

Effective and sustainable organic agriculture

Experiences from a small scaled farm in central Sweden.

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Situated in "Roslagen" in a mosaic landscape composed of glacial drift hills and valleys with decomposing peat



The project: Future Agriculture

The project aim was to, on an actively used farm, perform a management shift to intensive food production based mainly on locally and renewable resources, and to assess how the production of different biofuels compete with, and affects, food production output and nutrient fluxes



Participatory research; kick off 2009

The project aims at being an example on how a farm, might look like in 2030. The research farm should be :

- A place where creative ideas and methods, which might be risky for other to practice, could be tested and evaluated.
- A source for inspiration for other farmers, students, scientists, decision makers and the public, and a guide for others who want to try similar activities.
- A place to build up and maintain competence.

Our future scenario 2030 (according to IPCC and FAO)

- Emissions of not more than 1 ton CO₂eqv per person and year
- Production of food has to increase by 50 %
- The era with access to inexpensive fossil oil is ended and P fertilizer of good quality (stocks expected to be finished within 30-40 years) is a limited resource
- More insect species, previously restricted by low winter temperatures, will be established.
- Weeds adapted to grow under prevailing limiting light conditions occurring during autumn, winter and early spring, will due to increasing temperatures be a more serious problems.
- Risks for frost damages are increasing
- Longer drought periods during summers and lowered groundwater tables.
- Milder and more rainy winters with increased risk for nutrient leaching

Prioritized Research Focuses

- Sustainable crop rotations where food and feed crops are intercropped.
- Biological pest control and composting management of manure.
- Ecosystem services from livestock.
- Energy solutions. How to be self-sufficient with fuel?



A photograph of a red wooden barn with a corrugated metal roof. The barn has several windows and a door. The text is overlaid on the barn wall.

The farm:

8 ha arable land

3,5 ha meadows

5,5 ha pastures

18 ha forests (partly grazed)

Prerequisites

- P applications with human urine/feces, slaughter wastes, and ash
- N is supplied by N fixating crops
- Other nutrients are supplied through weathering of mineral soil material and increased availability through high humus content, good soil structure, high soil biological activity
- Reallocation of nutrients from pastures and forests to arable lands

The farm is estimated to supply 53 persons with food using 11,5 ha farm land + 5,5 ha pasture

Amount food from our study farm, kg per person and year	Amount food consumed by an average person in Sweden today per year
120 kg cereals and 20 kg for fodder	145 kg cereals
33 kg oil seeds	20 kg oil seeds
20 kg legumes plus 30 kg for fodder	12 kg legumes
150 kg potatoes and 100 kg for fodder	125 kg potatoes
4 kg egg	7,5 kg egg
25 kg meat	89 kg meat (<i>SJV 2013</i>)
270 kg milk	230 kg milk
Vegetables and berries/fruits cultivated in our home garden:	
170 kg vegetables	70 kg vegetables
200 kg berries/fruits	147 kg berries/fruit

Field trials for exotic species

	Harvest date	% germination without irrigation
Quinoa	20-30 September	40, 50 resp 75
Amaranth	After 1 November	60
Teff	20 September	0
Sorghum, Nigrum	30 September	30
Millet I, (plymhirs)	5 September	25
Millet II, (kolvhirs)	20 September	70
Sesame	After 1 November	0
Green lentils	10 September	70
Buckwheat	10 August	0
Sunflower, Lilia	5 September	70
Atriplex hortensis	30 August	75

Buckwheat



Relation between choice of biofuel and number of people supplied with food.

Three scenarios; ethanol from wheat and potatoes and one workhorse/one rapeseed oil driven tractor were compared with a pure diesel driven alternative regarding number of people supplied with food and nutrient recirculation

Impact of the choice of fuel on the amount of people the farm could supply with food, expressed as number of people and % of the diesel scenario

	Diesel	Rapeseed oil/ horse draft	Wheat ethanol	Potato ethanol
Number of people	69	65	53	57
% of diesel scenario	100	94	77	82

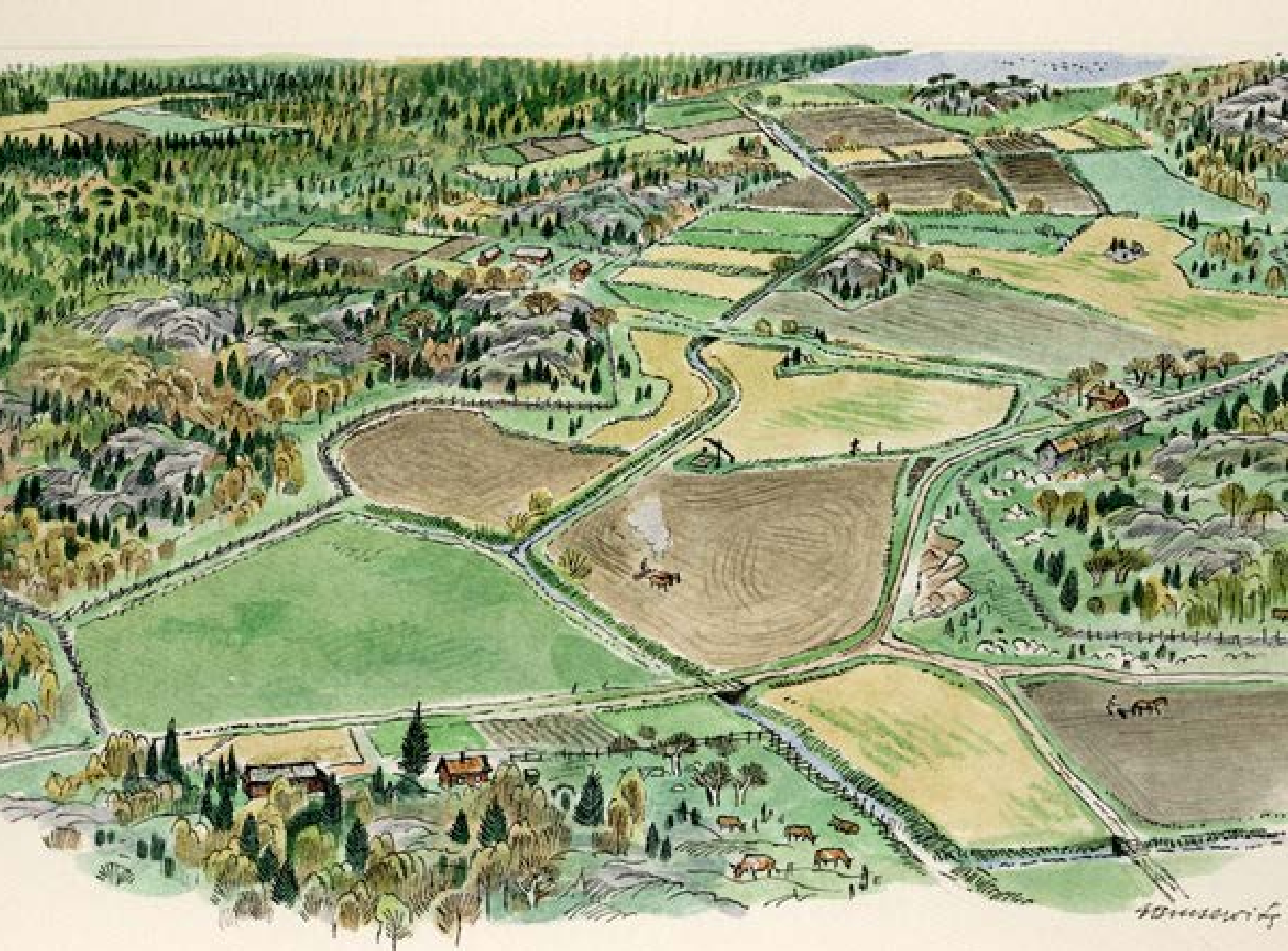
Number of persons supplied with food with different mixtures of livestock.

Case	Case description	Scenario I Conventional diesel	Scenario II 1 horse and rapeseed oil
1	17 large cows, 1 sheep, 65 hens	69	65
2	17 small cows, 37 sheep, 70 hens	47	44
3	158 sheep, no cows, 70 hens	35	33
4	22 small cows, 2 sheep, 64 hens	51	48
5	15 large cows, 19 sheep, 68 hens	67	62



Concluding remarks

- We have to consume what the soils can give, not the reverse!
- High yields demand livestock!
- The choice of biofuel affects both the food output and nutrient fluxes
- Knowledge of how to design the on-farm landscape to produce high amounts of food based on ecosystem services generated on the farm by livestock and wild organisms, is crucial.





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