim to develop understanding, methods of planning, designing, and quantitatively measuring sustainable patterns of human and ecological systems. He is a member of the Board of Directors of the International Society for the Advancement of Emergy Research (ISAER) (www.isaer.org). Meet Torbjörn and his experiences of teaching a qualitative understanding of the web of life in section 4 chapter 2.

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Abbreviations and glossary

Abbreviations and glossary as used in this text, and how the authors in this text interpret them.

ABIOTIC FACTOR A nonliving condition or thing, as climate or habitat, that influences or affects an ecosystem and the organisms in it.

AGROECOLOGY An integrative discipline that includes elements from agronomy, ecology, sociology and economics studying the interactions between plants, animals, humans and the environment within agricultural systems, also described as the ecology of food systems.

AGROECOPRAC Short for 'Agroecology in Practice', an education and training program at SLU, MU and UMU and funded by the international development agency in Sweden (Sida).

AGROECOSYSTEM An agricultural system, including humans, also understood as an agricultural ecosystem.

ANTHROPOCENTRISM Considering human beings as the most significant entity of the universe, and interpreting or regarding the world in terms of human values and experiences.

APPROACH A way of dealing with a situation or problem, here used for scientific methodology, meaning a set of methods, rules, or ideas that are important in a science or art, or a particular procedure or set of procedures.

AVAILABLE ENERGY Potential energy capable of doing work and being degraded in a process. This is also called exergy, units: calories, joules.

AXIOLOGY The study of the nature, types, and criteria of values and of value judgments. A sub-discipline of moral axiology dealing with structural and conceptual issues about value and value concepts.

BIOTIC FACTOR A living thing, as an animal or plant, that influences or affects an ecosystem.

BRICOLAGE See Institutional Bricolage.

CASE STUDY A situation in real life that can be looked at or studied to learn about the process and outcomes of human decisions in design of that activity.

CO-EVOLUTION Evolution involving successive changes in two or more ecologically interdependent species (as of a plant and its pollinators) that affect their interactions, but also the evolution of all systems, between species and its abiotic environment, at all scales over time.

CONSTRUCTIVISM A learning theory that suggests that humans construct knowledge and

meaning from their experiences.

CRITICAL OPINION When you criticize someone or something based on your own un-reflected preference.

CRITICAL THINKING A process of hunting assumptions – discovering what assumptions we and others hold, and then checking to see how much sense those assumptions make.

DUALISM The division of something conceptually into two opposed or contrasted aspects, or the state of being so divided: a dualism between human and nature.

EMERGENT QUALITIES OR PROPERTIES OF SYSTEMS A characteristic of a system that derives from the interaction of its parts and is not observable or inherent in the parts considered separately.

EMERGY Available energy of one kind previously required directly and indirectly to make a product or service, units: emjoules.

EMPIRICISM The view that experience, especially of the senses, is the only source of knowledge.

EMPOWER Emjoules/time.

ENERGY Anything that can be 100 percent converted to heat.

ENERGY TRANSFORMATION HIERARCHY Energy flows of the universe are organized in an energy transformation hierarchy. The position in the energy hierarchy is measured with transformities.

EPISTEMOLOGY A branch of philosophy which shows the nature, origin and scope of knowledge and how we know what we know, what we can know, how true is what we know is and how we can validate our knowledge.

EXTRINSIC VALUE Value given to something in relation to something else.

EXPERIENTIAL LEARNING Learning through action, by doing, through experience, discovery and exploration.

FACILITATOR A person that supports a group of people to collaborate well on their own learning process, development project and/or research.

FACIPULATION When a facilitator is trying to give the impression of only facilitating the collaboration and learning of others, but actually steers the process towards his or her own hidden agendas.

FLIPBOOK When computer documents are presented visually as books.

GDP Gross Domestic Product. This economic indicator measures the country's total output, including everything produced by all the people and all the companies in the country.

HEAT The collective motions of molecules, whose average intensity is the temperature that may be measured by expansion of matter in a thermometer.

IAD Institutional Analysis and Development. It is a methodology based on the notion that proper natural resource management requires a consideration of the 'Multiple governance tiers through which the meaning and implementation of policies are negotiated and transformed from the policy design stage until the arena where final resource users make decisions' (Clement, 2009:2).

ICT Information and Communications Technology. It is the study or business of developing and using technology to process information and aid communications.

INSTITUTIONAL BRICOLAGE This concept is used to suggest that mechanisms of resource management and collective action are borrowed as well as constructed from existing institutions, styles of thinking and sanctioned social relationship (Cleaver, 2002). In this case, community members are able to design institutions based on their social norms and this is participatory.

INSTRUMENTAL RATIONALITY The notion that nature's purpose is to be utilized by humans

INTRINSIC VALUE The acceptance that something is valuable for its own sake, un-compared with anything else at all.

KOLB'S LEARNING CYCLE A theoretical explanation of an experiential learning process.

MAXIMUM EMPOWER PRINCIPLE A suggested thermodynamic 4th law saying that over time, during self-organizing processes, network designs that maximize empower will prevail.

MECHANISTIC PARADIGM When nature is seen as distinct parts operating like a machine.

METHODOLOGY A set of methods, rules, or ideas that are important in a science or art: a particular procedure or set of procedures.

MU Mekelle University, Ethiopia.

NATURAL SCIENCE A branch of science that deals with the physical world through studying parts.

OMC Open Method of Coordination.

OPEN ENDED CASE A case study used for education that is not designed to exemplify a specific answer but is used for multiple learning processes.

OPEN SYSTEMS Systems interplaying with their context.

OPEN ENDED QUESTIONS Questions that can have multiple answers.

ONTOLOGY Scientific worldview.

PARADIGM A framework of a scientific discipline within which theories, laws, generalizations and the experiments performed in support of them are formulated.

PHENOMENOLOGY The study of structures of experience or consciousness.

PHILOSOPHY OF SCIENCE The assumptions, foundations, methods and implications of science used in different scientific paradigms.

PLAR Participatory Learning and Action Research.

R & D Research and Development.

REAL WEALTH Wealth as natural and social resources. Real wealth includes both work contributed by environmental systems and that contributed by humans. Emergy measure real wealth, money only measures what people are willing to pay for goods and services.

RICH PICTURE A picture that in some way shows the connectivity within a system and with it's context.

RME Rapeseed Methyl Ester also known as biodiesel.

SWOT Situation analysis in which internal strengths and weaknesses of an organization, and external opportunities and threats faced by it are closely examined to chart a strategy. SWOT stands for strengths, weaknesses, opportunities, and threats.

SELF-ORGANIZATION The organization of ordered structures, and their relationships, that emerges on all system levels if the energy quality and quantity to support that process is available, i.e. galaxies, planets, ecosystems and living cells.

SCIENTISM Science as authoritative source of knowledge.

SLU Swedish University of Agricultural Sciences.

SYSTEMIC THEORY Starts out form a world view of connectivity, including humans and the observer, and studies systems as open.

SYSTEMS THEORY Focus is put on the boundaries of a defined system and systems thinking is used as a method.

SYSTEMIC TRANSITIONS Transition processes analyzed or created from a systemic worldview.

TECHNOLOGICAL UTOPIANISM Count on technology to solve societal problems.

THERMODYNAMIC Characteristics of energy and the conversion to heat .

TRANSDISCIPLINARITY When power is shared between different actors from different professions working together and contributing with their experiences, knowledge and skills.

TRANSFORMITY Emergy per unit available energy, units: emjoule per joule.

UMU Uganda Martyrs University.

USEFUL ENERGY Available energy used to increase system production and efficiency.

WALK THE TALK Acting according to what you claim and say.

SECTION 1
Introduction

'We cannot solve our problems with the same thinking we used when we created them'

Albert Einstein

The need for humans to act in ways that strengthen life on planet earth has never been more acute, and today a large and growing proportion of humankind recognizes this. To start transitions toward improvement of the current situation it is essential to seek out the root causes to the social and environmental challenges we face. If the generations already born are to inherit a viable future we need to act for a long-term sustainability that covers all aspects of modern life. This has been internationally recognized since the Brundtland report from the U.N. (UN 1987).

If you choose to immerse in this publication, it will take you on an agroecological journey where our aim is to share an understanding of the essential transitions toward sustainability, based on a systemic theory, a systemic approach and experiences in practice. We hope that you read with a critical and open mind, and in the process decide on your own truths and opinions. We invite you to join in our immersion in agroecology through the stories shared by agro-ecologists from several countries who are doing their best in 'walking their talk'.[1]

IN DEPTH

The difference between critical opinions and critical thinking:

- Critical opinion is when you criticize someone or something based on your own un-reflected preference.
- 'Critical thinking is a process of hunting assumptions – discovering what assumptions we and others hold, and then checking to see how much sense those assumptions make'

S. D. Brookfield

1 'Walk the talk', meaning acting according to what you claim and say, to practise what you preach.

What we present may be perceived as nothing new, as the basic content probably is familiar to everyone. It is the application of the concepts and strategies and their combination in areas usually restricted to other ways of experiencing and interpreting the world that is the contribution of this report/book. If you are traditionally trained in formal science, what is shared here contains a paradigm shift that might take some time and reflection that compose deep learning. It takes training, not only education. As Groot & Maarleveld (2000) describe critically assessing the own learning process:

> Extensive research on the difficulties of double loop learning shows that early in life we seem to have learned rules and behaviour that prevent us from questioning our basic assumptions and beliefs. We typically use strategies like saving face, avoiding losing and suppressing emotions. People seem to act in ways that prevent them from learning about discrepancies between their intentions and actions and thus their learning behaviour remains unchanged..

All of the authors of this publication have in different ways had to put our guards down to question our own basic assumptions. We continue to foster the need to be patient with our own learning, un-learning and re-learning and appreciate the challenges of communicating with colleagues and other citizens who have different worldviews.

In this world of interacting processes of wind, rain, volcanoes, cities … among humans and other life forms, we see agroecology as a rich dynamic 'web' of integrating and interacting energy flows through plants, humans, animals, air, water, soil… everything on Earth that can be included in the agricultural and food system. As humans are part of this web, we include actions and collaboration with humans and other elements, as well as designing institutions, policies and strategies affecting the food system. Agroecology includes natural systems as well as the human activity systems forming our agricultural and food production. One definition of agroecology is the ecology of food systems (Francis et al., 2003), as this includes the production, economics, environmental impacts, and social dimensions of the food system and its interactions with the surrounding nature and society.

In this publication you will find a section (section 2) that provide an impression and overview of what agroecology can be, a description of the shifts of paradigm experienced by the authors and the philosophy of science that is the foundation of our reasoning (section 3). There are chapters where agroecologists give their views on needed transitions and how they personally 'walk the talk' of agroecology (section 4). We conclude with an analysis of the different sections and chapters and then reflect on the future (section 5).

We have written this publication based on working together in agroecological projects at different times. We have been using systemic approaches as teachers, facilitators, academics, researchers and farmers. Out of our individual and collective experiences from Uganda, Sweden, U.S.A., Nicaragua, Ethiopia and Norway, we have arrived at the conclusion that systemic approaches including collaboration and social learning, through teamwork based on equality, make long-term sustainable improvements possible. Although circumstances differ widely in different parts of the world, and agroecologists respect the uniqueness of place and context, we see the same basic worldwide needs – such as people working together as equals contributing with their experiences, knowledge, skills and potentials for visioning to improve the current situation. We owe no less to future generations.

Please enjoy!

Karin, Gabriella, Börje, Charles F, Margarita, Stella, Charles S, Torbjörn, Charlott & Lennart

SECTION 2
First impressions

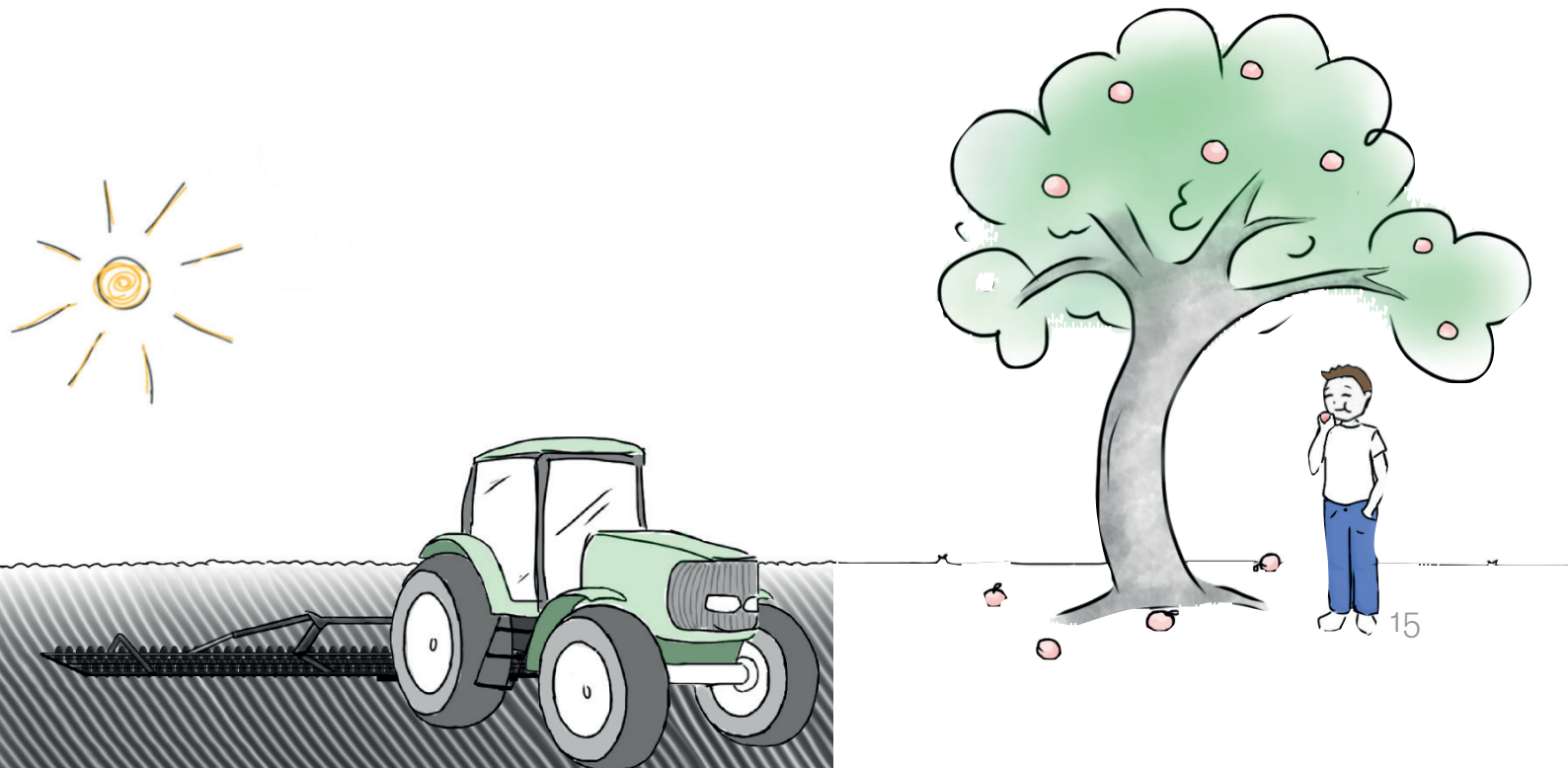
To begin the agroecological journey, this section provides an opportunity to gain insights during the quest toward understanding the approach to agroecology presented in this publication. The four examples presented may be considered in sequence, since each one serves the next in order.

Wombat – Everything is connected

Please watch the Foundation for Global Community's one minute sustainability education:
http://www.globalcommunity.org/flash/wombat.shtml

Life – An energy concept

Please compare the pictures below considering the energy source, form, effectiveness and sustainability and what these concepts may include.



Agriculture – A farm for the future

Please watch the BBC TV program A farm for the future:
http://topdocumentaryfilms.com/farm-for-the-future/

Collaboration – Participatory Rural Appraisal / Participatory Learning and Action (PRA/PLA)

Please watch the first 24 minutes of PRA Techniques NIRDLectures:
http://www.youtube.com/watch?v=hry68YiUrHs

SECTION 3
The very basics

What's new? Actually the concepts presented in this publication are as old as life. What could be considered different is the conscious application of them in farming, extension, formal development and academics.

Today, the human conscious understanding has grown about the complex connectivity of life. Examples as when DDT having been used at the equator is found near the North Pole, have helped build a global understanding that things are connected. Everybody in their daily lives is familiar with the connectivity of life, and uses systemic thinking to handle complexity, whether aware of this or not. It is not possible to survive without this capacity. But, really *understanding* how for example the interactions of water, soil, air, seed and light make possible the germination of grass, enables appreciation to grow about how the energy flows from the sun together with the tides and heat sources from inside the earth, provide possibilities for co-evolution of the biotic and abiotic factors. The factors that create ever increasing qualities of new emergent properties. In the same way, musicians and their instruments can in a creative way start to make yet unheard music that emerge and fill the entire room. Such consequences may be expected or not, but they are a result of unique combinations of interacting elements brought together in the appropriate context. This is similar to the specific adaptation of agroecosystems and agroecological thinking.

IN DEPTH

Emergent qualities or properties of systems – qualities that manifest themselves once all of the component parts of the system are organized (Gliessman, 2004). The fact that bricks, cement and work not only can become a wall, but also shelter, a defined space, a base for graffiti painting and echo, represent new qualities emerging from those of stone and 'glue'. We need mathematics well capable of handling such matters. An example of where such mathematics is being developed can be studied in Giannantoni (2002).

Furthermore, nothing new is presented about learning. It is today well known that learning is an internal process, deepened by practical experience and improved by relevance and collaboration. Though the 'transfer of knowledge' description of learning is

still widely used, it is known not to be an adequate explanation of how learning takes place.

Finally, it is accepted knowledge that how we as humans put value on things and processes have impact on what is possible of seeing, understanding, doing, and thinking as well as how to react. This means that when something is valued the reflection of the own values and not necessarily how the reality actually is, is seen. Also, for sustainability, it is not a question of whether matter is considered valuable or not, it is a question of where and in what form it fits into the interactions of the system.

This is common sense.

Approaches to science

To understand and come to terms with the environmental problems of today, Gobbie (2011) describes how modern researchers and society use science as an authoritative source of knowledge (scientism), count on technology to solve societal problems (technological utopianism) and see nature as distinct parts, operating like a machine (mechanistic paradigm). Further, many believe that true knowledge comes from observation only (empiricism), begins with the premise that humans are separated from nature (dualism) and represents the most important and advanced living creature (anthropocentrism), and that, that is why nature's resourses and purpose are to be utilized and even exploited by humans (instrumental rationality). Although this might sound extreme, looking at the very basics of two of today's most used paradigms, Natural Science and Constructivism, these are large parts of current human belief.

Simply put, all science is 'formed by assumptions about how the world is constructed (ontology), how knowledge is gained (epistemology) and the values and value judgments that are held to be relevant to it (axiology)' (Eksvärd, 2009, p. 29). Traditionally natural science depends on a single paradigm, while social sciences are poly-paradigmatic (Gilje & Grimen, 2004, p. 108). Here constructivism is used as an illustrative example of a social science paradigm. These approaches are explained in the boxes on page 19 and 20.

Both these approaches to science have their strengths, but they have not been developed to deal with the problematic and complex situations of present times. They were never meant to deal with the multi-dimensional challenges that are faced today and that society urgently needs to come to terms with. Neither really includes humans as components of the natural systems but each is based on dualism and separation.

As all philosophies of science are models describing the world, refinements may be needed whenever the model does not work well or new knowledge has been gained. The authors in this publication have looked deeper into the different paradigms to find what parts in the different philosophies of science that are aligned with what is today understood about how the world is connected. These parts have been re-structured, developed and added to, in search of a starting point for a scientific approach that deals well with the issues of sustainable development and studies of open systems.

A Systemic Philosophy of Science (see the box on page 21) includes that to come to terms with the problems of today, knowledge is needed from all types of professions, in order to deal with the effects of human action in its dynamic connectivity with nature. This also puts

trust in the truths of experience, starting out by considering human beings as one integrated part of nature (see figure 3). This means accepting that just as other species, humans are co-evolving with their surroundings, and a changing attitude of asking what to contribute with to the system, instead of what to gain from the 'environment', could be a more sustainable and productive strategy. Working as an agroecologist in line with this philosophy requires learning new thinking, approaches and methods, but also an unlearning of some behaviors, knowledge and pre-assumptions. It will furthermore call for re-modeling of institutions, including those involving formal collaboration and research.

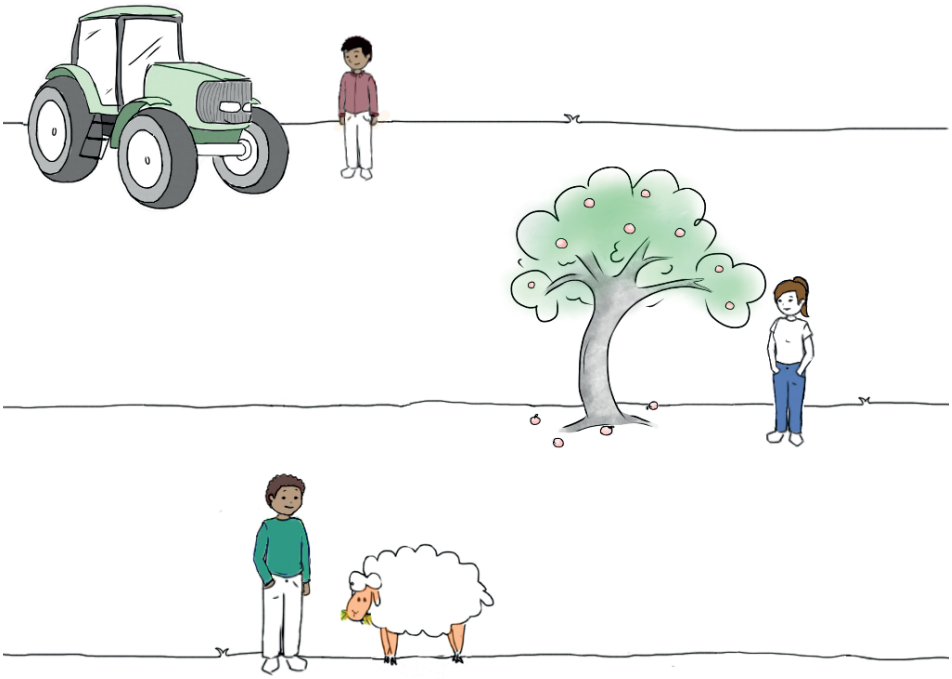


FIGURE 1. TRADITIONAL REDUCTIONIST NATURAL SCIENCE EXPERTS STUDY THEIR FIELD OF INTEREST RESPECTIVELY, AND THEN ADD THEM TOGETHER.

Natural science

WORLDVIEW (ONTOLOGY): The world is made of parts, put together working in a mechanistic way.

VIEW ON LEARNING (EPISTEMOLOGY): Knowledge is gained through studying the parts.

VIEW OF VALUES AND VALUE JUDGMENTS (AXIOLOGY): Not given, since values and value judgments are not considered to have anything to do with science.

According to the Natural Science mechanistic worldview the correct way to learn about something is to study one piece at the time as in figure 1, and then add the gained information together.

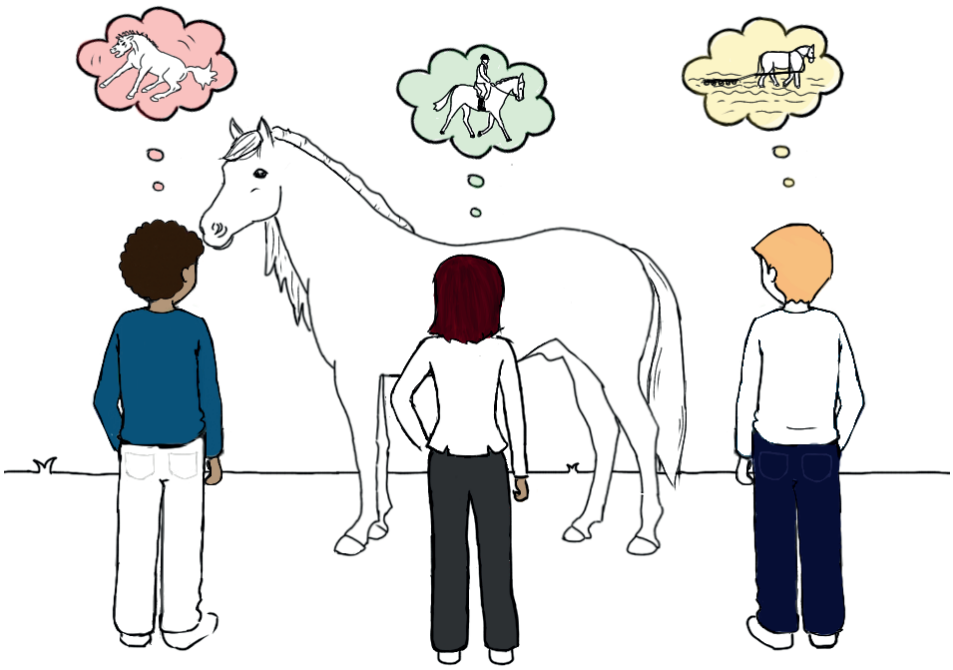


FIGURE 2. A HORSE AND DIFFERENTLY CONSTRUCTED PERSPECTIVES OF IT.

Constructivism

WORLDVIEW (ONTOLOGY): Not given, since those advocating constructivism say that the epistemology claims that the observer constructs the world.

VIEW ON LEARNING (EPISTEMOLOGY): What knowledge is gained depends on the perspective of the observer that through learning constructs their own knowledge and understanding of the world.

VIEW OF VALUES AND VALUE JUDGMENTS (AXIOLOGY): This depends on perspective, and extrinsic values are valid, i.e. values are given by the human perception.

As the Constructivism approach claims that knowledge is created by the observer, as in figure 2, no objective reality exists.

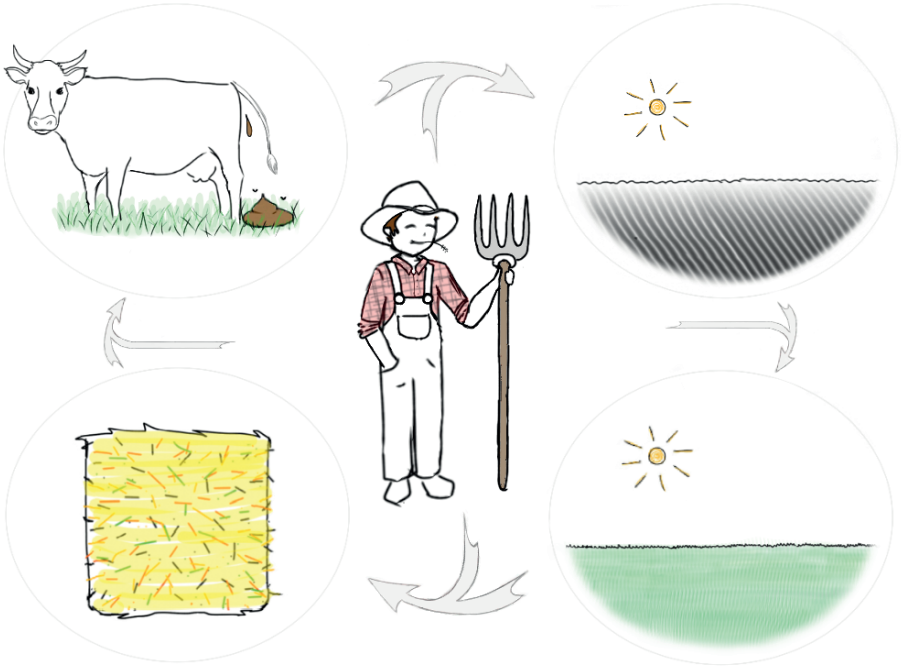


FIGURE 3: THE FARMER AS AN INTEGRATED PART OF THE CO-EVOLVING OPEN FARM SYSTEM

Systemic philosophy of science

WORLDVIEW (ONTOLOGY): Everything that exists is dependent on the energy flowing through the system, and has impact on, and is impacted by other things that exist as well as by unpredictable new events that take place (for example through human creativity). This means that all is connected, 'communicating' with other elements and that the world self-organizes and its components co-evolve.

VIEW ON LEARNING (EPISTEMOLOGY): New knowledge is gained through studying whole systems and the parts. It is improved by collaboration and experience, and is an internal process where both learning and unlearning takes place.

VIEW OF VALUES AND VALUE JUDGMENTS (AXIOLOGY): As all biotic and abiotic factors and functions in the planet's natural system are connected, all also have intrinsic value, non-dependent on people's preferences. Also, the partial understandings individuals hold of a full system are equally important to get a more complete picture of the system.

READ MORE

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The next section includes chapters written by individuals working with different aspects of agroecology and dealing with the challenges and possibilities of starting off from this exciting new base. The authors present how they 'walk the talk', that is practise the agroecological theory in their individual fields.

SECTION 4
Personal experiences

4.1 A farm as a part of a sustainable society system
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4.1 A farm as a part of a sustainable society system

By Börje Johansson

About the author

Börje is an organic farmer running a small-scale dairy production together with his wife. They have been widely involved in creating solutions for the farm to be part of a viable local community and engaged in issues of developing a sustainable society.
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Introduction

Small-scale farming in different parts of the world varies dramatically in size and type of production. Therefore, when reading this chapter, it is important for the reader not to get stuck on the size of the acreage or numbers of cows, but to remember that in the Swedish climate and agricultural context of today this example of dairy production is really small scale.

Hulta Norrgård is an organic dairy farm 30 km south of Linköping, Sweden. 18 dairy cows with calves, 25 sheep with lambs, a couple of ducks, some poultry, dogs and cats all contribute to the production and the functions of the farm. The farm is situated in an area characterized by its mixture of forest, grazing areas and fields at the edge of the large flatlands to the north. It has 40 ha of fields for crop production, 25 ha of pasture and 30 ha of forest. The milk production is about 7 000 kg per cow per year.

The farm 'Hulta Norrgård' has been run by Börje (husband) and Helen (wife) Johansson from 1981 until today, both working full time on the farm. They have just recently retired and the farming has been taken over by the son. This chapter tells the story of Börje and Helen's choice to contribute to a sustainable society through the development of the farm production and livelihood.

This is how Börje, tells their story:

The start and strategy

My father was getting old and needed support with the family farm. I was working as an electrical engineer at the time, but did not want to see farms being shut down and cows disappearing from the landscape. Also, I did not want to become a 'moonlight-farmer', the farmers that have other jobs during the day and then try to keep the farm going during nights and weekends. We decided to try the farming and that I be 'moonlight-electrician' if needed. This gave us the financial security of daring to go for being small-scale farmers. We knew that if it did not work out, we still could earn money. But I have never had to. We have both worked full time on the farm with no other source of income.

Our whole society is focused on large-scale farming for profit making. We had agricultural economists visiting us and they would not believe that we did not have other sources of income. If we did not do other types of work then we had to have stocks or other property…. They are wrong. We have lived well and raised a family on this farm. We have worked to be self-sufficient and to keep costs down. Big machinery, technical solutions and buying and transporting fodder are costly. We take good care of and repair the machinery we have and rather stay with older versions aligned with small-scale farms and we stay with the number of cows we can produce feed for. We have also stayed away from loans, saving before investing rather then paying twice afterwards.

Also, having both parents working on the home farm, I believe has had an impact on our children. Not that I have had a lot of time for them, but they have known well what we have been doing at work. A farm is a miniature society, you can't just 'get', you have to contribute. Those are things I learnt growing up here, and I believe they have too.

Organic farming

When the KRAV organization (a Swedish organic farming standard organization) was started, we formally became organic farmers. This was 1989. It gave a model and guidelines to use, though I have always said that the organic agriculture needs to be developed just as well. At about this time, was also when the governmental drive to abandon 'unproductive farmland' was in swing. I thought that was crazy! Give up farmland because it did not fit large-scale and resource consuming farming! No, we saw the organic farming as a way forward where the farm actually is a producer, not an industrial plant where purchased external resources are transformed to food. A farm shouldn't just transform inputs, it should be a real producer of inputs to society.

The local society 'Kretsloppsföreningen'

As an organic farm we made a nutrient budget of our farm. As we wanted to be as self-sufficient as possible we looked for other solutions than buying fertilizers to compensate for our losses. The amount we needed was equivalent to what the excrements of 200 humans contain yearly. That is about the same number of non-farming people who live in our village. This gave the spark to start the 'Kretsloppsföreningen', our local society to support the cycles of nature. In the beginning we collected the sewage sludge from the three compartment septic tanks but those are not built for collecting nutrients and it did not work out well. So we started with urine separating toilets. Together we were able to get funds through an application to install such toilets in 18 households. The urine, which is enough to feritilize 2 ha of fields, goes directly to fields while the faeces that are flushed with water, first are dehydrated and then composted. In the end it is less than one load in the manure wagon.

The problem with the organic certification system in the EU is that organic farmers are not allowed to use human excrements. So today, a neighbor conventional farmer uses these resources!

This society has started other activities too. Villagers subscribe to rows of potatoes from us. We do the pre-work getting the potatoes in the soil, they do the weeding, and pick the potatoes at harvest time. They learn about farming, see the connection of weeds and yield

and understand that the same amount of work and rent gives different yields different years. When deciding on what potatoes to grow, we all met and prepared different dishes from different varieties of potatoes! Otherwise today when you order potato tubers you are only asked about technical aspects. This time we chose from cooking quality.

We also used to sell milk straight from the tank to villagers, but we had to decide to stop that due to the risk of EHEC bacteria. The risk is so small, it probably would not happen, but authorities take it really seriously and if something would happen after someone had consumed un-pasteurized milk sold by us, we would be responsible. At first we just informed people about the risk, but then we realized we needed to stop.

This organization has given so many bonus effects on the social side. It has become a district society engaging in local communication possibilities, school issues and many other things. People come to the meetings and engage in the work.

Energy

Wanting to be self-sufficient we have thought about the energy issue a lot, both us as farmers, and in the local society 'Kretsloppsföreningen'. Growing oilseed rape and producing RME would work nicely for a dairy farm. You can produce the fuel for the tractor and rape-cake fodder for the cows, but that as well as biogas production takes a lot of resources (in cold climates) and continuous work. It also takes acreage to produce the organic material. The local society discussed setting up a windmill. One not very big windmill would give enough energy for the whole community. But we can't do that here due to the proximity to the airforce base. At the farm we have settled for solar panels for electricity. Today 2/3 of our barn roof is covered with solar panels and they produce all the electricity we need. We have also constructed them such that they pre-heat the air used for drying hay, reduce the noise from the hay-drying fan, and this construction in turn cools the electricity panels making them more effective!

If we could have many such small-scale electricity producers we would have such a strong production system. What is so great with the solar electricity production is that it takes no acreage from production, the infrastructure is already there, after installing it takes very little resources and work to maintain and the surplus production can be sold.

At the moment we use about $3m^3$ of oil per year for the machinery. I have counted that the last 1/3 of the roof would give the same amount of energy. I'm thinking about trying to re-construct an old tractor to see if we can have it run on electricity. Using electricity as a major on-farm resource would need a bit of new technology development. As batteries are a problem, much of the heavy work would need to be done at the farm and not in the fields. For example, in our case the silage chopping can be done in the yard and instead of in the field.

The importance of small-scale farmers and collaboration

Our work with the local society has also showed the importance of having viable farms in the community. Farms are like the central node, where people work locally and it contributes with important functions for the local society. Large-scale farms cannot adapt to the needs of the local community as easily as small-scale farms. Farmers keep the rural areas

alive, and of course, we need the local people living here. More small-scale farms would bring higher status to the rural areas, being able to provide local services.

Also, we have taken part in collaborations with other farmers and researchers in a Participatory Learning and Action Research group working on climate change strategies for farmers. A study on our farm showed that even though we tried so hard to be self-sufficient, we still rely heavily on resources from other areas. It is quite clear that Swedish production systems rely on inputs from other countries and that it is because of them we can rely so heavily on machinery. This is also a reason to become more self-sufficient.

Ending with satisfaction

We have shown that it is possible to stay small-scale as a farmer in Sweden today if you do not buy into all the large-scale solutions. Together with the local society we have also shown that it would be possible to live in this area in a local production system. The thing is, it wouldn't be difficult! We have shown that. It is quite possible to circulate nutrients here, produce the energy we need and live off the local food production of the area!

Our son is taking over now. He chose to take up the farming after having had another profession. We will see how he develops this place. It is all part of a sustainable development.

READ MORE

Hallbara_HultabygdenENG.ppt www.hultabygden.se/dokument/. (In English)

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4.2 From a quantitative mechanistic system perspective to a qualitative understanding of the web of life

By Torbjörn Rydberg

About the author

Torbjörn, has a PhD and is an Associate Professor in Crop Production Science. He has been involved for almost 20 years in research and education in the field of Agroecology, Environmental Sciences, and Systems Ecology. The research approach is holistic interdisciplinary with the aim to develop understanding, methods of planning, designing, and quantitatively measuring sustainable patterns of human and ecological systems. He is an elected member of the Board of Directors of the International Society for the Advancement of Emergy Research (ISAER). Together with his family he also runs a small-scale farm.
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Introduction

My priority interests during my period as a teacher and researcher have been open systems, such as ecosystems, agricultural systems, energy systems or economic systems and their combinations. I am interested in how they self-organize and develop, and what kind of theory is needed in order to understand them.

I will start this essay by giving examples on how I introduce fundamental concepts of self-organizing systems to students that are new into this discipline. I do this by asking questions they usually have not thought about before like: Who eats the sunlight? Why doesn't a tractor crank up with a hay bale in front of it? Forgetting where you hid almost all of your food reserve, can that be effective?

These questions lead into discussions that in a simple way exemplify how self-organizing open systems, like our ecological and social systems, work. If we use traditional natural science language these issues are almost impossible to explain, but by using everyday examples not reflected on, it is possible to create an understanding of why we are faced with the problems of sustainability. Through using plain questions, pictures and real life experiences that are familiar to the students yet a bit intriguing, it has also been possible for the students to put the 'spectacles' of the analytical mechanistic worldview aside and look at the situations afresh.

In this chapter I will both share discussions of the questions and pictures as well as the theoretical principles they build on.

The concepts here presented are few, but they are very important fundamental principles for self-organizing systems. First I will introduce a change of system view from a mecha-

nistic engineering one to an open systems perspective. This includes viewing the world as one system full of processes interdependent upon each other. The processes are operating on different time scales as well as upon different spatial scales and they are very different in size, compare for example galaxies and bacteria. The fundamental concepts I am talking about are:

1. Energy transformation, energy quality and energy hierarchical organization
2. Maximum empower

These have great consequences upon how we measure and evaluate systems performance such as productivity and efficiency. The theory behind is the thermodynamics presented in the 'in depth' box. They are basic concepts needed to understand sustainable development of open systems that include inherent unique qualities and where intra- and interconnectedness are highly complex as in any ecosystem. Suggested readings for further studies are given at the end of this chapter.

IN DEPTH

The first three thermodynamic principles described below correspond to a utilization perspective by humans. They are oriented toward obtaining maximum efficient results from all processes and are formulated according to an anthropocentric worldview. That all processes have their bases in properties of the surrounding environment is not considered.

In strong contrast to this we have the donor side approach, the fourth and the fifth thermodynamic principles. These principles are said to have a donor-based approach because of the fact that they are fundamentally centered on the surrounding environment as a donor. The environment is not only a donor of physical resources but foremost among already emerged properties giving new emerging qualities.

The maximum empower principle can be understood as a tendency principle that asserts the existence of an emerging quality that is associated with the generative processes in nature. The traditional thermodynamic principles on the other hand, state a description of the same processes, but without considering the associated quality. They can only describe resource flows and never give rise to new qualities.

Explanation on thermodynamics – Laws 0 – 5

Energy definitions and concepts – a user side approach

Zero law: If two systems are both in thermal equilibrium with a third system then they are in thermal equilibrium with each other. This law helps define the notion of temperature.

First law: Energy is neither created nor destroyed in circulation and transformations in a system. Energy is conserved as a consequence of its definition that energy can be defined as anything that can be 100% converted to heat. Heat is motion of molecules.

Second law: Concentrations of available energy are continuously degraded. The degradation of available energy occurs in any energy transformation process. Available energy (exergy) is potential energy capable of doing work but degraded in any process.

Third law: As the heat content approaches zero, the temperature measured in Kelvin scale approaches an absolute zero. At temperature zero molecules are in simple crystalline state, and the entropy of the state is defined as zero.

Network energy concepts – a donor side approach

Suggested Fourth law: Over time, during self-organizing processes, network designs that maximize empower will prevail.

Suggested Fifth Law: Energy flows of the universe are organized in an energy transformation hierarchy. The position in the energy hierarchy is measured with transformities.

Energy hierarchy – A day at the beach

The energy problem, a matter of quality?

The sun sends 10,000 times more energy to the earth in comparison with the total global consumption of non-renewable energy on a yearly basis. The total solar energy absorbed by Earth's atmosphere, oceans and landmasses is approximately 3,85 (10^{24}) J per year. If we could capture less than 0.02% of the solar beams reaching our planet it would be enough to meet the current energy needs. So why are we talking about an energy crises? Is it not only a technology issue? No, it is not but we will come back to that later.

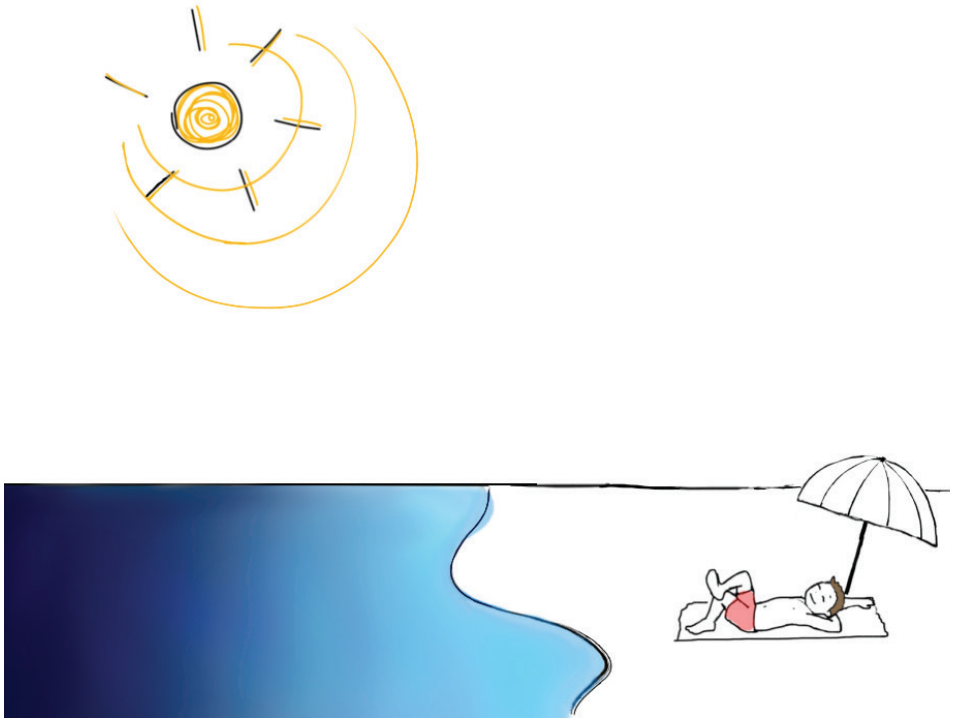

FIGURE 1. A DAY AT THE BEACH

One of the problems can be exemplified by the fact that I can spend all my time in the sunlight and no matter how much energy I receive on my body I will starve and die if I do not eat. I need food. If we only count the energy of inflowing solar energy measured in joules that my body receives and the energy in the form of heat that my body emits there shouldn't be a problem. This raises the question: is a joule a good enough measurement to describe energy? Are there no differences between the joules? My body clearly tells me there is a difference between different kinds of joules in the solar radiation and the ones in my diet.

Another question of concern is also if I'm not able to eat the sunlight – who is eating the sunlight and who is able to digest solar energy? A first answer would be that the plants are eating the sunlight. That is what is taught in school. This is true, but the answer is much more complex than that. On a global scale on a yearly basis the net photosynthetic efficiency on all land and sea beneath the atmosphere is 0.1% of total solar energy reaching the biosphere surface. For forests the annual general average is 1%, and for cereal crops with good farming practices in temperate climate and measured during the growing season only, the efficiency could be 3% of the total. This low number can be explained by the fact that most of the solar spectrum consists of photons that are either of too low energy or too high energy to be photosynthetically active. In theory the optimum efficiency rate at 16%. Under very favorable conditions in laboratory settings where conditions are optimized a utilization of the solar energy has reached about 8-9%.

But let us go back. We understand that a lot of energy is reaching the surface of the planet Earth. The living system on Earth is a result of billions of years of self-organization. The entire surface of the Earth is a solar collector, which also includes the oceans. These developed and still developing surfaces have the capacity to collect and transform both invisible and visible light from the sun.

To start with, the sunbeams heat the top layer of the water that evaporates from the oceans and lakes. Thereafter the air loaded with moisture is moved by the force of the wind, which in turn is created by the uneven distribution of sun radiation over the planet. The moisture loaded air moves into new areas where it can condense as clouds and become rain.

What we have seen is that the energy quality of solar radiation has changed into kinetic (motion) energy of flowing fluid, so the dilute solar beams have become concentrated and transformed. Concentrated heat makes the air rise and this drives the circulation of the air. This process seems to be the result of a long time period of self-organization. More than seventy percent of the Earth's surface is ocean. The oceans utilize the solar energy and make atmospheric vapor, and later on this water is distributed over land as rain that transports and dissolves material and nutrients and feeds the growing plants. This means the plants are fed by solar energy in many different forms through the wind for the evapotranspiration process, through the water that comes in a quality that the plants are able to utilize, and so on.

The energy hierarchy

The energies of different kinds have different abilities to support the different processes in the geo-biosphere. Energy in the form of solar beams needs to be transformed in several transformation processes before we can have it in a form that is digestible for humans as shown. Each time energy is transformed a large portion of the energy is converted to heat that is not able to do any more work (figure 2c). The amount of energy that is now available

to be transformed is less in numbers of joules but of another quality and is able to feed into other types of processes.

When we look at the energy transformations (figure 2) we see that they are connected in series. The organization of these transformation series is described as hierarchies, in figure 2 illustrated from the left to the right. The outputs from one transformation are the input to the next 'level'. As a portion of the energy transformed to the new level is used for feedback mechanisms of the earlier level that portion can be said to be an amplifier to the earlier level. These feedback loops can interact and control the input.

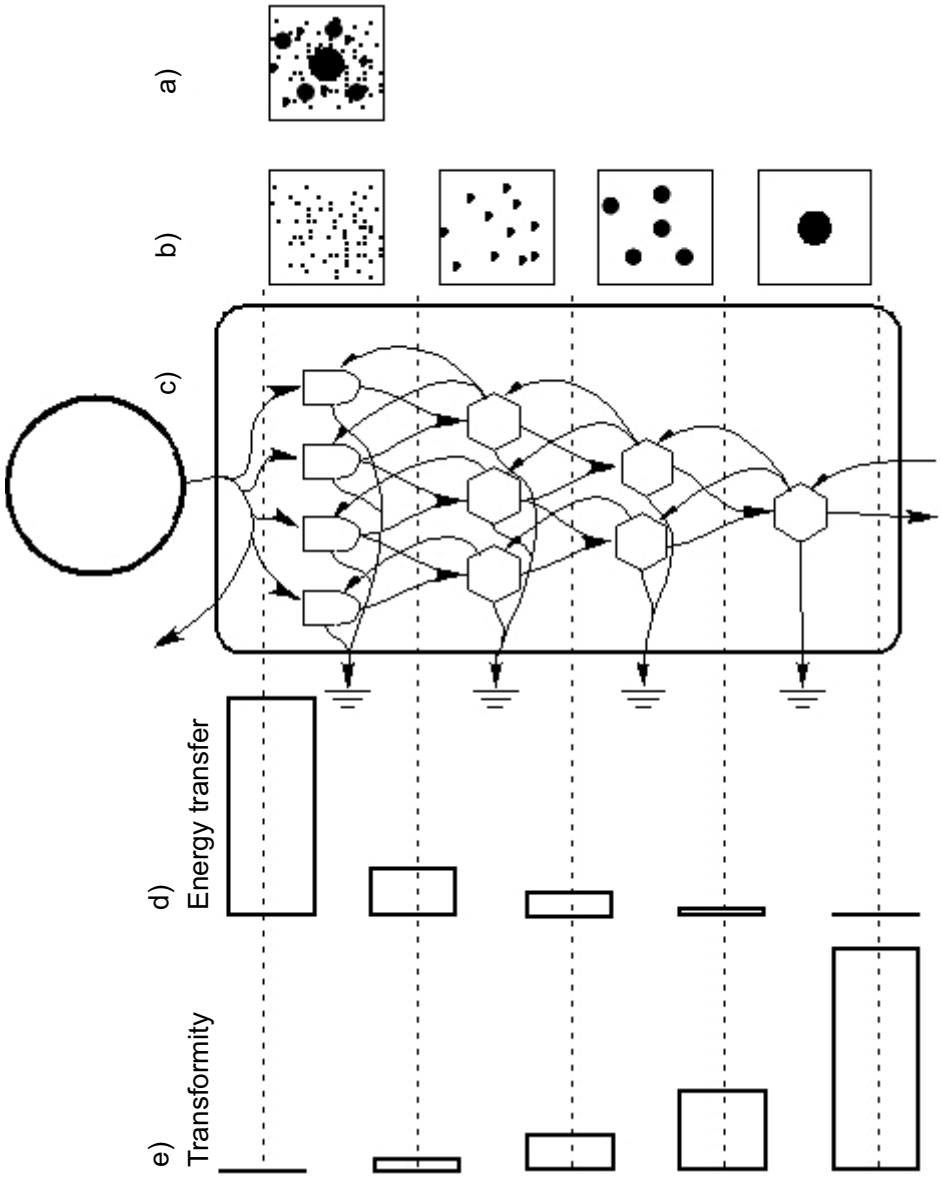

FIGURE 2. ENERGY TRANSFORMATION HIERARCHY. a) SELF-ORGANIZING UNITS VIEWED TOGETHER. b) UNITS SEPARATED BY SCALE, SHOWING TERRITORY AND SIZE OF CENTERS. c) ENERGY NETWORK DIAGRAM OF TRANSFORMATIONS AND FEEDBACKS. d) BAR GRAPH OF THE ENERGY FLOWS FOR THE LEVELS IN ENERGY HIERARCHY. e) BAR GRAPH OF TRANSFORMITIES. AFTER ODUM (1996).

Example on feedback mechanism

When a sheep grazes it does not only consume the grass it also contributes with 'feedback' on the grassland system and its plants. The sheep create a pulse in the growing cycle of the grass, which amplifies the grass production. They feed back manure to the soil that amplifies several macro organisms, insects and soil micro organisms. They contribute to the spreading of seeds in the landscape which also amplify the production of the plants.

An example could be the solar energy entering the system, transformed by plants, eaten by sheep, managed by a farmer or eaten by a wolf, interacting with surrounding systems.

In modern agriculture solar energy, wind energy, water energy, nutrient energy, soil energy, labor energy, machinery energy, and knowledge energy are used and transformed in crop production to get new products and functions that are typical for the specific plants. The needed energies that drive the plant processes all come from different levels in the universal energy hierarchy.

When energies of different kinds generated from different levels in the energy hierarchy are to be compared, or we need to combine and account them, they all need to be measured by the same unit. As we learned earlier in this chapter, the joule as used today does not work, as it doesn't consider the position in the energy hierarchy and therefore does not express the unique ability to do work in a specific work process. Therefore a new unit was defined called emergy (figure 3). It is defined as the available energy of one kind previously used up directly and indirectly to make a product or service.

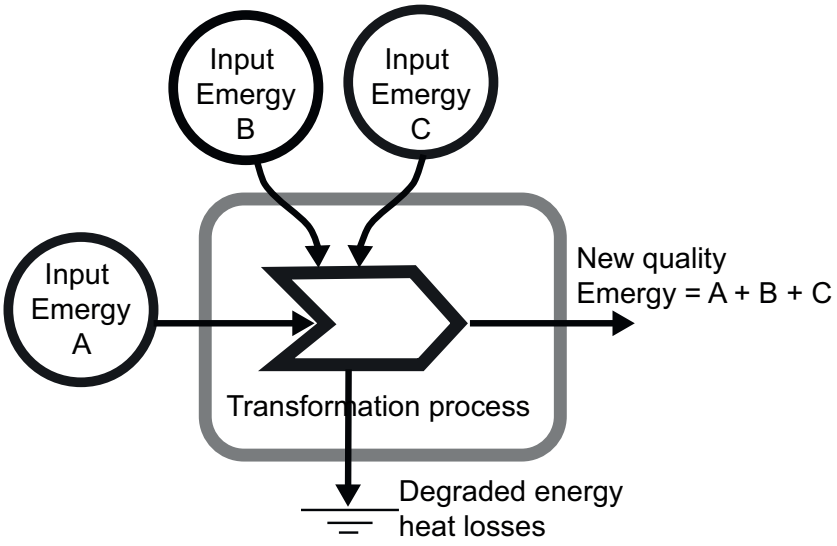

FIGURE 3. DIFFERENT FORMS OF ENERGY ARE NEEDED IN A TRANSFORMATION PROCESS.

In order to generate anything, different forms of energy are needed in the transformation process, i.e. a tractor, a squirrel, a sheep, a city or an ecosystem. The new product is of a new quality. Energy is degraded in a transformation process indicated by the arrow at the bottom of the figure. All energies needed for the specific transformation are not to be found in the product or the service; it is a kind of memory (emergy) of the availability that was used up. The new quality that we see has a new transformity. The emergy is a memory of the necessary support from the web of energy transformations in the geo-biosphere. Transformity as shown in figure 1e shows the position in the energy hierarchy.

The squirrel in the forest – how do we measure efficiency?

The squirrel collects nuts and fruits. It stores the yield in holes in trees and buries some of it in the soil. During the winter he feeds himself from his stored energies but the squirrel never finds a large portion of the yield again. Seemingly he has forgotten where he put it. Someone else has probably already eaten some of it. If we analyze the percent of his harvest that is utilized by the squirrel himself, we will find that the utilization degree is very low. Only a few percent of the harvest will be found and digested by the squirrel. One can ask why the efficiency of the squirrels harvesting work is that low? Wouldn't it be better if it were closer to 100% than closer to a few percent?

FIGURE 4. THE SQUIRREL IS SEARCHING FOR MORE FOOD.

What is an appropriate degree of efficiency? Taking a broader look at the system that the squirrel is working within, we have to zoom out and see other processes at the same time. The digging action from the squirrel means that the squirrel helps with planting new trees and bushes. More trees will germinate faster and that will insure more fruits and nuts in some future harvesting period. Some of the fruits and nuts are digested by insects and soil organisms and will therefore not be available for the squirrel. Their transformation of the harvest will improve the soil fertility directly and indirectly. That will in turn improve the quality of the trees and bushes that the squirrel feeds on. The entire forest ecosystem seems to be improved by the action of the squirrel, and the production and capacity of the whole system improves. If we use this type of broader system view and make new analyses that try to see the whole system and the interactions within it, we are now able to understand that efficiency measuring only one sub-process will be very misleading. What we see with this broader system view is a very efficient system. What would happen to the whole system if we theoretically could improve the efficiency of the squirrel in a narrow-minded mechanistic systems view?

When we consider systems containing several scales like a forest ecosystem with plants, trees, insects, mammals and microorganisms which all operate on different time and spatial scales, it seems like the interactions in the systems organize to maximize the use and the efficiency of available energy at each level of the hierarchy at the same time! This is called the maximum empower principle and is formulated as: self-organization develops designs to maximize empower of each scale at the same time. Empower is measured as emergy flow per time unit. The hypothesis is that the importance of an exchange between scales is in proportion to the empower involved. That is, an increase in the energy hierarchy means an increase in its amplifying empower. Feedbacks in the form of directives from governmental organizations have greater impacts on the organization of the agricultural landscape than the feedbacks from an individual plant, for instance. In contrast to when social systems are driven by non-renewable energy sources, in an ecosystem like a forest, the emergy flow is equal on all hierarchical levels within the system when it is driven on environmental energy sources only. The transformity increase in the energy hierarchy that develops by self-organization and the empower in the feedbacks increase accordingly.

So, when we consider that the squirrel will ‘lose’ some of his harvest we do not see the whole system. We analyze the process as if it were separated from its environment. With that theoretical framework and analytical perspective, emergent properties and the value of the amplifying feedbacks are not recognized. The new activity and behavior delivered by the squirrel to the system are contributing and amplifying the emergy use at several levels in the hierarchy and the systems performance is improved, which requires a new theoretical framework than offered by the analytical mechanistic worldview and its methods.

The tractor and the sheep – the lack of systems understanding

From hundreds of scientific studies and reports we are told that we can grow biomass, harvest it and have more than enough energy to 'feed' all the machinery used in agriculture of today. Some reports based upon traditional energy analysis also claim that bio-fuels make a good substitute for fossil fuels. In reaching these claims they do not even take into account the fuel used to support the needs of the people involved in the process. Some studies claim that we do not need more land to grow energy for the machinery than was needed for feeding the horses when they were doing the hard field job in western agriculture.

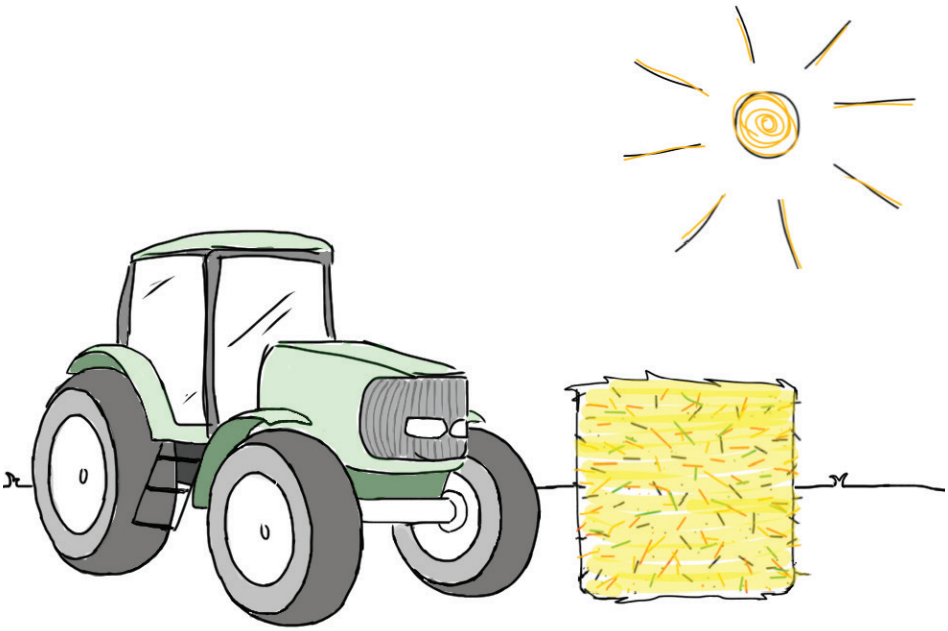

FIGURE 5a. A TRACTOR AND A HAY BALE.

Let's discuss this a bit. First I place my hay-bale in front of a tractor and wait for a while and hope that the tractor will crank up and be able to operate (figure 5a). When looking at the numbers of joules available, the hay-bale contains enough energy, which is not the problem. But, we need to transform the hay into a form, or quality, that the tractor is made for. It needs to be in a liquid form similar to diesel and petrol, or burnable gas. That can be done by technology we know well, and we can get our fuel for the tractor. It might be true that the land needed for producing the needed amount of energy to run the tractor is about the same needed for feedstuff for the horses needed for the same amount of work some years ago. What this type of arguing misses is the need for all other kinds of energy, material and services needed in order to transform the fuel into a quality that works for the tractor engine, and the energy needed to manufacture the tractor itself.

First, the farmer needs to grow the hay, she needs to sow the seeds, apply fertilizer, till the soil, harvest the hay, dry it, collect it and so on. Secondly, to make the tractor needed

to harvest the hay, several metals of different kinds are needed as well as rubber, plastic, glass, electronics, processors and much more. Furthermore to produce the tractor, and to convert hay to tractor fuel, takes industries and all the necessary goods to build them. This type of arrangement also needs a highly developed infrastructure of roads, railways, World Wide Web communication, and well-educated factory workers and engineers. All this together needs a well functioning natural environment that still provide us and these kinds of structures with ecosystem services. To claim that the hay bale (read bio-fuel in general) can support these systems and keep the tractor running is very misleading.

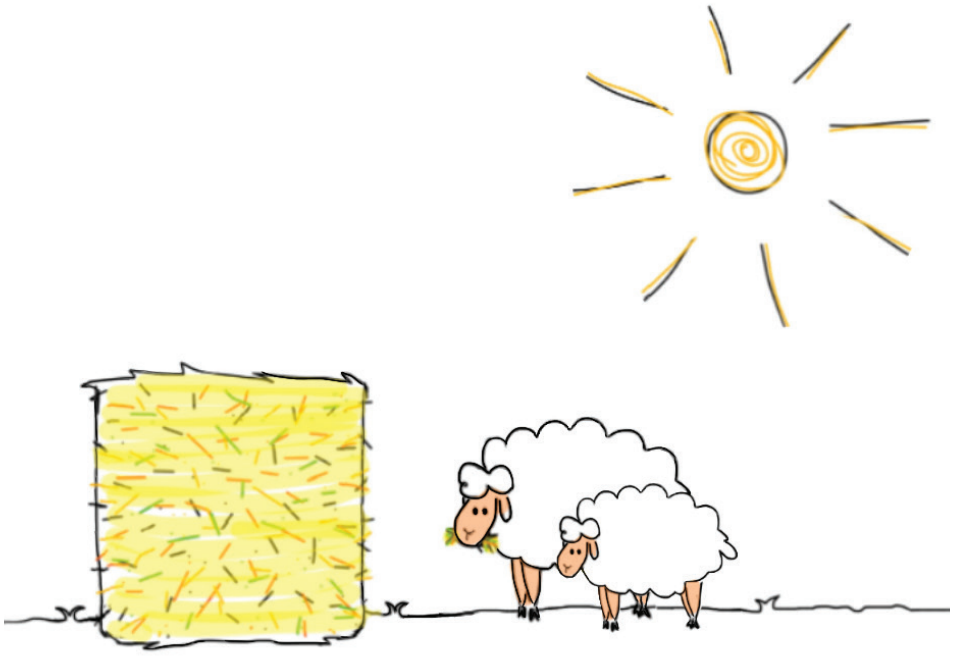

FIGURE 5b. SHEEP AND THE SAME HAY-BALE.

Let's move the same hay bale to a flock of sheep. The hay bale attracts the sheep and they start to eat it. Inside the sheep the hay is transformed into energy that fits the metabolism of the animal. This transformation doesn't only generate mechanical motion when the sheep moves; it also generates meat, wool, manure and milk as well as the ecosystem service 'grazing'. The hay is transformed into a very complex system that maintains itself. The sheep develops its own spare-parts. It is also capable of generating its own new prototype for the next growing season. This is what is illustrated in figure 5b.

No extra industries are needed; no extra infrastructure; no extra mining industries are needed for this type of technology. The sheep is an example of a system that has a good fit with the hay bale.

The tractor is an example of a system that has a very low degree of fitness with the hay bale. It is also a system that needs a fully developed industrial society that fuels itself mostly upon non-renewable resources. The sheep is a multifunctional system with a high degree of fitness with the grass that is the main emergy source for the sheep.

Conclusions

Study, education and the learning process do no longer necessarily need to be focused on a piece of the reality that is explored and analyzed bit by bit. The general systems theory and principles offer a framework that allows us to see and work with complex systems and the qualitative characteristics of them, not separated from each other into different academic disciplines.

Natural science, universities, and other schools have fostered us to look at nature as a passive object, where we, the scientists, teachers, thinkers and users, are the active observers. But it is a mental illusion that everything can be deconstructed, examined and reduced to atoms, and that we are living in a world in which the parts are in the foreground and the context and the vivid processes are of less importance. A world composed of static elements and predictable movements is nothing but a human made up dream. The call for multi-disciplinarity as a solution in research and education when complex systems are in focus can only add information that stems from an analytical mechanistic approach when such approaches are used by the participating disciplines. Even if the importance of systems thinking is well respected, few recognize nature as a self-organizing subject.

Trying to communicate these things when people keep their mindset in the analytical mechanistic paradigm is problematic, if not impossible. But by using the simple everyday and well-known truths, like a tractor that will not start with an empty tank and a bale of hay in front of it, problems of communication may be overcome.

We have to deal with systems that operate far from thermodynamic equilibrium, and that are extremely creative, active and interdependent. That nature can be seen as a subject and that nature is creating itself and organizes itself is the most important issue when teaching sustainability, not the parts of the system. The focus should be upon the organizing principles since they are what constitute the world.

We are part of a world and are created by a world that creates itself.

What is needed is a new type of science that is able to acknowledge and that is founded upon characteristics of self-organizing processes in the universe. The suggested thermodynamic laws, the fourth and fifth law of open systems thermodynamics, open up our minds for this type of development, not only in research but also in education.

Showing students that there is a way to understand what is going on and to deal with it is my mission as a teacher.

DEFINITIONS

AVAILABLE ENERGY: Potential energy capable of doing work and being degraded in a process. This is also called exergy, units: calories, joules.

USEFUL ENERGY: Available energy used to increase system production and efficiency.

EMERGY: Available energy of one kind previously required directly and indirectly to make a product or service, units: emjoules.

EMPOWER: Emjoules/time.

ENERGY: Anything that can be 100 percent converted to heat.

HEAT: The collective motions of molecules, whose average intensity is the temperature that may be measured by expansion of matter in a thermometer.

TRANSFORMITY: Emergy per unit available energy, units: emjoule per joule.

NETWORK EMERGY

MAXIMUM EMPOWER PRINCIPLE: Over time, during self-organizing processes, network designs that maximize empower will prevail.

ENERGY TRANSFORMATION HIERARCHY: Energy flows of the universe are organized in an energy transformation hierarchy. The position in the energy hierarchy is measured with transformities.

Source: Odum (1996)

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4.3 Experiential learning using open-ended case studies

By Margarita Cuadra and Charles Francis

About the authors

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Introduction

One major challenge in guiding students through the logical study of whole systems is their prior educational focus on the components that we organize into specific fields or disciplines. Academic learning is structured into narrowly-focused activities that deal with small pieces of the puzzle, making it difficult to understand and study complex and whole systems issues related to farming and food systems. We have experienced in our teaching that guiding students in learning about complex systems is not an easy task, and that we may need to encourage 'unlearning' some of the patterns acquired in many years of the structured class and classroom. In spite of more than a century that has passed since John Dewey (1897, 1966) described the importance of experiential learning, we in the academy find it difficult to deviate from the lecture mode and to help students integrate what they learn with prior experience. Part of the challenge is how we organize education. When we study in isolation the mechanisms of photosynthesis, the crop responses to fertilizer application, the economics of labor use in maize production, the erosion from a hillside, or the average age of farmers in a region it is often difficult to see how these factors are all related. It is nearly impossible for students … and instructors … to build the needed context of how such components fit into a larger system and interact to make systems function well. How can we encourage students to 'walk the talk', and how can we as instructors model this same appropriate behavior as we design and guide students through a new type of 'learning landscape'?

First it is essential to grasp the importance of a systems approach to research and to education, and agroecology provides a valid platform on which to build the academic components of systems. Next and even more difficult is the step toward responsible action, where we learn to identify the constraints to production and profit and family well-being, and how research and education could contribute to solving them through participatory learning and action together with stakeholders (Lieblein & Francis, 2007).

A solution to the dilemma of fragmented learning has been use of case studies to address complex issues, and to learn about these in the context of real-world challenges. Case studies have long been used in colleges of law, business, and medicine to prepare future professionals to deal with a wide range of challenges they will face in the future. Most studies of this type are 'closed' approaches designed to lead students through a series of steps to discover what is already known by their instructors. We have introduced the 'open-ended case' approach where student teams work together with clients and instructors to immerse in the real world of farms and communities to uncover and describe current challenges that have yet to be solved (Francis et al., 2009). In this chapter we describe the history of case studies and how they have been used in education in different contexts, further elaborate the details of the open-ended case strategy, and provide examples from farming systems and from community food systems. In our experience, this educational approach, both in real life and as Internet presented cases, has potential to better prepare young professionals for dealing with complexity and uncertainty in the future.

History of case study learning

Over millennia young people have learned the survival lessons of their ancestors by practical experience in the field, the forest, the sea, and the home. Alongside their elders, they were shown ways of hunting, gathering, fishing, and preparing food to sustain themselves and their families. This experiential learning continues today as we learn from others around us, and is formalized in practical apprenticeships and intern experiences. When societies became more sophisticated and began to specialize, education moved to assemble young people together and much of learning came to be concentrated in classrooms where one teacher could deal with many students at the same time. Such an educational strategy quickly moved to a lecture format in classrooms that resembled the medieval church with an authority figure in front and one-way communication of information from teacher to student. The adequacy of this method was challenged over a century ago by John Dewey (1897, 1966), who observed that students learned best by building on their accumulated prior experience and hands-on activities that integrated new information into each person's experience base. This is rarely achieved in classes with the lecture format.

The use of case studies in general for agricultural education was advocated by Simmons (1992), and a compendium of classical decision cases was assembled by the American Society of Agronomy (ASA, 1992) in the U.S. This approach was seen as a method of bringing the field into the classroom, and a valuable supplement to the theory and knowledge that is normally taught in our classical disciplines. The decision case brings a degree of real-world relevance to the subject matter of the day, and allows students to work with their current knowledge to seek a solution to a specific challenge that is faced by a farmer or other decision maker in the food system. As such, this is valuable practice and provides some context to the application of learning.

A general description of conventional decision cases that have been used mostly in teaching is summarized in the middle column of Table 1 (Francis et al., 2009). Students are

given a rather prescribed situation in which the farmer is faced with making a decision, and this may have production, economic, or environmental implications that need to be resolved. A menu or series of steps is provided to lead the students through a logical process of gathering information, looking at options, and choosing the one they perceive as most valuable for the farmer. Instructors own the process, and already have the answer in hand. Students need to be clever enough to figure out what the instructor (and client) already knows. Responsibility starts with the instructor, and is passed to the student to take charge of the search for a solution. This is a valuable learning technique, and appears to be most successful when the problem is clearly defined and can be solved by collecting and assessing hard facts from previous research or experiences. This is one efficient way of bringing the field into the classroom. The many examples in the ASA (1992) publication on teaching using case studies are illustrations of how this has been used, and University of Minnesota is credited with innovation in this type of learning method in agriculture.

TABLE 1. SUMMARY COMPARISON OF CONVENTIONAL DECISION CASE LEARNING AND OPEN-ENDED LEARNING STRATEGIES USED IN COURSES IN THE US AND NORDIC AGROECOLOGY PROGRAMS (FROM FRANCIS ET AL., 2009).

	Conventional decision case method learning	**Open-ended cases for learning in agroecology courses**
Goal	Develop solutions from a pre-determined situation	Envision potential solutions to real-world situations
Process	Follow a series of defined steps to uncover known solution	Follow a discovery process to envision alternatives
Information	Provided by instructors in a logical/sequential manner	Students seek out needed information from key clients in field/community
End product	Rational solution that may correspond to actual situation	Multiple possible future scenarios and their potential impacts
Type of learning	Close learning cycle to seek what is known to instructor	Open co-learning by students and instructor to explore unknown
Evaluation of learning	How closely does solution relate to the 'real answer'	How creative are future scenarios and evaluations of potential impacts
Ownership of process	Instructors know the answers and determine student success	Students own the learning and set their own criteria for success
Learning culture	Conventional search by students to find fixed answers	Open-ended search to develop future options and predict impacts
Institutional setting	Stimulus from teacher and response from students	Multiple sources of stimulation, continuous interaction toward goals
Role of instructor	Design the logical steps to reach the known (right) answers	Open a learning landscape for creative discovery of alternatives
Role of student	Active learner, engaged in a comfortable process	Autonomous learners find creative discomfort in a new and stressful learning situation
Responsibility for learning	Starts with instructor, passed to students in case study	Primarily rests with students, who are free to pursue different options
Applicable mainly to	Past and present situations that are known	Future situations that are complex and unknown
Appropriate mostly for	Lower hierarchical system levels	Higher order hierarchical system levels
Most useful for	Simple, well-defined systems and situations	Complex, ill-defined systems and situations
Answers and solutions	Mostly fixed and pre-determined by instructor	Mostly open and dependent on multiple factors and context
Major sources of inspiration	Hard facts and discrete systems that are well known	Hard facts and social methods, plus human judgment and creativity

We have searched for alternatives as we have developed the Agroecology MSc Programme in the Norwegian University of Life Sciences since 2000 (Lieblein et al., 2010), as well as a summer agro-ecosystems analysis course cooperatively conducted in Iowa, Minnesota, and Nebraska over more than a decade (Wiedenhoeft et al., 2003). We were seeking alternatives that would prepare students better for dealing with an uncertain and complex future, one in which even the key questions were not yet known. In a series of doctoral courses we began to accumulate experiences that led to development of another educational approach (Lieblein et al., 1999). Thus we looked outside of agriculture.

Open-ended case studies

Alternatives in professional schools started in the 19th Century, for example use of specific legal case studies in the Harvard Law College (Langdell, 1987). Decision cases or examples from actual situations have also been used in business colleges and in medical curricula. We had read about the examples of Tromsø University, Oregon Health Science University, and Marshall University medical schools where they changed from the traditional study of Latin names of bones and muscles during the first year to more of a focus on patients. Apparently the memorization of Latin names was in fact screening out some of the most socially concerned students who were most interested in the 'people part' of medicine, and could be one factor in selecting toward the tremendous interest in specialization in the current profession. What interested us was the move toward students immediately working with patients, taking case histories, providing preliminary diagnoses, and becoming immersed in study of the whole person. Such innovations are now being more widely adopted in study of human medicine, and may be one factor in the emerging focus on well-trained family doctors who have been in short supply for decades, at least in many industrialized countries.

There have been some attempts to use 'now cases' in areas related to agriculture, for example in ecological economics (Swinton, 1995) and in group problem solving (Tan et al., 2001). Yet the medical school examples provided major inspiration for us to use the approach of 'phenomenology' (Østergaard, et al., 2010) where students start on the farm or in the community rather than learning theory and facts without real-world context (Francis et al., 2011). When students confront complexity, and realize a need to understand the details of a system and mechanisms of how it works, then they are ready for additional information and the tools to apply it. Such an approach could be called 'just-in-time' education (Salomonsson et al., 2005). Based on comprehensive review of the long history of experiential education (Moncure & Francis, 2011), we have evolved a learning experience that seems to be applicable in agriculture. In this chapter we describe how the open-ended cases have been used by student teams in farming systems, in real life as well as in e-cases, and in community food systems.

Teaching with open-ended cases as we are using them in agroecology is summarized in the right hand column in Table 1 (from Francis et al., 2009). The table outlines the principle differences between the two methods, including the goals of the exercise, the process that is followed, and the primary sources of information. In each case, the situation is more prescribed and clear information is provided in the conventional case approach, while students using open-ended cases are responsible for their own goal clarification, how to pursue the team goals, and where and how they will accumulate relevant information. This has proven frustrating to many students who come from a traditional learning situation, yet the discomfort turns to satisfaction as they realize the responsibility of taking their own course of action. More evaluation of learning is presented in a later section. There is further description in the table about ownership of the learning process, the roles of

students and instructors, and how this fits into the institutional framework of a practical course in agroecology. Especially important are the final results, which in conventional decision cases are pre-determined by the instructor, since the answers are known and the students must be clever enough to find out what the instructor and client already know. In contrast, the open-ended case has not yet been solved and students must design potential scenarios to help the clients meet their goals, and to determine as much as possible a priori what the impacts of alternative decisions could be.

What seems most challenging to students is the undefined nature of the situation. They move out into the farm landscape, take transect walks across the farm, and interview the farmer and family and quickly realize that the situation is complex, messy, and poorly defined. When student teams approach community food systems they find an even more complex situation, due to multiple stakeholders and increased connections to organizations and markets outside the community. And they quickly learn that the instructors are not going to provide the definitions or prescribe a course of action. Thus it is up to the student teams to start defining, exploring, gathering information, and integrating new information into their prior experiences. We feel this provides an opportunity to practice real world problem solving in a relatively safe space.

With unpredictable climate, challenges of resource availability, and relatively less formal marketing infrastructure there is much uncertainty for small farm families in developing countries such as Uganda and Ethiopia. Many professional educators are seeking alternatives 'outside the box' of conventional teaching tools, and testing ways for students to explore the uniqueness of each agroecozone and how the production potentials can be realized on each farm has been used. Such challenges defy the menu-driven solutions that predominate in an industrialized, monocrop, homogenized agriculture such as found in much of the North. In our experience, agroecology provides an appropriate, integrative umbrella under which to study the production, economic, environmental, and social complexities that contribute to success of farming and food systems (Francis et al., 2003). The open-ended case learning approach allows students to expand their knowledge and toolbox to help them deal with complex systems in the future, and the confidence to communicate with their stakeholders in the rural environment.

This strategy does not resemble conventional education where the professor or instructor is considered to have custody of most knowledge, and his or her task is to impart this to students. In contrast, as outlined in Table 1 (right-hand column) the open ended case learning methods will help students discover contemporary challenges facing farmers and others in the rural food system within the context where those systems operate. Although developed in Norway and Sweden, the methods appear equally valid for education in other countries. Examples are now provided from the farming systems context as well as the community food context to illustrate how the method has been applied.

Open-ended cases: In real life

One primary goal of the farming systems activities in the Agroecology MSc course is to explore details about local food production and to do this through the eyes of farmers through personal discovery and team learning. We explain to students at the start of the autumn semester in the Agroecology MSc Program in Norway that their adventure through the learning landscape will be like no other they have experienced before in academia. Often they respond that project work has been important in prior courses for their

BSc degrees, and that they already have experience working in teams. This is valuable preparation, of course, but often students are not prepared for the in-depth and intensive interactions that are sustained over a 16-week semester, and the undefined nature of the assigned tasks is a challenge for many.

From the first days of the course, we immerse the students in their immediate rural and built landscapes, exploring the countryside and nearby community using transect walks and employing all their senses to soak in the context of this part of Norway (Francis et al., 2012). In the second week we stay for several days on a large organic dairy farm north of Oslo near the village of Stange, and use this as a central meeting place from which students visit and work on several other farms in the area. Students spend one full day working with the farmer on needed tasks, and report that this day of labor helps them understand the challenge and commitment that farm families have to the essential work in the fields and barns with crops and livestock. Students also walk the fields on a farm transect, observing and recording what they see. Individuals share their personal experiences as they identify crops and farming practices, uses of different types of resources and technologies, and integration of enterprises on these diversified farms. The teams interview the farmer and others involved in the operation, using some techniques provided by the instructors on open-ended interviews (Francis & Salomonsson, 2012; Ostergaard et al., 2013). Teams prepare rich pictures or 'mind maps' (Breland et al., 2012) of the farm, relate on-farm activities to the local food system, and present their information to the entire group. These activities are preparation for the semester-long major farm project in other locations.

Based on what we observe in the interactions of individuals and learning more about unique skills and communication abilities of people in the class cohort, we form new teams for the semester farm project. Teams are mixed and balanced for learning styles, prior diverse course and field experiences, gender, language skills, and country of origin. We have found that diverse teams provide both challenges and rich opportunities, and we assure that there is one Nordic student on each team in case translations are needed with clients. We assign communities to each new team, and identify the most likely farmer contact for their in-depth interviews and farm study. From there on it is up to students to arrange their travel, set up appointments, schedule their interviews, and settle into a house for a week's stay in a Norwegian community. While they are doing their farm projects, the teams will also be interviewing key people in the food system in each town, a process described later. Students visit the farms, talk to farmers and other key players, explore the sources of inputs and marketing activities, and learn as much as possible about the current farming operations. A key part of their investigation is to learn about the farmer's goals for the future, and identify principal constraints for achieving those goals. They also situate the farm within the context of the local community food system and how farmer goals coincide with those of leaders in the local food decision-making groups.

On return to campus, students spend several weeks processing the data they have collected and working through several iterations of rich pictures of the farm. They use tools such as SWOT [strengths, weaknesses, opportunities, threats] to assess components and interactions, peanut models to relate internal farm issues to those from outside the farm boundaries, force field analyses to determine relative importance of different forces impacting the farm, and numerous visual tools to describe what they have learned (Checkland, 1981). From this analysis, students begin to formulate potential scenarios that they think could help the farmer achieve long-term goals. These are discussed, worked with, checked against available data on production and markets, and fine-tuned to be ready to present back to the farmer clients. Students do this during a second week's visit to the same farm and community, and test their ideas for relevance and practical applicability by asking the farmer to evaluate their

results. With additional feedback from the farmer, the student teams return to campus for further discussion and preparing final reports. These are presented in oral and written format, and reports are evaluated by the whole class and by the instructors. Based on this major project and an individual learner document prepared by each student, the instructors assign grades with the review of an outside examiner. This is one half of the autumn semester activities, and the simultaneous community project is described in a later section.

Open-ended cases: Applications on Internet

A complement to 'real farm cases' is to use the digital form, so called 'farm e-cases'. There are cases from Denmark, Ethiopia, Nicaragua, Sweden and Uganda available on Internet. These cases are presented as flipbooks and four of them also as PDF documents, and are used in different educational venues as open-ended cases. The information in the flipbooks from the respective farms is presented as a combination of text, photos and maps/drawings and at times as videos.

To develop the first two e-cases, different web options were tested and a matrix was prepared with the information that was sent out to all members of Agroasis – a Nordic network of Agroecology/Ecological Agriculture – to assess the materials. It was decided to use the online flipbook layout and format, as this promised to be the best option to prepare the case studies for access via Internet. The presentation is attractive and accessible, and can be presented in PDF format as well.

The flipbook format presentation has been greatly appreciated by the students taking the Ecology of Farming and Food Systems course.

READ MORE

The five e-cases are provided online as flipbooks and four of the cases also in PDF-format. See attached links.

DENMARK

Online flipbook: http://www.umb.no/statisk/studieavd/laeringssenteret/danish_farm_case/

ETHIOPIA

Online flipbook including a good video of the region where the farm is located: http://www.umb.no/statisk/e-bok/e-case_ethiopia/flippingbook.swf

Online PDF: http://www.umb.no/statisk/e-bok/e-case_ethiopia/files/ecase-ethiopia.pdf

NICARAGUA

Online flipbook including a short video of the farm: http://www.umb.no/statisk/e-bok/e-case_nicaragua/flippingbook.swf

Online PDF: http://www.umb.no/statisk/e-bok/e-case_nicaragua/files/e-case_nicaragua.pdf

SWEDEN

Online flipbook including one short video clip with the Swedish farmer: http://www.umb.no/statisk/e-bok/e-case_sweden/flippingbook.swf

Online PDF: http://www.umb.no/statisk/e-bok/e-case_sweden/files/ecase-sweden.pdf

UGANDA

Online flipbook: http://www.umb.no/statisk/e-bok/e-case_uganda/flippingbook.swf
Online PDF: http://www.umb.no/statisk/e-bok/e-case_uganda/files/e-case_uganda.pdf

How to use the farm case in teaching and learning agroecology: example from a Nordic Agroecology online course

The MSc-course 'The Ecology in Farming and Food Systems' (5 ECTS) is built around farm e-case descriptions, so far the one from Denmark and the one from Nicaragua. Through such specific farm examples the students learn about the complexity of agro-ecosystems, and how to approach and interact with the farm and farmer, how to identify and propose improvements to the farming system, as well as how to use reflection as a tool for learning.

This is done through seven modules, each of which has a unique approach to the case using different educational tools or methods such as Mind-mapping, Multi-perspective analysis or Force Field Analysis. The e-case is presented in the second module of the course. In the final module, students are requested to write a reflection document where they are asked to reflect upon the case itself and their own learning. The structure of the course is built upon Kolb's learning cycle, and has proved to be a successful way of engaging students in exploring agro-ecosystems. During the past six years the course has been coordinated by SLU, with module-responsible teachers from UMB (Norwegian University of Life Sciences), HU (Helsinki University), CU (Copenhagen University) and SLU.

Student evaluations of case study learning

In the Nordic Agroecology online course, we have asked the students for their opinions about the farm e-case case usefulness as a learning tool. All of those that answered mentioned their appreciation of the farm case and considered it a very good learning tool for this course. Although initially skeptical about the potentials for e-learning by groups using shared field case studies, the faculty has experienced positive feedback from students and become convinced that this is a viable alternative type of systems learning. It is so encouraging that we are building on these methods to establish a doctoral programme in agroecology and capacity building that will be based on mixed models of learning for classes that include students from many countries, all connected and working with teams on line. This programme is still in development.

IN DEPTH

HOW TO DESIGN THE FARM E-CASE

Within the Agroasis network and Agroecoprac project a guide for working with the farm e-cases (Content matrix for e-cases) has been prepared (Cuadra, Swiergiel & Mathiasen, 2010). This guide provides detailed information on creating e-cases.

INSTRUCTIONS FOR MAKING THE FLIPBOOK FROM THE FARM E-CASES

By Øyvind Graham at UMB (University of Life Sciences-Norway)

Here is my advice for achieving the best results for the flipbook:

1. Page layout:

A. Best document aspect: quadratic, for instance: width: 210 mm x height: 210 mm (210 mm is the width of one A4 sheet of paper)

   Why?

   a. To utilize the screen area best. Two quadratic pages side by side utilize the most common screen-area: widescreen.

   b. Reference: http://www.w3schools.com/browsers/browsers_display.asp

c. Reference: http://www.w3schools.com/browsers/browsers_resolution_higher.asp

B. Best font would be some sans-serif font, such as Arial or Calibri for instance.
   a. A font with serifs is Times New Roman, serifs are better for print.

C. Best font-size for the example page-size (210mm x 210mm) should be at least font size 14

2. Navigation in the documents:

A. Marking up headers with a header-level in Word (h1, h2, h3, h4 etc.) (at the least all headers h1)

B. Using internal links in the document between related topics.

C. Linking to external case-resourses should be relatively easy. Meaning: only the file-name if the file is located in the same folder as the case-study.

Here is a little reasoning around why I recommend flipping-book and prezi:

Goal:

- To prepare case-studies for access via internet technologies.
- Important success-factor, in my opinion: Optimize the workflow so the teachers can focus on didactics and content in their topics
- In essence: Find ways of getting pedagogy and didactics flowing to the digital generation.

Why do I recommend flipping-book and prezi for these goals?

The fast path:

- One effective way to do this, is to acknowledge that academics are used to working with the written word in documents.
- Thus this format is the fastest way is to make documents more attractive and accessible online.
- And my practical solution is to use currently available pdfs and flipping-books. It gives us the best of pdfs, and makes it more attractive and accessible online.

The best path:

- However, even though not the fastest way – an even better way is to utilize the teacher's pedagogy and didactics to its fullest by enabling the teacher to directly apply their craft by means of tools for preparing presentations. Some of these tools are really easy to use in practice, but their use requires some planning and extra work. The first route here, is to use powerpoint-presentations, and present them via an online viewer.
- I think however that prezi is a better way to couple computer-interaction closer to the content in the course.

One can also supplement with video where the body-language and oral communication are key (basically using video in cases where physically attending a lecture probably would be better).

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Based on a personal communication to Margarita Cuadra on December 17, 2010.

READ MORE

LITERATURE USED FOR THE E-CASES

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Open-ended cases: In community food systems

Student teams in the Norway Agroecology fall semester are assigned to communities for their food system project. With a list of potential clients, students make their own contacts and set up a schedule for interviews during one week in the community. This is the same community where they study the farming system. The teams interview people in food processing and marketing, as well as in food procurement and food service in restaurants, schools, government canteens, military installations, and any other relevant group related to food. Some teams conduct consumer surveys. As part of the task, the teams explore connections of these groups to local farmers as well as to national cooperatives and other larger-scale organizations, and their relationships with regulatory agencies of the government. They search out the goals of the community with regard to future and desired food systems for that place. With this rich source of information, student teams return to campus to process and reflect, to organize and manage the data, to collect additional information from national sources, and to begin to interpret the information using similar tools to those used for the farming system.

After several weeks of processing information and interpreting results using these systems analysis tools, student teams begin to formulate potential future scenarios that the communities could consider in order to meet their goals. They identify additional information that should be accessed in follow-up visits to the same communities. The teams present their rich pictures and results of analyses to other students and the instructors in the course, and use the critique to fine-tune their results. The culmination of this work is another multi-day stay in the community and an opportunity to present the ideas to their stakeholders and receive feedback that could be used to improve the recommendations. Often this takes the form of a half-day workshop or visioning session with the local stakeholders, and the results of these forums become a part of their written reports and final presentations to the class.

One especially noteworthy result in the village of Tolga in the eastern valley north of Hamar was initiation of a local food festival, planned by students and people of the community, and brought to reality in both 2011 and 2012. With attendance of over 500 people each year, supplemented by speeches and music, the festivals featured and promoted local and organic foods. This was an excellent way to build awareness of the importance of agriculture and food to the local economy and culture, and plans are under way to continue this

new tradition innovated by the Agroecology student teams. Other impacts in Norwegian communities have been more subtle, but the fact that the community governments have provided partial financial support for the students while staying in their towns indicate that the local decision makers highly value the contributions of the agroecology teams.

Case studies as learning activities should be particularly useful in agriculture, food systems, and development work because students need to appreciate the uniqueness of each situation and context, and ecological economics is an example where the case approach could be especially practical in education (Swinton, 1995). Some teacher education programmes use the case study approach, a more fruitful strategy than lecturing on fixed situations that the students may never encounter in their teaching careers (Lundeberg et al., 1999). Having established the complexity of food systems at the community level, the multiple and often conflicting goals of stakeholders, and the myriad interactions with a national food system we perceived that an open-ended case strategy would be the most appropriate for students to learn about these systems and design potential changes to help clients meet their goals for the future.

IN DEPTH

Moving up the spatial scale to community introduces additional layers of complexity to the study of food systems, but the methods are parallel to those described earlier for farm studies. Although some solutions to local food challenges may be as simple as providing local markets and financial incentives for farmers to meet local demand, the multiplicity of stakeholders, range of different motivations and goals, and complex interactions with the larger farming and marketing sector raise many new questions. In fact, most of these questions do not have fixed answers, and even the key questions that should be addressed may be unknown (Cliff & Nesbitt, 2005). It is likely that the more complex the questions about food systems and the more uncertain the future, the results of a community study will provide answers that give rise to new and more complex questions (Margetson, 1993). Especially in the business world, where financial uncertainties and political intricacies continually impact the market, there is great need to establish methods for decision making in a climate of unpredictability. Barnes et al. (1994) questioned the usefulness of the lecture method in business schools, suggesting that more important knowledge and skills could be gained by focus on qualities of the mind and the individual decision maker, and to develop the capacity to adjust and react to an ever-changing financial climate.

Teaching tips to enhance agroecology learning

In the sections below we share some of our experiences from this type of education. They all focus on enhancing agroecology learning.

Building a social learning community

In addition to study in formal courses and fitting these together into an individual programme of study, we see social learning as a key part of the preparation of future agro-ecologists. Several methods have been used in the classroom and outside to help students better engage with their peers and become more productive team members. It is

essential to build trust and confidence, and to recognize that much of their future work will be done in groups. In class we promote this trust through learning about individual learning styles, and by fostering respectful discussion; outside of class there are both scheduled and informal gatherings to build community (Francis et al., 2011).

Personal biographies to build community

One of the introductory activities in most agroecology courses, workshops, or seminars is providing time and space for people to become acquainted. This goes beyond the brief 'name, country, discipline' introduction, and often uses visuals created by students and instructors to present their prior academic and other experiences, the tools and knowledge that they bring to the class, and the expectations they have for the course and for a degree in agroecology (Wiedenhoeft et al., 2013).

Transect walks across farms and landscapes

A rapid method of introducing students to a new agro-ecoregion, a farm, or a community is the 'transect walk' through that environment. We have used this method to build awareness of surroundings and to build appreciation of observational skills, using all the senses, as student pairs traverse the landscape to understand what is there. One variation is for students to take the outward path in silence, to minimize distraction from their personal observations, and to discuss what they have seen on the return. Often this transect is up to 3-5 km, and with the subsequent discussion can occupy a full half day of activity (Francis et al., 2012).

Practicing and preparing for stakeholder interviews

Most students in the agroecology courses have limited experience in conducting interviews with stakeholders, and an opportunity to develop needed skills in a 'safe environment' has proven valuable before they go to the field. Students learn to define clear research and learning objectives, structure interviews and divide responsibilities among the team, and practice conducting interviews in class with instructors or other students. This exercise has provided structure to the field work as well as built confidence in how to do interviews as a team and to glean the maximum information possible from limited time with clients (Østergaard, et al., 2013)

Farmer interview role play exercise

One innovative way to develop interview questions, practice before doing a client interview with farmers, and get valuable feedback from students and instructors is the design of mock interviews. In a course on nutrient cycling in Sweden, we asked students to interview three types of farmers (roles played by other students): a farmer who was open and articulate but gave too much information, a farmer who was reticent to respond and had to be coaxed to give details, and a farmer who apparently was providing incorrect or misleading information. Students designed the roles and did the interviews, and the rest of the class provided critique (Francis & Salomonsson, 2012).

Mind mapping to explore systems interactions

A visual method of summarizing massive and complex information assembled from the farm and food system client interviews and to incorporate this with other sources from national statistics and local people, is the comprehensive mind map. This can be a concep-

tual map of the farm and its multiple elements and interactions, or a map of the community that shows the major components and how they connect to others. When this map is taken through multiple iterations, the process of drawing and discussion promotes useful understanding within the team of complexity and function that emerges from the structure of the map. It is also useful in presentations (Breland et al., 2012).

Metaphors in agroecology education

Individual students learn in different ways, and one innovative way to stimulate observational skills and promote personal identity with the landscape and team identity with a system is through use of metaphors. As individual observers, students have imagined themselves as birds, as perennial plants, and as members of a livestock herd on the farm. As teams, students have imagined their farm or group as a tree, as a bus travelling through the landscape, as a ship on the sea, or as a complex system as represented by a ruminant animal. Such associations stretch the imagination, and provide a method of identity and understanding of complexity and adaptation to a changing environment (Francis et al., 2012)

Visioning future scenarios

In the quest to best work with farmers and community food system stakeholders, we have chosen to not be prescriptive in using the results of interviews and systems analysis. Rather we think it more valuable to work with these clients to derive a series of scenarios that could be used to meet goals and anticipate a priori to the extent possible the possible outcomes or consequences of pursuing those several courses of action. While student teams are responsible for developing scenarios, this is accomplished through interaction with clients on the farm and in the community as well as in consultation with the instructors and other students in the course. We have observed that clients, who are responsible for the results, will carefully consider all the options and choose components from multiple scenarios (Lieblein et al., 2011).

Conclusions and future plans

We conclude from these experiences with developing and using open-ended case study learning methods in Ethiopia, Uganda, Nicaragua, U.S.A., and the Nordic Region that the method is well accepted by students and useful to their learning. Over the dozen years teaching both in field and on line, we observe that students participate actively and with enthusiasm in the case learning approach. After becoming accustomed to the method and convinced that there really is no single right answer they must figure out, the learning process becomes both interesting and challenging, and students feel compelled to search for their own unique team approach to this complex situation. Students often feel deeply and internalize the challenges of their clients, and thus establish a rapport that is not possible with a dispassionate academic study of farming or food system questions in the classroom. Although we modify details of the learning process each year in response to student feedback, the general approach has served well in practical study of agro-ecosystems, including the production, economic, environmental, and social dimensions.

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4.4 Institutional coordination, collaboration, participation and implementation in the framework of a systemic approach to sustainability of the agro-ecosystem

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Introduction

According to our experience, this chapter presents the major institutional issues/bottlenecks hampering development of the agro-ecosystem, which an agroecology graduate may experience. The underlying problem is limited understanding of the importance of a systemic/systems thinking approach to sustainability of agro-ecosystems. This follows from the lack of capacity to understand and put into consideration all components as well as their inter-linkages in each agro-ecosystem. The multiplicity of components in an agro-ecosystem translates into multiple sectors and their functional inter-linkages. Thus, major bottlenecks identified in agro-ecosystems are the lack of coordination of components plus functional inter-linkages/cross-cutting issues, inadequate collaboration within various sectors and among smallholder farmers, missing participatory platforms (Chandra & Idrisova, 2011), thus leading to inappropriate implementation of development programmes/projects. Implementation strategies, which lack a systemic approach, have hampered sustainable development of farmers' agro-ecosystems.

Within each affected agro-ecoregion, there are deficits in institutional coordination, interlinkages and networking. This is resulting from farmers depending on a wide range of isolated institutions with no proper networking, thus making it a mystery to have specific increase in agricultural produce outputs, which would desire input of all component sectors. The poor institutional arrangement weakens the improvement of agro-ecosystems to the extent that quality human resources keep shifting to where there are better incentives. This causes serious limitations in the intra-sectoral and cross-sectoral coordination and collaboration during implementation of agricultural development policies, and this hinders development of agroecosystems as a whole. We note that most development failures, either macro or micro are linked to the internal functioning of one or more development arenas, i.e. the state, market and civil society.

Even with a clear institutional set up, if there are gaps in institutional performance, progress of the agro-ecosystem is hindered. Those coordination and collaboration, systemic approach gaps are related to mainly the following:

- Farmers lacking the capability to contribute to making decisions that affect them, indicating asymmetric power relations. Ostrom et al. (2002) describe asymmetric relations as those where farmers are at the end of the priority of national reform programmes while elites in Local Government are given first consideration.
- Lack of a multi-sectoral approach to agricultural development planning and implementation, for improved sectoral coordination: The most recent example to this is the National Agricultural Advisory Services Programme in Uganda, in which programme beneficiaries and other line ministries are not fully incorporated in agricultural plans. This causes limited communication flow between component sectors. It should be noted that from a systemic approach, there are multiple component factors and players involved in the agro-ecosystem, and that lack of a multi-sectoral approach implies the lack of understanding of how changes in components of the agro-ecosystem adjust to adapt to new environmental conditions. The same multi-sectoral approach idea is highlighted in the ICSU Belmont Report (2009) and Wolf (2011) who showed the importance of networking among different sectors that have crosscutting issues.
- Lack of a multi-sectoral approach leads to poor coordination, collaboration and limited participation, which causes monopolized implementation of agricultural development programmes. Thus, implementation is done individually by agro-ecosystem component sectors with disregard of involvement of complimentary sectors. Moreover, the complex agro-ecosystem has multiple components that dictate multiple sectoral collaboration.

Poor implementation approaches, with lack of proper coordination, collaboration and participation, result in loss of coherence, resources misallocation and misuse, as well as corruption, and culminates in environmental degradation. Further still, it has serious social-economic, cultural, and climate change implications.

Challenges of poor coordination, collaboration, participation and implementation can be addressed by embracing a systemic approach that calls for multi-sectoral, inter-sectoral and intra-sectoral coordination, collaboration, information sharing, as well as providing 'participatory platforms, …multilevel governance and policy coherence' (Chandra & Idrisova, 2011:1)

This chapter gives a more elaborated picture of the ideas presented above thus: institutional coordination and collaboration, participation and implementation in the perspective of a systemic approach to sustainable agro-ecosystems. The chapter is organized as follows:

- Meaning and importance of institutional coordination and collaboration to the agro-ecosystem.
- Participation and institutional bricolage for sustainable agro-ecosystems.
- Systemic approach to sustainability of the agro-ecosystems.

Meaning and importance of institutional coordination and collaboration to the agro-ecosystem

Institutional coordination refers to the process of organizing the different activities within a sector or across sectors or departments to enable them work together in an efficient and organized way. On employment, the agro-ecologist encounters different players who must work together in both policy planning and implementation of agricultural development policies to cause an efficient and sustainable agro-ecosystem.

In the same line of thought, collaboration refers to doing things together, in the production process or planning and implementation. To realize sustainable agro-ecosystems, economies should have solid policy frameworks formulated through coordinated processes within institutions, having linkages within public sector implementing agencies and technical capacity (IFPRI, 2011) to address effective coordination and collaboration within the different agricultural development planning and implementing agencies.

Figure 1 is an example from Honduras, illustrating an interlinkage between sectors and crosscutting issues, which must be considered for all sectors. The agro-ecologist is expected to handle agriculture hand in hand with other sectors to address crosscutting issues and bring about sustainable development.

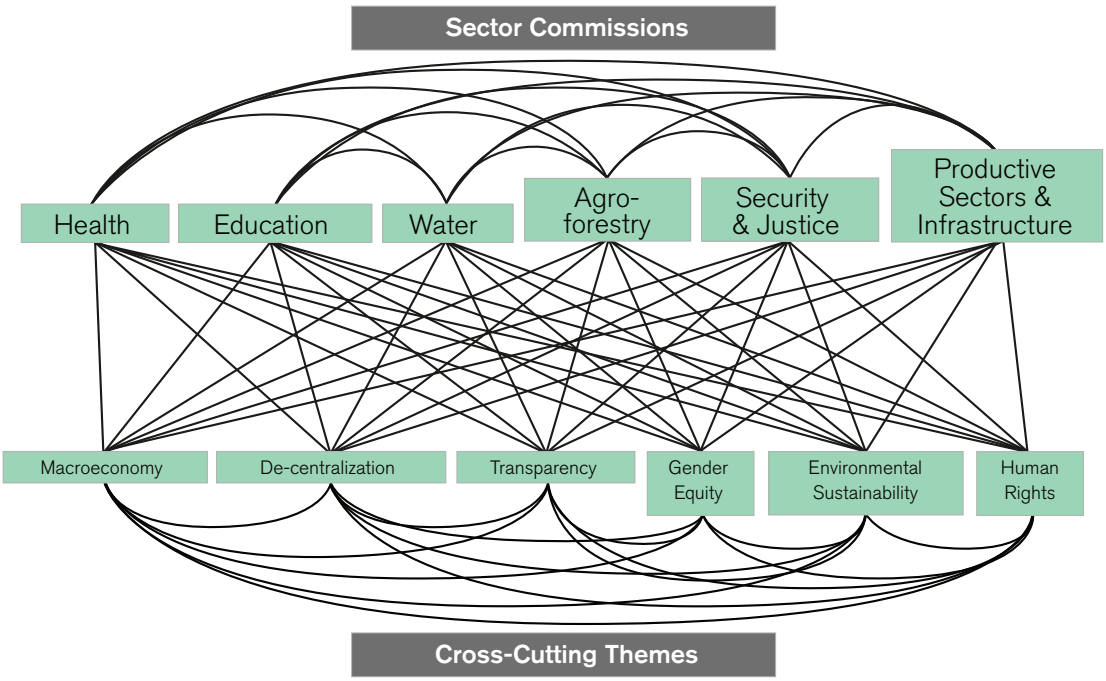

FIGURE 1. AN EXAMPLE SHOWING INTERLINKAGES BETWEEN SECTORS WITH CROSSCUTTING ISSUES, SOURCE: HUNT (2004).

Another example is the European Union (EU), which decided to have new modes of Governance that would embrace problem solving in line with sector coordination and collaboration. This implies that policymaking should become more collaborative within and among sectors and include citizens such that they get an opportunity to address issues touching them. Furthermore, the EU suggests the Open Method of Coordination (OMC)[2] also taken as participatory democracy in policy making stemming from the support of different stakeholders and having an integrated approach that brings on board all concerned sectors to address issues that touch each other (Borras & Ejrnaes, 2010).

Without a proper coordination of this nature, the agro-ecologist cannot expect to achieve sustainable development, because as also suggested by Ostrom et al. (2002) collective action has more far-reaching benefits in development in the 21st Century where we are facing severe climatic changes and continued growth in human population.

Our experience shows that the systemic approach is more important today than ever. This is the time for economies to change planning approaches, to ensure that all planning takes a systemic and multidisciplinary approach, and that plans are coordinated collectively to ensure incorporation of all crosscutting issues for each sector.

Taking the example of three sectors, agriculture, environment and education together in the development arena, coordination and collaboration of their various functions become cost effective to operate as suggested by Beckmann and Padmanabhan (2009). In this example, the implication is that synergies among these sectors are created, e.g. sharing staff and knowledge. In addition, when important environmental goals are set, it requires that farmers be sensitized, yet also if important agricultural functions are to be met, the education policy must be complementing the agriculture policy. This could be done by Ministries of Agriculture, Education and Environment working in close collaboration and coordination of jointly formulated policies and related implementation activities.

Uganda – our example

In Uganda, there are primary growth sectors and sub sectors involved in the direct provision of goods and services. Among these sectors are the agricultural sector, forestry, mining, manufacturing, oil and gas, ICT, housing development and others whose performance has been varying over the years as indicated by the National Development Plan (NDP) (2010/11-2014/15). Agriculture is the dominant sector of the Ugandan economy, comprised of cash crops, mainly coffee, tea, tobacco, cocoa, sugar cane, cotton, and exported flowers. There is also a variety of food crops, livestock and fishery. Uganda Bureau of Statistics (UBOS) (2011) indicates the agricultural sector as providing approximately 80% of the employment, and that most industries and services in the country depend on this sector. Additionally, in Uganda, 85% of the population lives in rural areas and depends on smallholder farming as a basic source of livelihood. However, despite being dominant, the sector's contribution to GDP has been declining over the years. UBOS (2011) indicates that in 2009/2010 financial year, agriculture realized a growth of 2.4%, hence contributing 23.8% to GDP at current prices. In 2010/2011, there was a reduction in the sector's performance, thus growing at 0.9% and contributing 22.5% to GDP. The NDP for Uganda set the annual growth target of the agricultural sector

2 The OMC in the EU's perspective was to work for cross-national Policy making which in this paper has been identified with sector coordination to address crosscutting issues.

at 4.9%, but this has been difficult to achieve as the sector has been growing at less than 3%. This situation has potentially lagged behind the entire economy; the results have been causing food insecurity, compromising nutritional quality, and stagnating the general wellbeing of Ugandans given that the majority depend on agriculture for survival.

Our observed causes of low performance are institutional bottlenecks resulting from poor coordination and collaboration within and among sectors. Below are such bottlenecks:

Overlapping responsibilities

Information from the International Food Policy Institute (IFPRI, 2011), noted that the Plan for Modernization of Agriculture (PMA) has overlapping responsibilities with the Agricultural Planning Department in the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) even when the Development Strategy and Investment Plan (DSIP) is the agricultural development strategy for Uganda's public sector. This continuous parallel functioning and duplication of efforts limit the cost effectiveness in administrative service delivery of Uganda's Agricultural sector, thus limiting good performance of the sector. There is a need to streamline duties and responsibilities. http://www.ifpri.org (last consulted: 16 May 2013)

Deficits in institutional coordination

The DSIP for (2010/11-2014/15) indicates that within Uganda's Agricultural sector there are deficits in institutional coordination and interlinkages within the implementing agencies of the public sector. This is resulting from the sector having a wide range of isolated institutions with no proper networking, thus making it a mystery to have specific increased outputs. These poor institutional arrangements have weakened the sector to the extent that quality human resources keep shifting to departments or programmes offering better incentives. This causes serious limitations in the intra-sectoral and cross-sectoral coordination and collaboration during implementation of Agricultural development policies thus hindering the development of the Agricultural sector and Uganda as a whole.

Disjointed policy and planning functions

Noting that most development failures, either macro or micro are linked to the internal functioning of one or more of development arenas i.e. the state, market and civil society, concern is directed to the Ministry of Agriculture's policy and planning function that is disjointed, hence making it 'dysfunctional'. According to the IFPRI Policy note (12) for (2011:3), it is shown that even when functions are related, they are not necessarily performed and/or supervised by the same 'departments and units. For example, the Policy Analysis Unit of MAAIF' is not coordinated with 'the Agricultural Planning Department', hence having policies which are unrelated to the market needs. This has resulted in serious losses to farmers due to production patterns and distribution not matching the market situation. This and other cases presented above give the actual reality a graduate agroecologist is likely to encounter and address.

Asymmetric power relations

Development gaps in institutional performance are exhibited in situations where local community actors lack the capability to contribute to making decisions that affect them, indicating asymmetric power relations where local actors are at the tail and elites in Local Government are involved in national reform programmes without proper coordination and participation, as is also indicated by Ostrom et al. (2002). This implies that though institutions are in place, they are not properly functioning because of that lack of collective action, moreover this would be one way of addressing real issues that hinder development.

Additionally, there are serious issues of gender relations where major planning decisions are taken by men, yet women (majority of whom are poor) are the major participants in the agroecosystem. At the same time, youth are not yet well on board, yet they would be the drivers of development programmes given proper planning and well-coordinated implementation.

Gaps in political will

Note that in any development programme, there must be political will. The lack of political will is a core dysfunctional problem that impedes collective action to produce joint benefits. Politicians can be very influential in addressing community needs, and if these groups of people are rarely involved during the planning and implementation of activities, especially at the district level where their opinions could be presented, little may be achieved. When this happens, it means there is lack of a communication process to agree on definite roles for each group, and lack of coordination among the various groups that can bring about joint efforts to development. Ostrom et al. (2002 pp.25-44) also present this as 'inadequate motivation… missing or asymmetric information about actions or actors' moreover, for economic development, there must be political will and a consideration of all players involved in planning and implementation of development programmes, and in their different disciplines.

Limited communication flow

In our Ugandan agricultural sector, The National Agricultural Advisory Services Programme (NAADS) was initiated to improve agricultural performance. However, there is limited communication flow between the Ministry of Agriculture (MAAIF) and the NAADS secretariat even when the MAAIF is the parent. Thus, MAAIF is not involved in NAADS implementation, programme monitoring, and evaluation. At the same time, the Ministry of Finance as a major funder has not integrated its financial management system with the NAADS-secretariat, thus limiting financial information flow. All in all despite factors like Uganda's geography that limit development and are beyond our control, the agricultural sector has to strengthen the weak institutional structure by addressing technical, managerial and institutional hindrances especially resulting from the many institutions in this sector that hinder coordination and collaboration, and we observe that any development only comes with collective action. This is one responsibility of the graduate agroecologist.

Participatory approaches and institutional bricolage for sustainable agroecosystems

Another dimension presented in this section is the understanding of the extent to which a participatory and decentralized coordination of the policy implementation process within the complex ecosystem may improve the agricultural sector performance and contribute to agroecosystem development. In this, three aspects need to be considered by the graduate agroecologist. First, the comprehensive nature of decentralized policy coordination at the planning and implementation stages is key to successful development. Second is the participation (Chambers, 2010) of stakeholders in the policy process and programme implementation at various local government levels. Third is the institutional bricolage[3] (Cleaver, 2002) to suggest that mechanisms of resource management and collective action are important for sustainable agroecosystems as well as natural resource management.

The decentralized bottom-up approach to planning and implementation implies a participatory approach whereby all concerned stakeholders and local people are directly or indirectly involved. It brings on board application of various types of knowledge and skills as well as initiatives and creativities. It also calls for a thorough consideration of all local governmental levels to define the problem, to plan and then to implement the plan.

During the Technical Centre for Agriculture and Rural Cooperation CTA (November 2011) Conference, on Linking Knowledge to Policy and Action for Food and Livelihoods, it was reported that smallholder agriculture and family farming are core contributors to agricultural production, and food and nutrition security in developing countries. Advisory services were seen to be central to achieving the above and the coordination of public, private and civil society actors at national, regional and international levels was considered necessary. This implies that the agro-ecologist has to apply a comprehensive and participatory approach in the implementation of rural advisory services.

Advocates of participation, like Chambers (2010), acknowledge the importance of participation in development. Participation should involve all concerned stakeholders, and is thus 'a people paradigm' (Chambers, 2010:13 cited in Namanji & Ssekyewa, 2012). Participation requires a bottom-up rather than a top-down standardized approach to planning and implementation. In the same line of thought, the best way of understanding the relationship between the natural and social worlds is by beginning from a narrow basis; this can be exemplified by planning approaches that start from the local council village level, district, and parliament up to the Ministry of Finance, which incorporates all plans. This helps to predict and improve the outcome of a particular institutional process compared to beginning from a wider basis (Cleaver and Franks, 2005). Cleaver uses the concept of institutional bricolage to suggest that mechanisms of resource management and collective action are borrowed as well as constructed from existing institutions, styles of thinking and sanctioned social relationship (Cleaver, 2002). In this case she considers the concept of DIY to mean 'do-it-yourself', community members are able to design institutions basing on their social norms. In this case, institutions that would bring about sustainable development/agriculture should base themselves on better understanding of social relations and existing decision-making processes. Therefore,

3 Institutional bricolage: This concept is used to suggest that mechanisms of resource management and collective action are borrowed as well as constructed from existing institutions, styles of thinking and sanctioned social relationship (Cleaver, 2002). In this case, we consider the concept of DIY to mean 'do it yourself' in which case, community members are able to design institutions basing on their social norms and this is participatory.

resource allocation, which in principle requires that people understand the relationship between themselves and nature, would be better managed, and with dynamic, socially embedded decisions. You as an agro-ecologist should follow this principle because it brings you closer to nature thus enabling you to manage nature sustainably.

For example, in a bid to improve water access and better the process of bricolage, a better policy would call for smaller scale and context specific interventions that can allow better participation and usage of local knowledge, making it effective and more environmentally friendly (Wong, 2010) otherwise, technologies will always fail. This follows on the principles that often-new water technologies are not pro-poor. They undermine structural and social embeddedness in terms of gender or race. Those who are powerful make decisions for others, and as such technologies are not adopted because they did not go through a process of bricolage. Note that for any technology/project to be easily adopted, it should be well negotiated with all concerned parties involved or at least well represented to air their views; this is what we mean by going through a process of bricolage. Where there is no institutional bricolage, political elites take decisions without involving grassroots users. Many times, these technologies/projects are unsustainable.

In the same line of thought, sustainable agroecosystems and natural resource management strategies are maintained when planning and implementing policies as well as programmes take a participatory approach, through a bricolage process that enhances communication and interactions between different classes of actors. That way coordination is fostered, and good social conditions are socially embedded so that in the end there is less confrontation. Even when it comes to developing strategies for climate change adaptation through transboundry water projects (Wong, 2008), there is need to provide enough participatory space so as to incorporate local indigenous knowledge, rather than making local people simply adopt to blueprint policies which may fail. This implies that it is better to work through existing fair and just social and political hierarchies, and also to learn from the poor through bricolage because it promotes social justice and development of sustainable ecosystems.

Systemic approach to sustainability of agroecosystems

The previous sections have shown that the biggest obstacle to achieving sustainable agroecosystems originates from institutional failures such as uncoordinated activities and policies, lack of collaboration and participation. This was seen to be resulting from non-inclusion of multiple users in taking decisions about resource usage, asymmetric power relations and poor communication. Here concepts of coordination, collaboration, participation and implementation are presented in the framework of a systemic approach aimed at creating sustainability of the agro-ecosystem.

The systemic approach involves interconnectedness with the whole, just like systemic chemicals used to treat plants or animals enter and spread to all parts. In this context, institutional coordination, collaboration, participation and multilayered bricolage happens at various layers of national governance as well as with international and local people. This facilitates proper and sustainable management of the agroecosystem as well as natural resources. In this section, we use literature from various scholars that support the systemic approach and then recommend a proper methodology for an agroecologist to apply when managing the agroecosystem. This methodology employed is based on the notion that sustainable agro-ecosystems are realized in consideration of the 'multiple governance tiers through which the meaning and implementation of poli-

cies are negotiated and transformed from the policy design stage until the arena where final resource users make decisions' (Clement, 2009:2).

These approaches to policy decisions are not only at one level but also at multiple levels, national and international as well as an incorporation of the local resource users in taking decisions pertaining to resource use. The way forward to this approach is the adoption of Institutional Analysis and Development framework (IAD) (Clement, 2009; figure 2) which clearly shows multiple levels of governance through which we should have bricolage at all governance levels.

Institutional Analysis and Development framework

The IAD framework is useful in producing a huge body of theory particularly in the way of managing common pool resources like forests and wetlands, considering that these play a vital role in fostering sustainable development. Clement uses ideas from other scholars for insights on the gap between legal rules and actual practices. These expound on the existing power mechanisms and local power struggles over natural resources between different actors (Clement, 2009 in Ribot & Peluso, 2003; Byant & Bailey, 1997) only solved by a method that reduces the gap between the rulers and the ruled as well as coordination of the policy process.

Apostolopoulou and Pantis (2009)'s suggestion of 'collaborative governance' is in line with Clement's (2009) IAD framework that involves 'multi level approaches' to policy formulation and implementation, noting that conservation is vital for sustainable agro-ecosystems. In the same perspective, scholars like Gunderson et al. (1995) showed that systems are dynamic not linear: Small changes in its diverse components may be amplified through feedbacks, stressing the need to consider the scale of management interventions and crosscutting interactions, as well as thresholds.

Therefore, to achieve sustainability of the agroecosystems, there is a need to put into consideration multilevel approaches to take on board bricolage at all governance levels as a way of harmonizing policies and reducing tensions. The IAD framework is very instrumental in causing this achievement. The same framework was used in Vietnam to manage forest resources. In their case, it is considered at three levels, i.e., the central level, the provincial level and the village level.

1. At the provincial level, consideration is made of international and national political-economic context attributes of the policy community, rules in use, biophysical conditions and international and national discourses.
2. At the provincial level, they take into consideration similar aspects as at other levels in addition to international and national discourses, and instead at this level they involve regional discourses.
3. At the village level, the same process applies, though at this level, consideration is made of local discourses where local people are involved in the action arena.

Below is the IAD framework as adopted from Clement (2009).

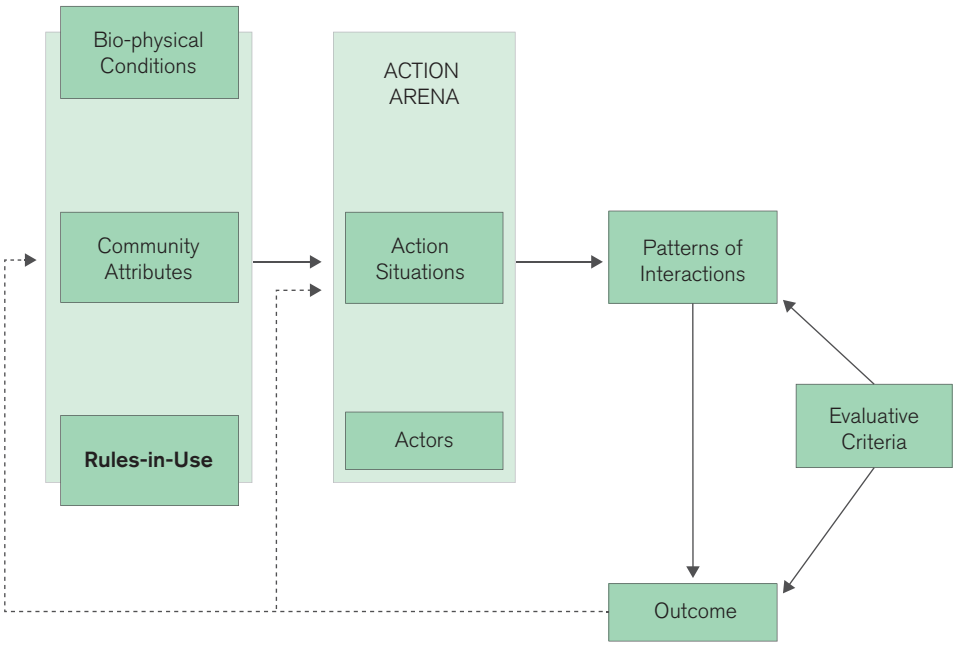

FIGURE 2. INSTITUTIONAL ANALYSIS AND DEVELOPMENT FRAMEWORK. IT SHOWS DIFFERENT COMPONENTS OF INSTITUTIONAL ARRANGEMENT. ADAPTED FROM CLEMENT (2009) IN KISER & OSTROM (1982); OSTROM ET AL. (1994)

The IAD framework endeavors to explain collective action in field settings with diverse structures and was particularly aimed at catering for the complex public economies as well as common property regimes. In Uganda, there is still a gap in using this framework and as such it is the duty of an agroecologist to make this known and used in the management of natural resources for a sustainable agro-ecosystem.

IN DEPTH

Ostrom & Cox (2010) in their 'Moving beyond Panaceas' present some facts about the IAD framework: The IAD framework is a metatheoretical conceptual map that identifies an action situation, patterns of interactions, outcomes and evaluation of these outcomes.

Efforts to explain collective action in field settings with diverse structures, particularly the complex public economies of USA metropolitan areas and common property regimes around the world, were the stimuli leading to the development of the IAD framework.

The framework has been used as the foundation for creating coding forms to be used in an extensive meta analysis of irrigation and fishery cases around the World (see Schlager 1990; Tang 1992) for irrigation systems in Nepal (Shivakoti & Ostrom, 2002) and for the extensive studies of forests undertaken by the IFPRI network. As such the framework has proven to be quite useful and the body of theory produced, particularly in common-pool resource settings, is now extensive (Ostrom, 2007a)

The way in which this framework operates is that the action situation is central, and it is structured by working parts such as actors, who are assigned positions, and positions assigned to actions. There is control over actions, and potential outcome from actions, which result from information and finally net benefits and costs (figure 2). Each of those working parts can take multiple forms that jointly affect the decision made by actors.

Concisely, sustainability of any system requires that various components of that system have vertical or horizontal interlinkages and are supposed to work hand in hand. There are many components that make up the agroecosystem and they fall within different sectors and ministries. The implication is that agroecologists implementing development programmes should ensure that sectors work together because they have crosscutting issues that have to be addressed. In the process of addressing crosscutting issues, agroecologists must engage coordination and collaboration within and among the line ministries as well as creating bottom-up participatory platforms where institutional bricolage for proper planning and implementation of sustainable agricultural development programmes occurs

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4.5 Facilitating transdisciplinary research and development for improved agricultural sustainability

By Karin Eksvärd

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Introduction

In principle, a facilitator is a person who supports a group of people to collaborate well in pursuing their own learning process, designing and implementing a development project and/or accomplishing collaborative research. This chapter shares examples of practice, theory and approaches that might be of interest to other facilitators from experiences when the author has been facilitating collaboration in agricultural R&D work aiming for very high degrees of participation.

Providing a full description of facilitating transdisciplinary research and development processes for sustainable development in agriculture is a much larger and complex task than what can be presented in a short chapter. Therefore suggestions for further reading are provided for some of the issues not covered here.

READ MORE

There are many publications and courses on facilitation, where you can learn approaches, methods and group dynamic exercises.

As the approach of 'learning together' is prominent, the author prefers:

Pretty et. al. 1995. *Participatory Learning and Action – A trainers guide*, by http://pubs.iied.org/6021IIED.html.

Another easily accessible example is:

Geilfus, F. 2008. *80 tools for participatory development – Appraisal, Planning, Follow-up and Evaluation*. http://www.iica.int/Esp/regiones/central/cr/Publicaciones Oficina Costa Rica/80tools.pdf

If you are into reading theses, the following can be recommended:

Groot, A. E. 2002. *Demystifying Facilitation of Multi-Actor Learning Processes*. Wageningen University. http://edepot.wur.nl/165782

King, C. A. 2000. *Systemic Processes for Facilitating Social Learning: Challenging the Legacy*. Swedish University of Agricultural Sciences http://www.researchgate.net/publication/35502876

Personal background and experiences of the author

The author has a solid, lifelong interest in farming. All her understandings of farming, through studies, discussing with farmers and through practice, is a foundation for her work as an agroecologist. But during her studies it became clear that there is need to rely on more skills and understandings then just the pure agricultural ones, when walking the talk of agroecology. As a facilitator of research and development processes with farmers, researchers, advisors and other stakeholders she will share a few such experiences.

The experiences shared start from the notion that we are a part of a system – the world, life, society, family, a R&D-group – with which we as individuals have a very partial basic experience. Therefore, for high yielding R&D processes leading to sustainable transitions, collaboration is needed. Also, as our individual experiences are often driven by self-focused needs, which are not a good base for collaboration, a focus on the collaborative quality is also needed. The author has learnt that if one wants to contribute to improvements as systemic transitions, then one's decisions, actions and reactions need to be based on intentions to fully contribute to the system, and nothing else. This will be illustrated by the examples later in the text.

Together with partners outside the agroecological process facilitation work, the author has developed guidelines to secure improved intentions of choices meant to be beneficial to oneself as well as the context. Examples of some of the guidelines are how to deal with judgment, self-focus and extrinsic valuing of self and others[4]. This has been very helpful when working with facilitation.

Often transitions come from people daring to make decisions, and choosing new approaches outside the established 'boxes' for thought and of habit. To be able to facilitate also such choices and really walk the talk, not just talk about a systemic world with continuous learning and equal values, the author chose to start to learn to live it. When focus shifted from what had to be done by somebody, to being conscious of one's own patterns and reactions, actions and thoughts, it became easier to consciously start making choices of what to do personally to contribute to sustainability transitions. This took paying attention to and transforming her reactions, actions and thoughts that she caught to be judgmental, self-focused and close-minded. It has been an exciting road to navigate, and the experience is that the facilitation task has become much more relaxed, focused and fun.

What is a transdisciplinary Research & Development process about?

A transdisciplinary research and development process takes place when power is shared among different actors with different backgrounds and professions, and they meet to learn about, research, and develop a situation. An example of this is a group of stakeholders that learns about and researches the possibilities of improving the sustainability situation of Swedish agriculture by developing modern agro-forestry production systems.

When the Agroforestry Group in the example below (see the box) started to work together, there had been a long pre-process giving funding for one year to initiate Participatory

4 Believing someone is better or lesser compared to others because of [for example] the type of car, education, background, looks, house, religion, or knowledge the person has.

Learning and Action Research (PLAR) in the area of Agroforestry in Sweden. This funding was later extended.

Group example: Group formation

The background of the Agroforestry Group (2012-present)

The human activity 'agriculture' does not only need to reduce the non-supportive environmental impacts it causes, but also to increase the supportive ones. It is designed to produce food, feed, energy and materials but also needs to include other ecosystem services that make the agroecological system as well as its context function. A prerequisite for this is that we as humans play our parts for the system to be able to produce, reduce and support.

Group definition:

The Agro-forestry Group has defined their collaboration using the CATWOE tool (Checkland, 1981).

In short it can be expressed as 'that the participants have the power to make all decisions, that they perform the work together with temporary affiliated researchers and students, that the target group apart from the them self are persons and groups interested in agroforestry, farming and sustainable development, that the work is based on that all humans have to take responsible actions to make live styles sustainable, that life is a constant learning process and that development improves by collaboration, the work is also based on the knowledge of the connectivity of systems and that natural ecosystems may work as models for system development' (Björklund et.al. 2014).

The group consists of farmers, gardeners, teachers, researchers, farmer union officials who are collaborating across 14 different locations for their research and development. This includes case studies of locally adapted forest gardens with the same design and with cases of pastoral systems that complement each other. This group's work needs several years for production results, and a few years to draw conclusions on experiences from questions faced and practical situations that are solved.

When planning a research and learning process as with the Agro-forestry Group the experience within transdisciplinary participatory and action research approaches is not to plan the subject contents ahead of the workshop but only prepare for the coming process. In this case the pre-process to get funding had been elaborated by several actors discussing the needed contents on how to develop modern agro-forestry systems in Sweden. But when the actual work started there was a new group of people joining and a new collaboration process starting.

Preparing for, but not planning, the content ahead, apart from the core invitation to the workshop focused on 'researching and developing modern agro-forestry systems in Sweden', is a crucial foundation for a successful process and valid results. However, if a facilitator decides what the collaboration is going to focus on ahead of the participants, he/she immediately limits the learning process, putting it in a box. The facilitator's partial understanding would set boundaries on what this was about, and on top of that suggest that his or her contributions are more important than the contributions of others. This means leaving the axiology (equal value/importance) and epistemology (internal, experiential and collaborative learning) behind, and limit the possibility of working according to a systemic ontology (worldview based on connectivity) (see section 3). These three go

hand in hand, being prerequisites for each other. Therefore the focus on the collaboration of this sort is quite different from other research approaches and is one of the challenges when shifting to R&D approaches with high degrees of participation.

Group example: Planning

In the case of the agro-forestry group not planning the subject content meant starting with a brainstorm exercise on the questions 'What has impact on an Agro-forestry system', and 'What does an Agro-forestry system have impact on?' (In Swedish one question with both meanings 'Vad påverkar ett agro-forestry system?')

When the question had been raised a brainstorming session started generating a list of factors of interest. From all the factors noted, the first issues to focus on were prioritized and developed further.

READ MORE

Read about different research approaches in agriculture and possible effects of mixing them in the process:

Eksvärd, K. 2010. Is conventional agricultural research fit for the purpose of supporting ecological agriculture? A case study of an attempted transition in Sweden. *Renewable Agriculture and Food Systems*: 25(1): 55–68

Especially in the formation stage, when a facilitator knows of inputs that will contribute to the group's work, that information will contribute more if shared when everyone in the group is ready to contribute based on the same premises. When to share knowledge might seem like a small difference, but it has a huge impact on everything that comes after. The experience is that when the facilitator allows for it, often someone else will bring up what was thought of and the only thing the facilitator needs to do is a check mark in the mind that it has been taken care of. By focusing in this way, the process is formed on a systemic base through how the workshops, collaboration process and platform are planned. Space can be provided for everyone's contribution. When everyone in the group has agreed on the content matter, the chances are great that everyone will gather around its aims and goals.

IN DEPTH

Example: Collaborative platform

A collaborative platform for the group process and work can be built through:

- Keeping to the approach of equality
- Personal presentations
- Open individual decision making on participation
- Making a group contract
- Defining the groups work

The bullet points are described in different sections of the chapter.

Facipulation vs trust

The author has experience with the dramatic and narrowing effects on creativity of a pre-decided process, compared to how it can flourish when the participants are trusted to define the situation to improve and phrase the questions of interest themselves. This experience was gained at a time when she did not early on share her understanding of processes with the project owners that set the agenda and the turmoil that came after. Still the first time she gained this understanding was when watching an educative film where a seed company arranged a participatory evaluation of bean varieties with farmers who had been growing them for this purpose over the season. The beans were both the traditionally grown beans the farmers themselves had developed over generations to fit into their local context, and the 'improved' variety produced by the seed company. In the end of the clearly tilted process all the farmers expressed the conclusions that it would be better for them to spend their cash on the seed company's been production package than continue with any of their own selected seed. What the seed company succeeded with has a name; 'facipulation'. You can read about such manipulative facilitation processes in plenty of literature. But, not sharing what you yourself actually know and have understood, like in this case the farmers probably did not, also sets any participatory process askew.

READ MORE

Stuff expat aid workers like http://stuffexpataidworkerslike.com/2011/02/16/24-facipulation/

Driver, T. and Kravatsky, A. 2000. Particpatory learning and action or Participatory acting? PLA Notes 38: 3-5.

Participatory Learning and Action or Participatory Acting?: http://pubs.iied.org/pdfs/G01880.pdf

From the start of a new group and through the whole process, it is important to keep in mind that it is the whole group that owns the process. It is the whole group that together decides on the questions of interest, on investigations and trials, on what will be considered an output or outcome, and does the analysis and draws the conclusions

Not to fall in the trap of facipulation, the author has had to recognize her own desire to control the content and goal. This requires putting trust in the process the participants will form together and that it will proceed and develop into much more than if being boxed in by anyone's hidden agendas, including that of the facilitator. As soon as all group members start taking interest in making the group work open and collaborative, and focusing on how they can contribute instead of having personal gain as main goal, the R&D process can start taking off strongly. Everyone will then gain from the process in more ways than they could have expected beforehand.

An easy way to start a collaborative platform for trust building in the group is to use any presentation technique that gives participants the possibility of sharing a bit more of themselves then the usual 'name, title and profession' presentation. Also, it is useful to assure that each member of the group, who chooses to be part of the process and is ready to contribute, can be given the space and encouraged to phrase this. If the group

is small enough it can be a good idea to ask each individual to phrase the commitment out loud, which is good for the others to hear. Another important part of this platform is the group contract technique (described on page 78), which facilitates trust that all participants have agreed on how to conduct themselves and participate in the collaboration. Common elements in these contracts are 'equality', 'sharing', and 'listening'. Doing this also shows from the start that you and the rest of the group are ready to deal with issues of group dynamics if needed.

READ MORE

Eksvärd, K. 2010. Facilitating Systemic Research and Learning and the Transition to Agricultural Sustainability, *The Journal of Agricultural Education and Extension,* 16:(3):265 – 280

Personal example: Self focus

Personally I have had to go further than just using tools to let go of the desire to control the process. Using methods as illustrated above to create trust has been really useful, but the need to go further became clear when I tried to insist to a group that they create a website and they gave me clear feedback that this was not what they wanted to prioritize at that point. At first, having focused on how I had acted, I felt really bad. But when focus was turned to the group it made me happy to realize that the other participants had not let themselves be facipulated by me. I have come to understand that this wanting to control had three roots:

1, the idea that I would know better than the others,

2, wanting the other participants to think I did a good job, and

3, to verify that I was important.

So through leaving the basic axiology of everyone's equal value and contribution through wanting to appear 'better than' and show off, in practice I set the epistemology and ontology aside. Nowadays I keep asking myself: 'how can I contribute in the best interest of this group?' Just as I know when I am lying, I can feel when I am not sincere about this intention. The sincere intention is all I can justify – the control of the end results will be in the hands of the group.

Note that this does not set my interests aside as I am part of the group, but it puts aside any selfish wish to gain anything on behalf of the group and the results.

In short, to build trust

A. Create together a collaborative platform (page xx) for trust that everyone agrees to

B. As a facilitator make sure to stick to that platform throughout the process, as well as being open and willing to build onto it when needed and if suggestions emerge from the group to do so.

C. Give and encourage honest and straightforward feedback

When participants are open about their agendas, trust each other to contribute and start to look at what overall is needed, the process starts to self organize, new types of questions are phrased, and useful transitions may start. The experience shared is that groups usually start off asking 'safe' questions connected to their practice, while questions relating to their approaches and worldviews, reaching deeper levels of learning, will come later. In one case in which the author participated, it took three years before such questions where asked.

READ MORE

Argyris, C. & Schön, D. A. 1996. *Organizational Learning II. Theory, method, and, practice*. Addison-Wesley Publishing, Reading, UK.

Tosey, P., Visser, M., Saunders, MNK. 2012. The origins and conceptualizations of 'triple-loop' learning: A critical review. *Management Learning* Vol 43 (3): 291-307.

Eksvärd, K. & Björklund, J. 2010. Is PLAR (Participatory learning and action research) a sufficient approach for the purpose of supporting transitions for sustainable agriculture? A case study from Sweden. *Journal of Agricultural Extension and Rural Development* Vol. 2(9):179-190. Available online http://academicjournals.org/article/article1380032121_Eksvärd and Björklund.pdf

Group example: Trust and safety

In a group of nine, three people were chosen to come with suggestions on what color was to be painted around the windows of an industrial building. They suggested a beige color and the 8 people present found it perfect. When the ninth person of the group was informed that everyone had agreed on the color beige, he looked around at the group with amazement and said: 'No way!' He walked off and picked a bright green leaf from a birch. Coming back with a big smile, he said: This is the color I suggest we should have instead. On the spot, everyone agreed. As no one had any personal agendas as prestige or need to win the discussion, it was easy for the first eight persons to see that this was a better option. The result was perfect and today everyone enjoys the color and is pleased that the suggestion of color beige was cast aside.

In society, it is common to listen for what you do not agree with when others present their ideas, and then start the discussion with an objection. This is quite in line with a strategic rationality often used when the personal aim is to win a discussion. Using a collaborative rationality, aiming to reach shared understanding, needs another start. Through experience, the author has learned that when taking people's good intentions for granted, listening to

beneficial facts you agree on and then adding on to what is expressed, many valuable ideas may flourish. Whatever may need to be sorted out and thought more about will be taken care of collectively. As this approach connects well with the platform of trust, it often has a tendency to spread within the group if the facilitator sticks to this strategy. Such an approach makes collaboration much nicer and smoother. Also this way of meeting and listening to people creates for the group a safe space where it is easier to challenge the opinion of the majority.

READ MORE

Groot, A. & Maarleveld, M. 2000. *Demystifying facilitation in Participatory Development*. Gatekeeper Series no 89. International Institute for Environment and Development. http://www.wageningenportals.nl/sites/default/files/resource/demystifying_facilitation_in_participatory_development_annemarie_groot_and_marleen_maarleveld_iied_2000.pdf

Rand, D. G., Greene, D. J. & Nowak, M. A. 2012. Spontaneous giving and calculated greed. *Nature* 489: 427-430.

Collaboration quality as a base for research quality

A well-known problem when working in groups is the danger of getting stuck in 'group think', i.e. scratching each other's mental backs and creating 'group critical opinions'. At this stage the flow of information with the surrounding context and society is limited. As soon as there are thoughts of other people as 'them', and considering them as of lesser or better intelligence/professionalism/ability than 'us', there is a need for attitudes to open up and relationships to improve. When this happens the systemic ontology is left behind (with a we – them division instead of connectivity), the epistemology (internal, experiential and collaborative learning) does not work, and the axiology (equal value/importance) (see section 3) has been thrown out the window. All that is possible to do when this is the dominant state of mind is traditional dualistic research in its worst settings. Such situations in groups like these are serious business, that have to be dealt with right away or the quality of the work done will be reduced.

Personal example: Standing strong

When I started as a facilitator, I found it awkward to face people with their behavior and actions that detracted from the prosperous work of the group. Who was I to tell others how to behave? And really I am not. But I as a facilitator as well as everyone in the group are responsible for how the collaboration functions both through our own actions and in giving feedback to others. Therefore it is crucial for me as a facilitator to speak up and kindly point out the deviation from our agreed-upon platform. If a person does not get feedback on the behavior, there is very little chance for that person to gain insight on his or her deviation from the platform by acting the way he or she does. There have been times when I hoped someone would learn as the process proceeded and that things would improve without me or someone else having to step in. Wrong! I have learned that until the person responsible faces a behavior that does not serve the group, nothing will change. So, informing at least gives the person a chance to reflect on the behavior and take any kind of action he/she finds appropriate.

Personal example: Judgment vs constructive feedback

As described above giving feedback to group members not acting according to the agreed-on collaborative platform was not always easy. After some time I realized that the feelings of awkwardness were all about my own presumptions of what others would think about me if I acted. I found three roots of the feeling of awkwardness: 1, fear of how I would be perceived by the group; 2, fear of how the person I gave feedback to would react; and 3, fear of not being able to stand strong to that person. But, I have learnt that when things are said without any judgment and with the intent of wanting to contribute to the person and the quality of the group work, anything has been possible to point at as an area of potential improvement. My experience is that when I am completely at ease with an issue and not projecting any 'un-ease', the person receiving the feedback has listened in a constructive way. If this did not happen immediately, they have almost invariably taken the feedback to heart in the long run.

To give constructive feedback

1. Realize feelings of awkwardness are all about oneself.
2. Let go of any judgment; don't judge the person even if not agreeing with his or her actions.
3. Be sure to act from an intention of doing the best for the whole group as well as living up to the platform everyone agreed on.

A key to reducing judgment of others and myself has been to separate the actions from the person committing them. Actions may disappear when a person learns to change. The person is still there. They are not the same. When I started seeing behavior as part of a learning process and that people really try their best according to their capacity in the moment, the task of facing behavior was not as awkward at all. I actually started appreciating getting that kind of feedback myself, understanding it to be a great chance to improve the quality of my life.

I have asked myself:

Do I ever truly want to act according to selfishness and 'bad behavior'? No, had I at that very moment known a better way to act than my old patterns, I would have. Does anyone ever truly want to act according to selfishness and 'bad behavior'? Most likely not. In my case all the selfishness I have recognized so far has been due to lack of awareness.

And if I am proved wrong and there is someone who actually truly, from the depth of their soul wants to act badly, I will still keep this approach, as my experience shows that it has increased the quality of life and collaboration tremendously.

It is an important task for the facilitator to notice deviations from the platform (page 72) that everyone agreed on. Repeated behavior such as talking too much so that others do not get an opportunity, breaking agreements, interrupting, insisting on meeting times that do not fit the rest of the group, gossiping about others, and in any way demanding special treatment without factual causes or anything of similar self-focus must be dealt with to make sure that these kinds of behaviors get as little space as possible.

A process of quality

The quality of the collaboration sets the quality of the whole R&D process with its outputs and outcomes. If people do not speak up when they find something to be wrong, or that something can be added or changed, the validity of the results and solutions that will fit into and improve the situations will be reduced. If someone does not speak up and say 'yes I know that it is environmentally best to produce composted manure from our residues on the farm but it will not happen as it is a hard and time consuming work, I have a back problem and need to take my daughter to soccer practice every week' or 'I know research says that this is the best way to treat this plant, but it does not work at my place', then the R&D process going on will miss out on information that might make the whole difference of new knowledge being developed, situational correct knowledge being developed and change and transitions actually taking place. Having open conversations where everyone contributes is actually part of the validation process.

IN DEPTH

Group contract and team development

Aim: To create clear rules for the group's collaboration, to talk about what the participants find important in good collaboration.

Materials needed: Pen and paper

To facilitate a good mode of collaboration a group contract can play an important role. It can be done to different degrees but always aims at creating a feeling of security among the participants and clarity on accepted and non-accepted behavior. In its simplest form it is a piece of paper with keywords for what the collaboration should be conditioned by. Let everyone have a say, one at a time, and exemplify immediately the importance of everyone's contribution. The contract, which is part of the platform, should always be available pinned to the wall to make it possible for any participant to refer to if needed. It should be revised from time to time and every time there is a new participant joining.

This exercise can be done in several steps if wanted.

After the round of 'one at the time brainstorm' where the conditions have been identified;

Define what the characteristics mean to each one, by letting the person who mentioned it start.

Agree that this is an agreement on how to collaborate.

Check if there are there any additional ideas that need to be developed or looked into? If there are several, only do maximum two at a time.

Agree on how the participants can create or improve the discussed condition in the group.

To facilitate a start where the participants feel free to share their open minds and participate on equal premises, it is important to introduce the possibility of making an agreement on how the group would like their collaboration to be. The agro-forestry group phrased this as being characterized by 'enjoyable, respect, flow, responsibility, sharing, defined participation, clear communication, share the aim'. It is not likely that anyone in a group would say they want the collaboration to be grumpy, mean, or self-focused. Doing this exercise makes the group aware of their own values of what good collaboration takes.

By putting focus on the collaboration the quality of the whole R&D process has a great possibility to be accomplished. When a group does not agree on rules for collaboration and does not handle grumpiness and critical opinions (see section 1), the base for a functioning epistemology and axiology will be set aside and not make a systemic ontology possible.

Facilitating the formalities

Working with R&D in this way may raise critique from people not used to these approaches: 'So, what are you doing, research or development?' or 'How can you call this research?' are questions raised. The author claims that there is no good development going on without a researching attitude, and no good research that does not lead to some kind of development. With a systemic worldview the boundaries are open and the two can be part of the same processes of improvement.

Because there is Participatory and/or Action research going on does not mean the formalities are less then when doing conventional research. Whenever there is a 'suitable research methodology, based on a clear ontology, epistemology and axiology, a structured way of identifying questions, a well-defined and documented learning process, validated or verified outputs and outcomes and where transferable or generalizable new knowledge has been shared with a wider audience' there is research going on…. Furthermore, insofar as this research was carried out with multiple actors who acknowledged the transformations in their thinking and practices induced by that learning, then participatory learning and action research can be said to have taken place. If all actors have an equal possibility of influencing the work and taking responsibility for the process, then this can be said to be research that is 'driven by the participants'.' (Eksvärd, 2009). With PLAR all the basic principles are in place.

As a facilitator of a R&D group, one needs to keep the research approach well in mind where learning, reflection and action is continuous and questions develop over time. The new 'expertise' is an emergent property of the collaboration among the individual skills, knowledge and experiences in the group and their interaction with the context and society.

There is plenty to read on PLAR, action research, participatory research, collaborative learning, action learning, and social learning that will give formal inputs on how to do the R&D work. What is emphasized in this chapter is shifting the scope of focus from finding correct answers to pre-decided problems to finding solutions to collaboratively examined situations, and to shifting the attention away from arguing only your point, while being attentive to listening for what you agree with in what others have to say. The research rigor and the critical thinking are still there, but the approach is different from other research and development approaches often used.

There is still a need to keep track of the research process and documentation, something that is covered in other literature.

READ MORE

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The facilitator: one of the group

Remember, a facilitator is just one person in the group, only another participant. Your task is just one of many needed for successful work to proceed. And if all goes well, having one person to focus on facilitation will be less and less needed as all learn to contribute. If you want to be special compared to others – don't facilitate! If you see everybody as special, including you – facilitation will be much easier. Being one in the group may also mean that what you have planned for the meeting might not be what actually needs to be done. Other group members might realize other needs or come with other suggestions. Flexibility is a key asset. The author has also learnt to follow up on hunches and 'a flick of second thoughts' as they have proved to be inputs to herself from her own mind when it is difficult to keep the full picture active in mind.

Group example: Workshop program 1

A facilitator had planned a full day's program for a farmer group. They met four times a year and there were several things that 'had to' be discussed and looked into. Immediately after starting the meeting, thus the program had to be pushed aside. One of the farmers had acute, serious problems with keeping his farm and needed support of his colleagues to see the situation with clear eyes. This was prioritized by the group and took a large part of the day. Then the group collaboratively decided what in the original program to look into and what to deal with in other ways. It turned out not to be a problem for the group work and the farm enterprise in fact kept going.

Group example: Workshop program 2

In the beginning of a workshop starting off the planning process to write new and up-to-date educational material in agroecology, a comment from one of the authors helped the facilitator of the workshop realize she had been thinking 'inside the box', aiming for an educational material and organization with traditional subject chapters, and had planned the day according to the traditional model. The first plan was quickly abandoned and a creative process initiated that involved the whole group, which then explored the type of contents this material could include.

Often other participants in the beginning look at the facilitator as 'the leader' and expect him/her to have the answers to their problems. This type of role stereotype is so common we often do not even stop to realize it. Farmers are expected to ask questions and researchers and advisors to give the answers. Make sure not to step into that kind of 'knowledge leader'- role and do your best to not give 'THE ANSWER'- when such questions are raised. If someone can phrase a question about something they already have knowledge or skills, ask them to explain what they know, invite the others to join the conversation, and see if you have something to add. Don't forget to encourage the quiet ones.

Facilitators need to take leadership on their tasks and do their part of the work to 100%. No less, but also not more. If you do more than your part, you will be 'stealing' others' possibilities of engagement, development, and having fun, and things may go more slowly. This means that if one pushes the process to go faster, doing more than the facilitator's part, the experience is that the entire process slows down.

Group example: Collaborative facilitation

A group with a facilitator A had problems getting things done and A was getting more and more frustrated. Facilitator B was asked to give external facilitation support. The solution was to list the different types of tasks that needed to be done and then in consensus decide on who would take the responsibility to see that each of the tasks actually was accomplished. When the group realized what A, a non-paid facilitating advisor, actually was trying to do by herself and pushing to get the work done, and she realized it was not possible within the available time, the other participants took more responsibility of getting their own tasks done in time without reminder. They also took turns taking and distributing the notes, making it possible for the group to continue their work.

Monitoring, evaluation and transformation

Monitoring and evaluating the work and process collaboratively in the group enhances learning and verifies the outcomes. It is most important and there is plenty to read on this. In this chapter the focus has been on paying attention to 'monitoring', and evaluating the personal patterns, actions, reactions, thoughts and ideas to make sure that no self-focused interest puts brakes on the self-organizing, creative, transforming and rigorous PLAR processes.

When the complementary patterns, actions, reactions and thoughts can be better integrated and improved, the following guidelines might help:

- Don't compare, relax, and recognize that our differences do not imply different intrinsic value.
- Don't judge others' behavior, but share another way if appropriate, and realize that we are all capable learners.
- Don't judge yourself; we all need to practice, sometimes many times before we learn new ways.
- Step out of self-focus and contribute to the larger context, enjoy self-organizing collaboration in the group, and experience the difference.

READ MORE

On process monitoring and evaluation:

Participatory monitoring and evaluation: Learning from change. 1998. IDS Policy Briefing, 12. http://www.ids.ac.uk/files/dmfile/PB12.pdf

SEWA Jeevika Project. 2005. *Participatory Monitoring and Evaluation: A Manual for Village Organizers*. Coady International Institute St. Francis Xavier University http://www.coady.stfx.ca/tinroom/assets/file/resources/abcd/SEWA PME Manual.pdf

Creating space

As a facilitator of trans-disciplinary Participatory Learning and Action Research processes, the author sees the main tasks to be:

1. Keeping in mind the open systems approach.
   - Mentally constantly moving between looking at the whole process and its parts, as well as looking at the process as a part of its context. It can be described as shifting the focus of the lens to catch the interactions of the different parts of the process and tasks.
   - Having in focus the needs of the group as a whole without walking over the needs of the participants – seeing each and every one of the participants as an important contributor.
   - Working with improving farmer situations rather then focusing on single practices or problems.
2. Shifting the scope of focus
   - Facilitating a continuous learning, reflection and action process where questions develop over time, and not focusing on finding answers to questions decided on by someone before collaboration started.
   - Seeing 'expertise' as an emergent property of collaboration among individuals providing their skills, knowledge and experiences as well as through interaction with the context, not as something one person 'contains or owns'.
   - Trusting, preparing and keeping track of the process, not controlling it.
3. Shifting the attention
   - Keeping the attention on the intentions to contribute to the collective work and being open to all kinds of solutions and ideas, leaving critical opinions and argumentation behind.
   - Looking for the self-evolving, emerging ideas and solutions that appear while interacting with each other, not trying to come up with smart ideas oneself.
   - Remembering simplicity – looking for the simple, honest, easy to understand solutions everyone will agree on, not trying to create fancy, complicated solutions that might look impressive at first sight.

None of the above is possible without monitoring one's own thoughts, actions and reactions to be in line with the philosophy of systemicity, continuous learning and equality. This means to keep in mind having a basic intention of wanting to contribute to what is in the best interest for the group, the participants and the on-going R&D process. Though a lot of focus on these matters is put on collaboration, it is the personal responsibility of everyone in the group to see to their individual learning, their capacities to un-learn and re-learn as well as contribute, which forms the R&D process and shapes the outputs and outcomes.

Creating space for what is needed for a thriving process without knowing the outcome is the task of facilitators.

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SECTION 5
Conclusions

In this publication a number of authors have presented a systemic base for research, education and practice in Agroecology. This base has evolved during experiences as described in the individual chapters on transitions and changes. They are what the authors have seen needed and/or have acted on in their professional lives to better align solutions to sustainable development with the actual global problems of today.

The need for transitions is described to exist in the range from worldviews and philosophy of science to everyday professional practice, institutional development and personal behavior. From what is presented, roots to the sustainability problems of today can be found in the dualistic and mechanistic explanatory models of the world that mark many societal and human actions. The material highlights needs of personal insights, practical work, methodologies and educational approaches well aligned with the situations and problems in question to be able to improve and solve them.

From the different chapters lessons can be drawn on improvements in several areas.

In the first chapter on agroecological practice and small-scale farming, we learn about the possibilities of adapting farming to an appropriate scale in the area. This is essential even though agricultural policy goes the other way. Examples of improving sustainability through co-solutions with the local community in Sweden are also presented. Many of the practical thoughts the farmer describes correspond with theory presented in the next chapter on a qualitative understanding of the web of life: sustainability means keeping systems in open interactions with the context, the different parts need to contribute to each other and the whole system, and solutions need to be adapted to place.

Furthermore, from the second chapter we learn what it means to apply an ontology that the world/universe is: (1) open and self-organizing and (2) interacts in connection with the environment. This means that it is observed how the universe, at all levels, builds complex structures and connections (i.e. it 'self-organizes') through constant flows of energy through the system giving cause to different transformations. Also, (3) in this web of connected self-organization, new 'unpredictable events' happen (called 'random' some times and 'creativity' at other times). (4) These processes are also under 'testing' (Maximum Empower principle), which leads to (5) co-evolutionary development processes. The uni-

verse is evolving, not only changing. This offers a framework that allows humans to see and work with complex systems and the qualitative characteristics of them, not separated from each other into different academic disciplines.

In the third chapter it is shown that a faith in the self-organization processes, means also a faith in students' creativity and initiative. The knowledge and experiences they bring into a learning landscape with other students and teachers provides a foundation for experiential learning, and application of open-ended case studies. This approach enables students to become more practical and participate actively in the learning process. The practical sessions in real cases enable them to see things differently, and better able to realize that we need sustainable agroecosystems and that these can't be in place unless the big picture of the agroecosystems are in focus. The approach also takes un-learning for both students and teachers used to more traditional approaches of how teaching should be done.

From the ontology presented in this publication, it will be logical to expect contextual adaptation of formal and informal institutions, which have been 'tested' in a kind of 'self-organizing' process over time. In the fourth chapter there is a call for the ability to have all components of the agroecosystem coordinate and collaborate both horizontally and vertically while including all actors who will affect the entire system. It is discussed that policies can benefit if they integrate with the institutions or lose if they neglect them. By working with participative approaches and institutional bricolage in policy work, it would be possible to use much more creativity, new initiatives and local knowledge within institutions at all levels. This takes trusting the process of self-organization just as when experiential learning is used in teaching.

The fifth chapter gives examples of facilitation of creative and self-organizing R&D processes. It explores what it means to get conscious about one's own ontology, epistemology and axiology and to apply the described set of those in an Agroecology of responsible actions. Any agroecologist is encouraged to monitor personal thoughts, actions and reactions to be in line with the philosophy of systemicity, continuous learning and equality.

For agroecologists to contribute to improved sustainable development, we conclude that there is importance

- of being aware that the philosophy of science, the approach, the methods and the personal actions should be aligned and appropriate for the problem that needs to be solved or the situation that needs to be improved.

- of paying attention to the intention behind human actions, decisions and opinions in transition work for sustainability; will it support sustainable development or not?

- of learning more about self organization and how human actions, reactions and decision can support the development of such viable systems.

This does not only take research, education and planning, but also practice, training and patience. It means leaving the old definition of anthropocentrism as humans being the only important players, to another way of seeing that it is these same humans who are capable of actions and decisions that could lead to the viability of a future world.

What are your intentions for the future?

SECTION 6
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This publication not only presents a basic platform that, according to the authors, provides for R&D to contribute to sustainable development. It also gives an overview of agroecology as well as a peek into the work, ideas and activities of agroecologists 'walking their talk' of this broad subject.

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We hope you enjoy this presentation of Agroecology and that it will inspire and encourage you on the walk of your talk.

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