

Looking for sustainability of local food systems: Halfway between traditional and current organic agriculture in the Czech Republic



Eva Fraňková

Department of Environmental Studies
Faculty of Social Studies
Masaryk University, Brno, Czech Republic
eva.slunicko@centrum.cz

&

Claudio Cattaneo

Barcelona Institute of Regional and
Metropolitan Studies
Autonomous University of Barcelona
claudio.cattaneo@uab.cat

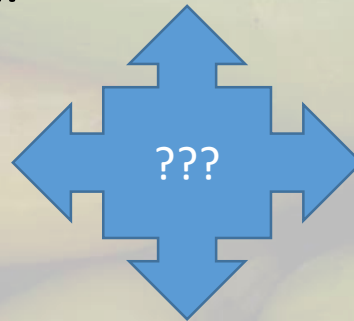


Industrialized Agriculture & Alternatives

- Soil degradation
- Biodiversity loss
- Animal welfare loss
- Food quality degradation
- Pressure on farmers' livelihoods ...



- Open nutrient cycles
- Dependency on fossil fuels
- Energy inefficiency
- High-External-Input Agriculture
(Giampietro et al. 2014:41)



- Agroecology
- Eco-localisation
- Community Supported Agriculture (CSA)

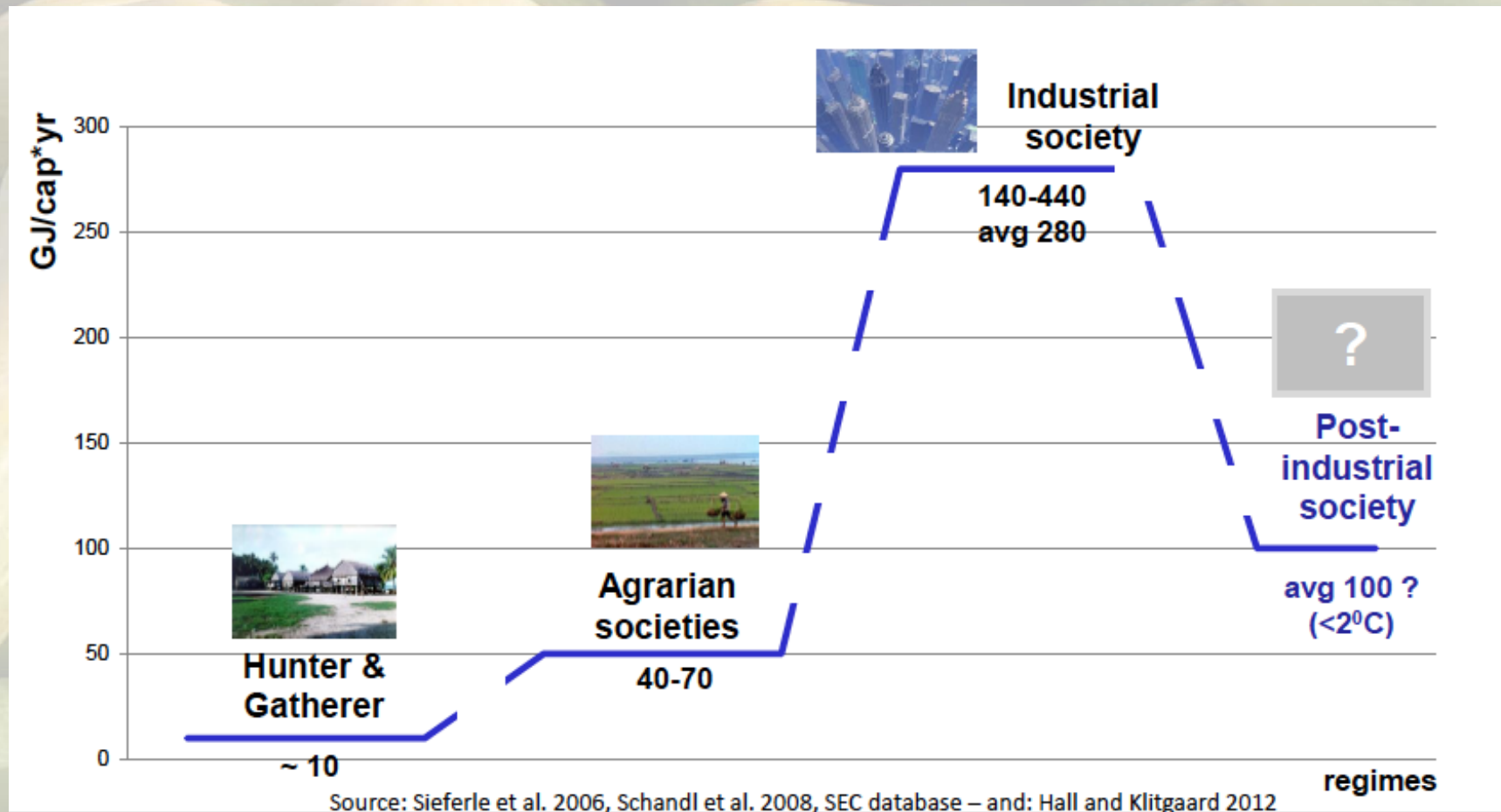
- Social metabolism
- Human Appropriation of Net Primary Production (HANPP)
- Biphysical option space (Erb et al. 2015)

Energy (in)efficiency in Agriculture

Production Type	Energy output : Energy Input
Tropical small-scale agriculture – kasawa	65-70:1
Non-mechanized rice production – Thailand	38:1
Tropical small-scale agriculture – various crops	15 – 40:1
Pastoralist production of meat and milk – Africa	10:1
Tropical agriculture – small amounts of chemical fertilizers	5-10:1
Hunters and gatherers	5-10:1
Non-mechanized maize – Mexico	<3:1
Wheat – GB	3,5:1
Maize – USA	2,8:1
Home vegetable garden – GB	1,3:1
Agriculture of GB in 1968 on average	1:2,8
Mechanized strawberry production – USA	1:5
Cattle meat – USA	1:5
world agricultural production on average	1:10
Chicken meat production – GB	1:10
Ocean fisheries – GB	1:20
Fisheries – Mediterranean sea	1:100

Still almost ½ of the world population (Fischer-Kowalski et al. 2011:147)

Socio-metabolic regimes (E consumption) & metabolic transition



Socio-metabolic regimes (material throughput)

hunter and gatherer society



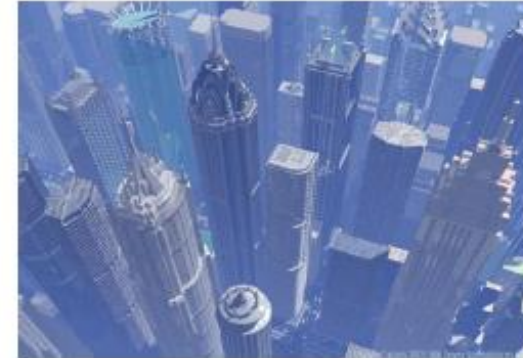
1t biomass (food, wood)
<0,1t minerals (stones, metals)

agrarian society



4t biomass (food, fodder, wood)
0,2-2t minerals (stones, metals)

industrial society



5t biomass (food, fodder, wood)
5t fossil fuel energy carriers
8t construction minerals
2t metals

20t total DMC/cap*yr

Traditional organic agriculture (Tello et al. 2012)

Material metabolism in t/cap*yr

Source: SEC database

Metabolic transition in CZ agriculture

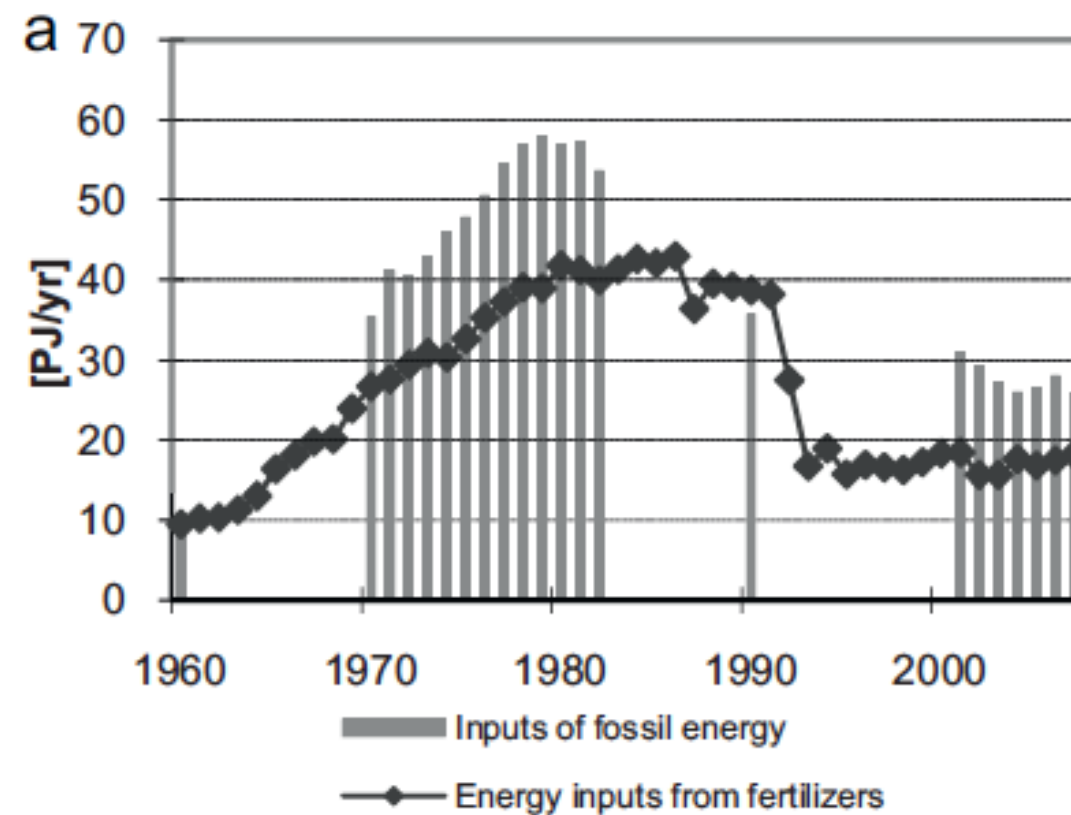
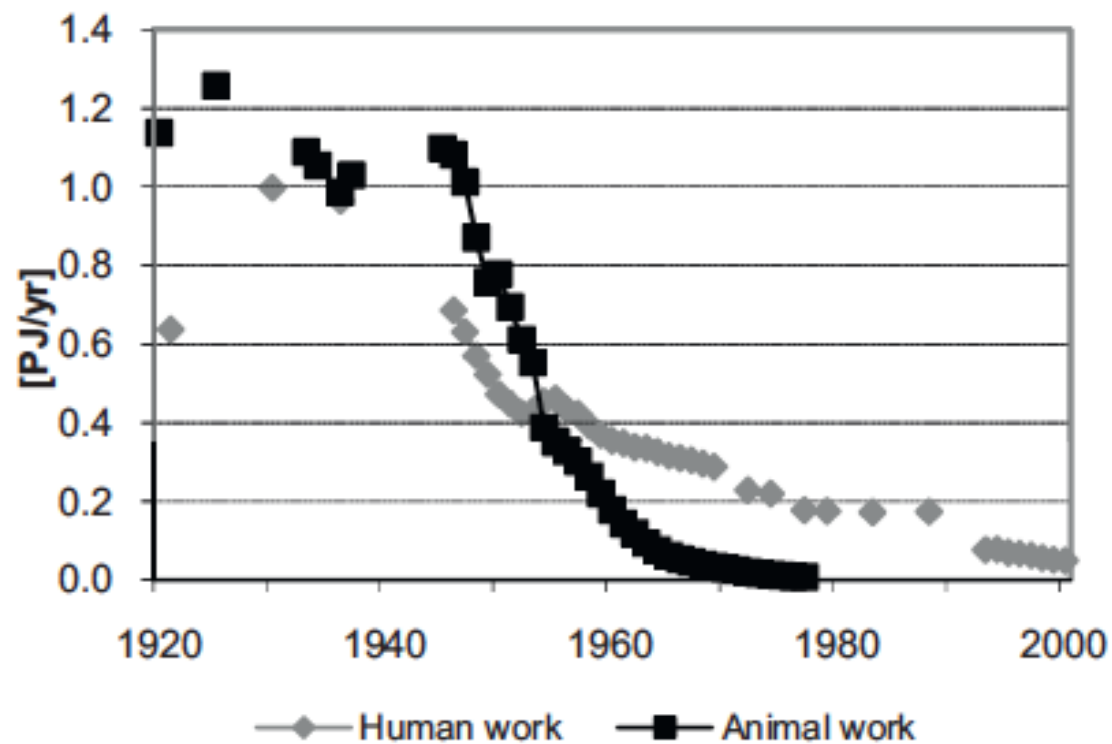


Fig. 2. Energy use in the Czech agriculture [PJ/yr]: human and animal labour [PJ/yr].
Source: author's calculations; see text.

Energy efficiency in CZ agriculture

Table 4
Energy flows in Czech agriculture 1960–2005 (PJ).

	1960	1970	1979	1990	2001	2002	2003	2004	2005
<i>Flows from the economy into the agricultural system (energy use)</i>									
Human labour	0.35	0.29	0.18	0.17	0.05	0.05	0.04	0.04	0.05
Animal labour	0.18	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Fertilisers (embodied energy)	9.5	26.7	39.0	38.7	18.4	15.6	15.6	17.6	16.8
Energy	10.3	35.4	57.9	35.7	31.0	29.1	27.0	26.0	26.4
Total energy use	20.4	62.4	97.0	74.6	49.5	44.8	42.7	43.6	43.3
Imported feed	9.3	9.2	13.4	7.6	4.1	3.7	3.8	4.9	4.9
Total inputs	50.0	134.0	207.5	156.8	103.1	93.3	89.1	92.2	91.4
<i>Flows from the agricultural system into the economy (production)</i>									
Animal production	15.9	21.0	26.9	31.7	20.9	21.0	20.5	19.9	19.6
Plant production	241.7	244.8	255.7	290.1	186.3	150.6	104.8	193.6	169.3
Total production	257.6	265.8	282.6	321.8	207.2	171.6	125.3	213.5	188.9
Production/Energy use ratio	5.1	2.0	1.4	2.1	2.0	1.8	1.4	2.3	2.1

Source: author's calculations. See text.

Social Metabolism (SM)

“Any social system not only reproduces itself culturally but also biophysically through a constant flow of materials and energy with its natural environment as well as with other social systems.” (Singh et al. 2010:5)

- Land use [ha]
- Time use [h]
- Energy and material flows [GJ, t]
- Derived indicators e.g. [GJ/cap/y]
- Current farm (2012),
direct field research
- Historical village (1840s)
Franciscan stable cadastre

Farm research – SM on the local level

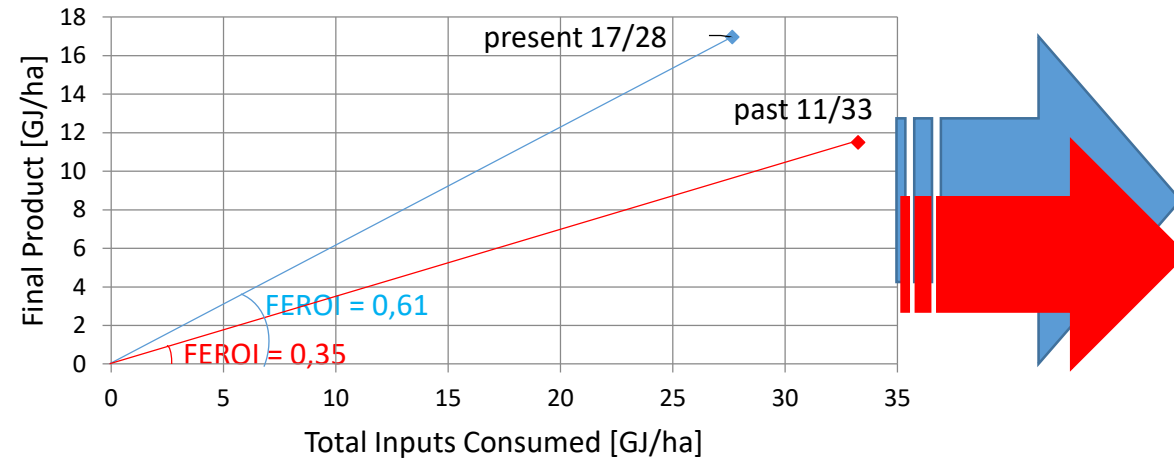
1. Small-scale organic family farm

integrated in terms of:

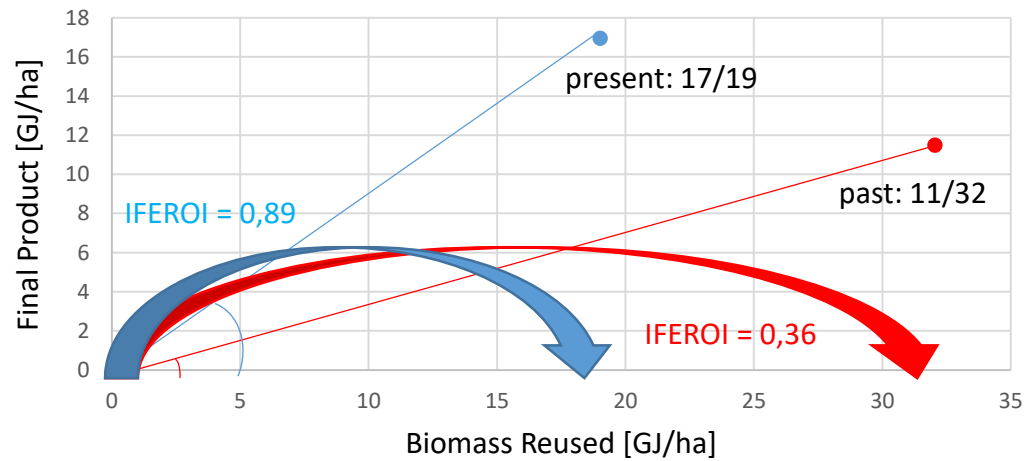
- Farm composition & Land use: 28ha (cropland 52%, grassland 30%, woodland 18%)
- 3.4 LU500 (pigs 79% , sheep and goats 15%, chickens 6%)
- Management practices: machinery and fossil input (power capacity of 100kW, 3.58kW/ha of farmland) + significant human labour input (1,597 h/cap/yr, 314 h/ha/yr)
- Aims: „good“ food production, autonomy, economic viability of the family, connection with the consumers (CSA)



Per ha relations of Final EROI



Per ha relations of Internal Final FEROI



Per ha relations of External Final EROI

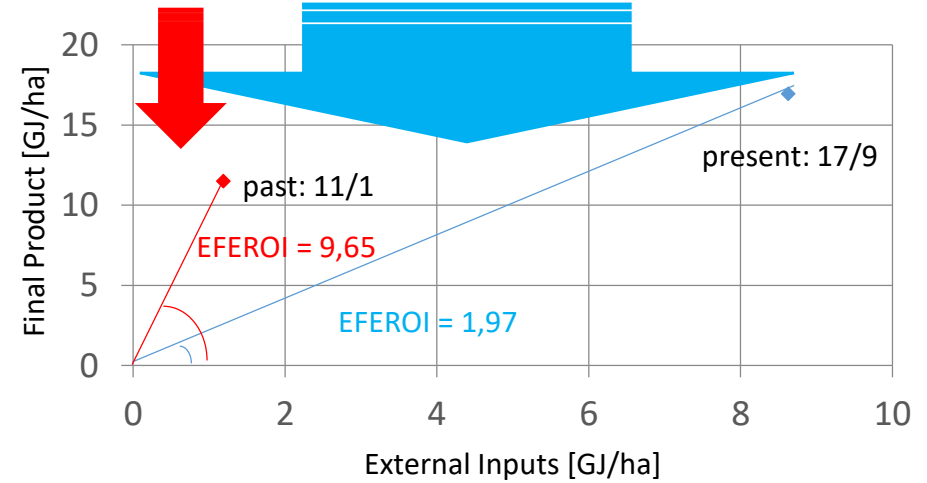


Figure 2: Decomposition of Final EROI, IFEROI and EFEROI. Red line and arrow = village level, c.1840 (past); blue line and arrow = farm level, 2012 (present). Source: own calculation, based on methodology by Tello et al. 2016

Average distance travelled

Sale points	Distribution [kg]	Distribution [kg,%]	Revenue [EUR]	Revenue [EUR,%]
Total	32 035	100,0%	25 124	100,0%
CSA	8 399	26,2%	4 773	19,0%
other farmers	7 580	23,7%	1 390	5,5%
organic shops	6 563	20,5%	5 723	22,8%
direct farm sale	5 583	17,4%	8 340	33,2%
farmers' markets	1 818	5,7%	1 763	7,0%
restaurants	1 723	5,4%	2 046	8,1%
schools	188	0,6%	215	0,9%
individual consumers	90	0,3%	100	0,4%
wholesaler	52	0,2%	732	2,9%
unknown	40	0,1%	41	0,2%

Source: own calculation, see more in our coming paper (Fraňková and Cattaneo 2016)

What it means to be halfway between *traditional organic* and *industrialized organic* agriculture

Food, Feed, Fibre, Fuel, AND Finance



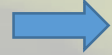
Trade-offs within certain option space

larger woodland share



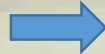
higher energy return

larger garden share

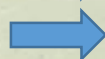


higher labour input

lower proportion of draft animals



higher need for external inputs in mechanization but also




higher animal food produce ...



Conclusions

- Sustainability debate in agriculture – very complex
- Social metabolism – very useful
- Current farm results – very preliminary
- Local food systems – very promising



Thank you for your attention!

Questions welcomed ...

now and anytime later:

eva.slunicko@centrum.cz

<http://humenv.fss.muni.cz/english>

Acknowledgments:

Supported by TAČR project: Development of Methodology for Assessment of Areas of Urban and Garden Production, no TD03000345 (2016-2017)

References

- Erb KH, Lauk Ch, Kastner T, Mayer A, Theurl MC, Haberl H (2016) Exploring the biophysical option space for feeding the world without deforestation. *Nature communications*. 7:11382
- Fischer-Kowalski et al. 2011. Sociometabolic transitions in subsistence communities: Boserup revisited in four comparative case studies. *Research in Human Ecology*, vol. 18, no. 2, pp. 147 - 158
- Fraňková E and Cattaneo C. 2016. Organic farming in the past and today: sociometabolic perspective on a Central European case study. *Regional Environmental Change* (under review)
- Giampietro et al. 2014. Resource accounting for sustainability assessment. Earthscan/Routledge: London
- Grešlová Kušková P (2013) A case study of the Czech agriculture since 1918 in a socio-metabolic perspective—From land reform through nationalisation to privatisation. *Land Use Policy* 30:592-603.
- Singh SJ et al. 2010. Local studies manual. A researchers guide for investigating the social metabolism of local rural systems. Social Ecology Working Paper, Vienna.
- Tello E, Garrabou R, Cussó X, Ramón Olarieta J and Galán E. (2012). Fertilizing methods and nutrient balance at the end of traditional organic agriculture in the Mediterranean bioregion: Catalonia (Spain) in the 1860s. *Human Ecology* 40, pp. 369-383.
- Tello E, Galán E, Sacristán V, Cunfer G, Guzmán GI, González de Molina M, Krausmann F, Gingrich S, Padró R, Marco I, Moreno-Delgado D (2016) Opening the black box of energy throughputs in farm systems: A decomposition analysis between the energy returns to external inputs, internal biomass reuses and total inputs consumed (the Vallès County, Catalonia, c.1860 and 1999) *Ecological Economics*, 121: 160-174.
- Ulčák Z. 2003. *Metodologické aspekty hodnocení udržitelného hospodaření v krajině*. [Disertační práce]. Mendelova zemědělská a lesnická univerzita v Brně, Agronomická fakulta, Ústav krajinné ekologie. Brno
- ULČÁK, Zbyněk a Jiří PALL. 2003. Indicators of Agricultural Sustainability - The Moral of a Story. In *Sustainable Development of Multifunctional Landscapes*. 1. vyd. Berlin, Heidelberg, New York: Springer-Verlag, pp. 67 – 78