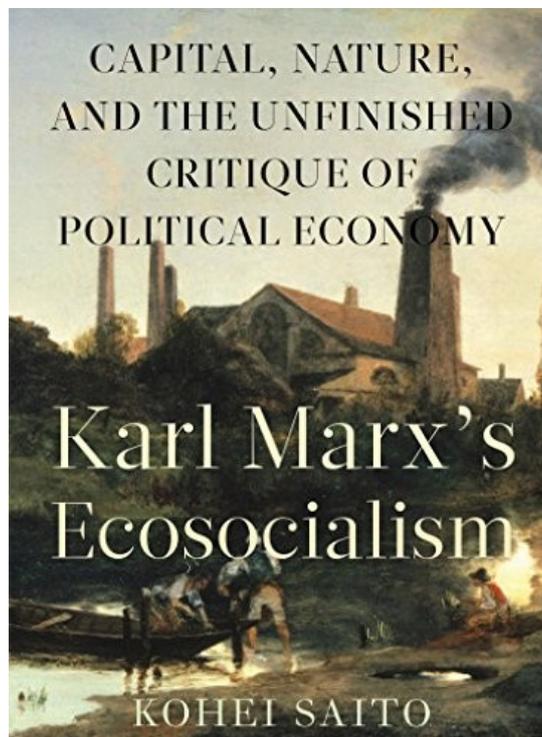


Kohei Saito

Karl Marx's Ecosocialism:

**Capital, Nature, and the Unfinished Critique
of Political Economy (2017)**

Education guide



Aims

This guide is designed to help understand the central ideas in Kohei Saito, *Karl Marx's Ecosocialism: Capital, Nature, and the Unfinished Critique of Political Economy*. New York: Monthly Review, (2017).

By the end of this course, comrades should better understand:

- how
- the.

Methods

- Seven sessions, lasting no more than two hours each
- Before each session, do the required reading. Annotate your copy of the book
- During each session, listen to the introduction and presentation. Make notes
- Discuss the questions provided. Ask your own questions and contribute to the discussion
- Read further to extend your knowledge and understanding
- Teach this course and other courses.

Sessions

Session 1: Marx before metabolism

Reading:

Introduction

Chapter 1. Alienation of Nature as the Emergence of the Modern

Session 2: Metabolism

Reading:

Chapter 2. Metabolism of Political Economy

Chapter 3. Capital as a Theory of Metabolism

Session 3: Metabolism applied

Reading:

Chapter 4. Liebig and Capital

Chapter 5. Fertilizer against Robbery Agriculture?

Session 4: Metabolism extended

Reading:

Chapter 6. Marx's Ecology after 1868

Conclusion

Session 1: Marx before metabolism

Key ideas

- Alienation
- Private property
- Nature
- Communism

Questions

1. Why is private property a problem for nature?
2. What does Marx mean by alienation?
3. How will communism improve humanity's relationship with nature?
4. Is Marx's description of nature as "Man's inorganic body" unecological?

Key passages

The universality of man manifests itself in practice in that universality which makes the whole of nature as his inorganic body, (1) as a direct means of life and (2) as the matter, the object and tool of his activity. **Nature is man's inorganic body**, that is to say, nature in so far as it is not the human body. Man lives from nature, i.e. nature is his body, and he must maintain a continuing dialogue with it if he is not to die. To say that man's physical and mental life is linked to nature simply means that nature is linked to itself, for man is a part of nature.

Marx (1844) *Economic and Philosophic Manuscripts*. MECW 3: 275-76

Private property is thus the product, the result, the necessary consequence, of alienated labour, of the external relation of the worker to nature and to himself. Private property thus results by analysis from the concept of alienated labour, i.e., of alienated man, of estranged labor, of estranged life, of estranged man. True, it is as a result of the movement of private property that we have obtained the concept of alienated labour (of **alienated life**) in political economy.

Marx (1844) *Economic and Philosophic Manuscripts*. MECW 3: 279-80

Association also reestablishes, now on a rational basis, no longer mediated by serfdom, overlordship and the silly mysticism of property, the **intimate ties of man with the earth**, since the earth ceases to be an object of huckstering, and through free labor and free enjoyment becomes, once more, a true personal property of man.

Marx (1844) *Economic and Philosophic Manuscripts*. MECW 3: 268

This **communism**, as fully developed naturalism equals humanism, and as fully developed humanism equals naturalism; it is the **genuine resolution of the conflict between man and nature and between man and man**.

Marx (1844) *Economic and Philosophic Manuscripts*. MECW 3: 296

Moreover this nature, which precedes human history, is really not the nature in which Feuerbach lives, not the nature that no longer exists anywhere today except perhaps on **isolated Australian coral islands of recent origin**, hence does not exist for Feuerbach either.

Carver and Blank, *Marx and Engels' 'German Ideology' Manuscripts*. 2014: 57

Session 2: Metabolism

Key ideas

- Metabolic interaction
- Metabolic rift
- Rational regulation of metabolism
- Communism

Questions

- 1) How did Marx learn about metabolism?
- 2) What is the key to the metabolic interaction of humanity and nature?
- 3) What is meant by metabolic rift?
- 4) How is metabolic restoration achieved?

Key passages

The labour process ... is purposeful activity aimed at the production of use values. It is an appropriation of what exists in nature for the requirements of man. It is the universal condition for the **metabolic interaction** [Stoffwechsel] between man and nature, the everlasting nature-imposed condition of human existence, and it is therefore independent of every form of that existence, or rather it is common to all forms of society in which human beings live.

Marx (1867) *Capital*, Volume I. 1976: 290; MECW 35: 194

Large-scale landownership, on the other hand, reduces the agricultural population to a constantly decreasing minimum and confronts it with a constantly growing industrial population conglomerated together in large towns; in this way it produces conditions that provoke an **irreparable rift** in the interdependent process between social metabolism and natural metabolism prescribed by the natural laws of the soil. The result of this is a squandering of the vitality of the soil, and trade carries this devastation far beyond the bounds of a single country (Liebig).

Marx, MEGA2 II/4.2. 2012: 752-53

Marx (1894) *Capital*, Volume III. 1981: 949; MECW 37: 799

From the standpoint of a higher socioeconomic formation, the private property of particular individuals in the earth will appear just as absurd as the private property of one man in another man. Even an entire society, a nation, or all simultaneously existing societies taken together, are **not the owners of the earth**. They are simply its occupiers, its beneficiaries, and they have to bequeath it in an improved state to the **succeeding generations** as *boni patres familias* [good heads of household].

Marx (1864-65) *Economic Manuscript*. 2015: 763

Marx (1894) *Capital*, Volume III. 1981: 911; MECW 37: 763

The associated producers, **govern their metabolic interaction with nature rationally**, bringing it under their collective control instead of being dominated by it as a blind power; accomplishing this metabolism with the smallest expenditure of energy and in conditions most worthy and appropriate for their human nature.

Marx (1864-65) *Economic Manuscript*. 2015: 885

Marx (1894) *Capital*, Volume III. 1981: 959; MECW 37: 807

Session 3: Metabolism applied

Key ideas

- Soil fertility
- Guano
- Urban toilets
- Rational agriculture

Questions

- 1) How did Liebig sum up modern agriculture's relationship to nature?
- 2) What conclusions did Marx draw from Liebig's later work?
- 3) Why is rational agriculture incompatible with capitalism?
- 4) How would communism manage agriculture ecologically?

Key passages

"Great Britain **robs** all countries of the conditions of their fertility. She has already **ransacked** the battlefields of Leipzig, Waterloo and the Crimea for bones. She has ploughed up and used the skeletons of many generations accumulated in the catacombs of Sicily. And she still destroys yearly the food for a future generation of three and a half million people. We may say to the world that she hangs like a **vampire** on the throat of Europe, and even the world, and sucks out its life-blood, without any real necessity or permanent gain to herself."

Liebig, *Einleitung in die Naturgesetze des Feldbaues* (1862)

Marx-Engels Archive (MEA), IISH, Amsterdam, Sign. B 106, 58

Liebig points to "the terrifying fact that Great Britain is not producing food necessary for her 29 million population," and argues that "the introduction of **water-closets** into most parts of England results in the irrecoverable loss of the materials capable of producing food for three and a half million people every year." Liebig thus argues that "the progress of cultivation and civilisation" are dependent on the problem of urban toilets.

Saito, *Karl Marx's Ecosocialism* 2017: 198

Apart from the daily more threatening advance of the working-class movement, the limiting of factory labour was dictated by the same necessity that forced the manuring of English fields with **guano**. The same blind desire for profit that in the one case exhausted the soil had in the other case seized hold of the vital force of the nation at its roots.

Marx (1867) *Capital*, Volume I. 1976: 348; MECW 35: 247

To have developed from the point of view of natural science the negative, i.e., **destructive side of modern agriculture**, is one of Liebig's immortal merits. His historical overview of the history of agriculture, although not free from gross errors, contains more flashes of insight than all the works of modern political economists put together.

Marx (1867) *Capital*, Volume I. 1976: 638; MECW 35: 507; MEGA2 II/5, 409-10

The bourgeois system runs counter to a rational agriculture, or that **a rational agriculture is incompatible with the bourgeois system** even if, technologically speaking, it promotes its development and needs either the touch of the small private cultivator or the control of the associated producers.

Marx (1864-65) *Economic Manuscript*. 2015: 229 (1894) *Capital*, III. 1981: 216; MECW 37: 123

Session 4: Metabolism extended

Key ideas

- Climate change
- Deforestation
- Desertification
- Extinction

Questions

- 1) What does Marx take from his reading of Fraas?
- 2) How does deforestation create deserts?
- 3) What does Fraas believe causes climate change?
- 4) How did Marx view human extinction?

Key passages

Very interesting is the book by Fraas (1847): *Climate and the Plant World Over Time: A Contribution to the History of Both*, namely as proving that climate and flora change in historical times... The first effect of cultivation is useful, but finally devastating through **deforestation**, etc. This man is both a thoroughly learned philologist (he has written books in Greek) and a chemist, agronomist, etc. The conclusion is that cultivation – when it proceeds in natural growth and is not consciously controlled (as a bourgeois he naturally does not reach this point) – **leaves deserts behind it**, Persia, Mesopotamia, etc., Greece. So once again an **unconscious socialist tendency!**... His history of agriculture is also important. He calls Fourier this “pious and humorous socialist”... It is necessary to keep a close watch on the recent and very latest in agriculture.

Marx (25 March 1868) Letter to Engels. MECW 42: 558-59

“**Deforestation** of a region, particularly when it possesses a very arid and sandy or furthermore even calcareous soil, is counted as the most powerful cause for creating heat..

“The great transformation of climate and change of vegetation are most convincingly proved by an escalating steppe formation and the transition to a **complete desert** in the places the ancient people knew as the most fruitful regions of the world. The unique, loose, saliferous soil in very fertile Mesene used to be covered by grus sand and mud in every flooding. But if this soil is not constantly irrigated, covered by mud and then drained, it is exposed to a unique transformation, one similar to the decomposition of mud of the Nile river in Egypt... or the coasts in Greece.”

Fraas, quoted in Marx, MEA, Sign. B 112, 49

“Man in various ways changes his environment, on which he is quite dependent, and he **changes nature** more than one usually imagines. In fact, he is able to change nature to such an extent that later it completely malfunctions as the indispensable means for the realisation of a higher level of mental and physical development, forcing him to confront extreme physical obstacles... There is no hope of overcoming this reality... The biggest enemy [of nature is] cultivation accompanied by **commerce and industry**... **Trees** in mountain areas should never be cut down without the highest necessity because they are most influential.”

Fraas, *Klima und Pflanzenwelt*. 1847: 59, 68, 136

“The extinction of species is still going on (Man himself [is] the most active exterminator).”

Marx, MEGA 2, IV/26. 2011: 233

Timeline

Part	Marx and Engels	MEGA2
1	Works, Articles, Drafts	24/32
2	Capital und Preliminary Work	15/15
3	Letters	14/35
4	Excerpts, notes, marginalia	15/32

Date	Work	MEGA 2	Pub
1844	M: Economic-Philosophic Manuscripts	I/2	2009
1844-45	M/E: The Condition of the Working Class in England, Holy Family	I/4	
1845-46	M/E: German Ideology.	I/5	2017
1846-48	M/E: Poverty of Philosophy; Communist Manifesto	I/6	
1865	M: Value, Price and Profit	I/20	2003
1875	M: Critique of the Gotha Programme	I/25	1985
1873-82	E: Dialectics of Nature	I/26	1985
1878	E: Herr Eugen Dühring's Revolution in Science	I/27	1988
1878-81	M: Mathematical Manuscripts	I/28	
1884	E: The Origins of the Family, Private Property and the State	I/29	1990

Date	Work	MEGA 2	Pub
1857-58	M: Outlines of Political Economy (Grundrisse)	II/1	2006
1859	M: On the Critique of Political Economy (printed version)	II/2	1980
1861-63	M: Manuscript of 1861-1863	II/3	2013
1864-65	M: Manuscripts for Capital Volume III	II/4.2	2012
1865	M: Manuscripts for Capital Volume II	II/4.1	2011
1867	M: Capital, Volume I, 1 st German edition (printed version)	II/5	1983
1867-68	M: Manuscripts for Capital Volume II M: Manuscripts for Capital Volume III	II/4.3	2012
1868-81	M: Manuscripts for Capital Volume II	II/11	2008
1871-72	M: Chapter 6: Results of the Direct Production Process	II/4.1	2011
1871-81	M: Manuscripts for Capital Volume III	II/14	2003
1872	M: Capital, Volume I, 2 nd German edition (printed version)	II/6	1987
1872-75	M: Capital, Volume I, 1 st French edition (printed version)	II/7	1989
1883	M/E: Capital, Volume I, 3 rd German edition (printed version)	II/8	1989
1884-85	M/E: Manuscripts for Capital Volume II	II/12	2005
1885	M/E: Capital, Volume II, 1 st German edition (printed version)	II/13	2008
1887	M/E: Capital, Volume I, 1 st English edition (printed version)	II/9	1990
1890	M/E: Capital, Volume I, 4 th German edition (printed version)	II/10	1991
1894	M/E: Capital, Volume III, 1 st German edition (printed version)	II/15	2004

Date	Work	MEGA2	Pub
1842	M: Berlin and Bonn Notebooks	IV/1	1976
1843-45	M/E: Kreuznach Notebooks	IV/2	1981
1844-47	M: Paris Notebooks	IV/3	1998
1845	M/E: Manchester Notebooks, 1-5	IV/4	1988
1845-50	M/E: Manchester Notebooks 6-9	IV/5	2015
1846-47	M/E: Glich Notebooks	IV/6	1983
1849-51	M/E: London Notebooks I-IV	IV/7	1983
1851	M: London Notebooks VII-X	IV/8	1986
1851	M: London Notebooks XI-XIV	IV/9	1991
1851-52	M/E: London Notebooks XV-XVIII	IV/10	
1852-53	M/E: London Notebooks XIX-XXIV	IV/11	
1853-55	M: History of Diplomacy and Spanish History	IV/12	2007
1854-57	M/E: Political Economy, History of Diplomacy, Crimean War	IV/13	
1857-58	M: Crisis Notebooks	IV/14	2017
1858-60	M/E: Critique of Political Economy	IV/15	
1860-63	M/E: Vogt, History of the Polish Question	IV/16	
1863	M/E: Critique of Political Economy	IV/17	
1864-68	M/E: Political Economy, Agriculture	IV/18	2019
1868-69	M/E: Political Economy, Money and Crisis	IV/19	
1868-70	M/E: History of Ireland	IV/20	
1869-74	M/E: Irish Question, International Workers' Association	IV/21	
1875-76	M/E: Russia after the Reforms	IV/22	
1876	M/E: Physiology, History of Technology	IV/23	
1876	M/E: History of Landed Property and Constitutional history	IV/24	
1877-79	M/E: Political Economy, Banking and Finance, Arithmetic	IV/25	
1878	M: Geology, Mineralogy and Agricultural Chemistry	IV/26	2011
1879-81	M/E: Ethnology, Early History, History of Landed Property	IV/27	
1879-82	M/E: Russian and French History, Agriculture, Landed Property	IV/28	
1881-82	M/E: Chronological Table of World History	IV/29	
1881	M: Mathematics (Trigonometry, Algebra und Differentiation).	IV/30	
1877-83	M/E: Natural Science	IV/31	1999
	Karl Marx und Friedrich Engels library	IV/32	1999

Session 1: Marx before metabolism

The ecological Marx

The key concept in this context is “metabolism” (*Stoffwechsel*), which leads us to a systematic interpretation of Marx's ecology.

Saito, *Karl Marx's Ecosocialism* 2017: 13

In this book I will demonstrate that Marx's ecological critique possesses a systematic character and constitutes an essential moment within the totality of his project of *Capital*. Ecology does not simply exist in Marx's thought—my thesis is a stronger one. I maintain that it not possible to comprehend the full scope of his critique of political economy if one ignores its ecological dimension.

Saito, *Karl Marx's Ecosocialism* 2017: 13-14

Saito's book

In chapter 1, I show that Marx in 1844 is already dealing with the relationship between humanity and nature as the central theme of his famous theory of alienation.

Saito, *Karl Marx's Ecosocialism* 2017: 14

In chapter 2, I trace the formation of the concept of metabolism in Marx's theory. Marx used it for the first time in his neglected *London Notebooks* and elaborated on it even more in the *Grundrisse* and *Capital*.

Saito, *Karl Marx's Ecosocialism* 2017: 15

I provide in chapter 3 a systematic reconstruction of Marx's ecology through his theory of “reification” as developed in *Capital*. I focus on the “material” (*stofflich*) dimensions of the world as essential components of his critique of political economy, which is often underestimated in earlier discussions on *Capital*... Thus I argue that “material” (*Stoff*) is a central category in Marx's critical project.

Saito, *Karl Marx's Ecosocialism* 2017: 15-16

Part II I offer a more complete examination of Marx's ecology than the earlier literature, scrutinizing his natural science notebooks that will be published for the first time in the new Marx-Engels-*Gesamtausgabe*, known as MEGA2.

Saito, *Karl Marx's Ecosocialism* 2017: 12

Interestingly, during the last fifteen years of his life Marx produced one-third of his notebooks. Moreover, half of these deal with natural sciences, such as biology, chemistry, botany, geology, and mineralogy, whose scope is astonishingly wide.

Saito, *Karl Marx's Ecosocialism* 2017: 17

Economic and Philosophic Manuscripts (1844)

First published by the Institute of Marxism-Leninism in Moscow MEGA1, 1932.

In English by the Foreign Languages Publishing House (now Progress Publishers), Moscow, 1959

Jürgen Rojahn's careful philological examination showed in a convincing manner that the bundle of texts called *The Economic and Philosophic Manuscripts* do not constitute an independent work; that is, they are not a coherent and systematic treatise.

Saito, *Karl Marx's Ecosocialism* 2017: 27

Private property is thus the product, the result, the necessary consequence, of alienated labor, of **the external relation of the worker to nature and to himself**. Private property thus results by analysis from the concept of alienated labor, i.e., of alienated man, of estranged labor, of estranged life, of estranged man. True, it is as a result of the movement of private property that we have obtained the concept of alienated labor (of alienated life) in political economy. But analysis of this concept shows that though private property appears to be the reason, the cause of alienated labor, it is rather its consequence, just as the gods are originally not the cause but the effect of man's intellectual confusion. Later this relationship becomes reciprocal.

Marx (1844) *Economic and Philosophic Manuscripts*. MECW 3: 279-80

Saito, *Karl Marx's Ecosocialism* 2017: 34

In the same way **association** also re-establishes, now on a rational basis, no longer mediated by serfdom, overlordship and the silly mysticism of property, **the intimate ties of man with the earth**, since the earth ceases to be an object of huckstering, and through free labour and free enjoyment becomes once more, a true personal property of man.

Marx (1844) *Economic and Philosophic Manuscripts*. MECW 3: 268

Saito, *Karl Marx's Ecosocialism* 2017: 35

We will not join in the sentimental tears wept over this by romanticism. Romanticism always confuses the shameful of huckstering the land with the perfectly rational consequence, inevitable and desirable within the realm of private property, of the huckstering of private property in land. In the first place, feudal landed property is already by its very nature huckstered land—the **earth which is estranged from man** and hence confronts him in the shape of a few great lords.

Marx (1844) *Economic and Philosophic Manuscripts*. MECW 3: 268

Saito, *Karl Marx's Ecosocialism* 2017: 36

The **domination of the land as an alien power over men** is already inherent in feudal landed property. The serf is the adjunct of the land. Likewise, the lord of an entailed estate, the first-born son, belongs to the land. It inherits him. Indeed, the dominion of private property begins with property in land—that is its basis. But in feudal landed property the lord at least appears as the king of the estate. Similarly, there still exists the semblance of a more intimate connection between the proprietor and the land than that of mere material wealth. The estate is individualized with its lord: it has his rank, is baronial or ducal with him, has his privileges, his jurisdiction, his political position, etc. It appears as the inorganic body of its lord.

Marx (1844) *Economic and Philosophic Manuscripts*. MECW 3: 266

Saito, *Karl Marx's Ecosocialism* 2017: 37

Association, applied to land, shares the economic advantage of large-scale landed property, and first brings to realization the original tendency inherent in [land] division, namely, equality. In the same way association also reestablishes, now on a rational basis, no longer mediated by serfdom, overlordship and the silly mysticism of property, **the intimate [gemüthliche] ties of man with the**

earth, since the earth ceases to be an object of huckstering, and through free labor and free enjoyment becomes, once more, a true personal property of man.

Marx (1844) *Economic and Philosophic Manuscripts*. MECW 3: 268

Saito, *Karl Marx's Ecosocialism* 2017: 43

Communism as the positive transcendence of private property as human self-estrangement, and therefore as the real appropriation of the human essence by and for man; communism therefore as the complete return of man to himself as a social (i.e., human) being—a return accomplished consciously and embracing the entire wealth of previous development. **This communism, as fully developed naturalism equals humanism, and as fully developed humanism equals naturalism**; it is the genuine resolution of the conflict between man and nature and between man and man—the true resolution of the strife between existence and essence, between objectification and self-confirmation, between freedom and necessity, between the individual and the species.

Marx (1844) *Economic and Philosophic Manuscripts*. MECW 3: 296

Saito, *Karl Marx's Ecosocialism* 2017: 43-44

The universality of man manifests itself in practice in that universality which makes the whole of nature as his inorganic body, (1) as a direct means of life and (2) as the matter, the object and tool of his activity. **Nature is man's inorganic body**, that is to say, nature in so far as it is not the human body. Man lives from nature, i.e. nature is his body, and he must maintain a continuing dialogue with it if he is not to die. To say that man's physical and mental life is linked to nature simply means that nature is linked to itself, for man is a part of nature.

Marx (1844) *Economic and Philosophic Manuscripts*. MECW 3: 275-76

Saito, *Karl Marx's Ecosocialism* 2017: 44, 65

In contrast to Althusser's interpretation that simply dismisses Marx's texts before 1845, one finds important insights in his *Paris Notebooks* of 1844 that fundamentally characterize Marx's lifelong project of critique of political economy. His formulation is, however, not at all the final one, but a personal sketch without an intent to publish it. Thus the humanist interpretation of *The Economic and Philosophic Manuscripts* turns out to be one-sided, because though Marx preserved a certain economic insight attained in 1844, he also quickly gave up his philosophical conception of alienation, which he borrowed from Feuerbach and Moses Hess. The fact that Marx abandoned Feuerbach's anthropological philosophy was of significance with regard to his ecology as well because his new critique of philosophy in *Theses on Feuerbach* and *The German Ideology* prepared the theoretical basis for a more adequate understanding of the historical modifications of the relationship between humanity and nature.

Saito, *Karl Marx's Ecosocialism* 2017: 50-51

The German Ideology

The *German Ideology* was first published in Marx/Engels Gesamtausgabe, Erste Abteilung, 5. Band, in 1932 by the Institute of Marxism-Leninism of the Central Committee of the C.P.S.U.

The first English translation of the whole work, was issued by Progress Publishers, Moscow, in 1964. MECW 5: 587-88

A new English translation of the original Feuerbach manuscript, produced by Terrell Carver and Daniel Blank (2014), along with a separate commentary (2016), explains how the 'German Ideology' book myth was created. Far from elaborating a philosophy of historical materialism, Marx and Engels were mostly settling accounts with some of their previously close contemporaries.

For that matter, nature, the nature that preceded human history, is not by any means the nature in which Feuerbach lives, it is nature which today no longer exists anywhere (**except perhaps on a few Australian coral islands of recent origin**) and which, therefore, does not exist for Feuerbach either. Marx and Engels (1845-46) *The German Ideology*. MECW 5: 40
Saito, *Karl Marx's Ecosocialism* 2017: 59

Moreover this nature, which precedes human history, is really not the nature in which Feuerbach lives, not the nature that no longer exists anywhere today except perhaps on isolated Australian coral islands of recent origin, hence does not exist for Feuerbach either. Carver and Blank, *Marx and Engels' 'German Ideology' Manuscripts*. 2014: 57

The first premise of all human history is, of course, the existence of living human individuals. Thus the first fact to be established is the physical organization of these individuals and their consequent relation to the rest of nature. Of course, we cannot here go either into the actual physical nature of man or into the natural conditions in which man finds himself—**geological, oro-hydrographical, climatic and so on**. All historical writing must set out from these natural bases and their modification in the course of history through the action of men.

Marx and Engels (1845-46) *The German Ideology*. MECW 5: 31
Saito, *Karl Marx's Ecosocialism* 2017: 60-61

We have to make a start... By setting forth the first premise of all human existence, and therefore of all history, namely the premise that men have to be in a position to live in order to be able to 'make history'. [Geological, hydrological etc relations] But living requires above all else eating and drinking, shelter, clothing and yet other things. The first historical act is therefore the production of the means to satisfy these needs, the production of material life itself and indeed this is a historical act, a founding condition of all history, which must be fulfilled today, on a daily and hourly basis, just as it was thousands of years ago, simply for man to stay alive.

Carver and Blank, *Marx and Engels' 'German Ideology' Manuscripts*. 2014: 63

Comments and critics

Marx's statement in *Economic and Philosophic Manuscripts 1844*: "Nature is man's inorganic body":

"the product of Marx's well-known transposition of **God's** features and role in the Hegelian system of thought onto man... Thus Marx's theory represents an extreme form of the placing of man in the role previously attributed to God, a transposition so characteristic of Enlightenment thought... "[Marx's claim that nature is man's body] seems to carry also the unattractive implication that **nature is man's property** – one's body is, after all, one's own, and usually considered to be entirely at one's disposal, subject to only very minor qualifications. The analogy thus reinforces damaging 'human property' views of the natural world."

Val Routley (1981) 'On Karl Marx as an Environmental Hero', *Environmental Ethics*, 3: 239-40, 243

"A **dualistic** view of humanity and nature and an instrumentalist view of the latter... Marx distinguishes between nature as 'organic body', that is, as human body, and nature as 'inorganic body', that is, the rest of nature. While a mere distinction between two such realms within material nature is not, obviously, in itself an ontological false step, the valuation underlying the distinction is another question. The 'inorganic' quality of 'external' nature signifies its instrumental character in relation to an abstracted humanity, which is taken to be the source of all value."

John Clark (1989) 'Marx's Inorganic Body', *Environmental Ethics*, 11: 243, 251

"In the so-called *Paris Manuscripts*, Marx referred to the labour process as effecting the progressive 'humanization' of nature and 'naturalization' of humanity. Nature was described as 'the inorganic body' of humanity that had been increasingly assimilated, through work, into an 'organic' part of humanity... Marx's treatment of humans as **homo faber** is a central feature of the antagonistic dialectic between humanity and nature set out in these early writings ... Although more and more areas of nature would come under human control through technological development, the **antagonistic dialectic between humanity and nature** would never be entirely resolved."

Robyn Eckersley (1992) *Environmentalism and Political Theory*: 78-9

"Nothing in the science of ecology entails that there is no significant division between an individual organism and its environment... It entails **no radically holistic ontology**. Hence it does not entail that 'I and nature are one' or that the 'the world is my body'."

John O'Neill (1994) 'Humanism and Nature', *Radical Philosophy*, 66: 26

"In ancient Greek usage, the word organ (*organon*) also meant tool, and organs were initially viewed as 'grown-on tools' of animals – whereas tools were regarded as the artificial organs of human beings... Marx had taken notes on the section of Hegel's *Encyclopedia* dealing with the philosophy of nature in 1839... Marx employed the organic/inorganic distinction in three different but related senses, which can be designated as (a) *scientific*, (b) *dialectical*, and (c) *materialist*. First, he referred to nature (other than the human body) as the inorganic body of humanity in conformity with the **scientific vocabulary of his day**, wherein organic referred to bodily organs, whereas inorganic meant unrelated to bodily organs... Marx's reference to nature as the inorganic body of man was meant, then, to convey that human beings and nature were **connected** to each other bodily (i.e. in the most intimate way possible), but that human beings through tool-making were able to extend their material capacities beyond their own bodily organs (i.e. 'inorganically' in this sense)... It is the **separation** of human beings from the soil (and hence from the organic products of the soil) and their agglomeration into huge cities that constitutes, for Marx, the *differentia specifica* of capitalism."

John Bellamy Foster and Paul Burkett (2017) *Marx and the Earth*, 65, 66, 70, 77

Session 2: Metabolism

Origins

The concept of 'metabolism' was first employed in physiology at the beginning of the nineteenth century, even though it is often claimed that Liebig's book on Organic Chemistry (1842)... was the first formal treatise...

Saito, *Karl Marx's Ecosocialism* 2017: 68

Roland Daniels, doctor, Communist League, dedicated book, *Poverty of Philosophy*
Book manuscript: *Mikrokosmos: Entwurf einer physiologischen Anthropologie*.

"I would risk my organic **metabolism** against my mental metabolism..."

Daniels, Letter to Marx, 8 February 1851. MEGA2 III/4, 1984: 308

Marx carefully studied Daniel's manuscript in the next month and commented on it critically, as Daniels had asked in his letter dated March 20. The first usage of the concept of 'metabolism' in *Reflection* is certainly closely connected with his critique of Daniel's *Mikrokosmos*, as both texts were written in the same month.

Saito, *Karl Marx's Ecosocialism* 2017: 72-73

Marx's **first usage** of the concept of metabolism... his *London Notebooks* of March 1851, titled *Reflection*... before his reading of Liebig's book in July 1851.

Saito, *Karl Marx's Ecosocialism* 2017: 70

*"Unlike ancient society where only the privileged could exchange this or that [item], everything can be possessed by everybody [in capitalist society]. Every **metabolic interaction** can be conducted by everyone, depending on the amount of money of one's income that can be transformed into anything: prostitute, science, protection, medals, servants, cringer – everything [becomes a] product for exchange, just like coffee, sugar, and herring. In the case of rank [society], the enjoyment of an individual, his or her **metabolic interaction** is dependent on a certain division of labour, under which he or she is subsumed. In the case of class [it is dependent] only on the universal means of exchange that he or she can appropriate... Where the type of income is still determined by the type of occupation, and not simply by the quantity of the universal medium of exchange like today but by the quality of one's occupation, the relationships, under which the worker can enter into society and appropriate [objects], are severely restricted, and the social organ for the **metabolic interaction** with the material and mental productions of the society is limited to a certain way and to a particular content from the beginning."*

Marx, *London Notebook* March 1851. *Reflection*. MEGA2 IV/8 1986: 233-34

Saito, *Karl Marx's Ecosocialism* 2017: 71

The concept of 'metabolic interaction' is clearly used to deal with the transhistorical character of the necessity to organise social production.

Saito, *Karl Marx's Ecosocialism* 2017: 71

In Daniels' *Mikrokosmos*, the concept of 'organic metabolism' appears many times...

Even if Marx did not accept the general direction of Daniels' materialist project, intensive discussions between them prompted Marx to use the concept of metabolism in his private notes in *Reflection*, and he came to be more interested in physiology, as documented in the *London Notebooks* after July 1851, most notably in excerpts from Liebig's work. Marx shared an opinion with Daniels that the new physiological concept could be usefully applied to social analysis.

Saito, *Karl Marx's Ecosocialism* 2017: 73

Unfortunately, further intellectual exchange between Marx and Daniels was interrupted when the latter was arrested in June 1851 in Cologne because of his political activity. He suffered terrible conditions in prison, and after his release died, on 29 August 1855.

Saito, *Karl Marx's Ecosocialism* 2017: 74

In the *London Notebooks*, Marx's Prometheanism is still discernible, but as a result of integrating Liebig's critique he corrected his earlier optimistic vision about the potential agricultural revolution in the 1860s.

Saito, *Karl Marx's Ecosocialism* 2017: 178

After his exile to London in 1849, and despite severe financial hardships, Marx went to the British Museum every day and filled **twenty-four notebooks** that are today known as the *London Notebooks*. These contain a substantial number of excerpts on agricultural chemistry.

Saito, *Karl Marx's Ecosocialism* 2017: 179

Grundrisse

*It is not the unity of living and active humanity with the natural, inorganic conditions of their **metabolic exchange with nature**, and hence their appropriation of nature, which requires explanation or is the result of a historic process, but rather the separation between these inorganic conditions of human existence and this active existence, a separation which is completely posited only in the relation of wage labour and capital.*

Marx, *Grundrisse* 1973: 489

Saito, *Karl Marx's Ecosocialism* 2017: 66

Hence exploration of all of nature in order to discover new, useful qualities in things; universal exchange of the products of all alien climates and lands; new (artificial) preparation of natural objects, by which they are given new use values. The exploration of the earth in all directions, to discover new things of use as well as new useful qualities of the old, such as new qualities of them as raw materials etc.

Marx (1857-58) *Grundrisse*, London: Penguin Books, 1973: 409

Saito, *Karl Marx's Ecosocialism* 2017: 95

To sum up, Marx in the *Grundrisse* employed the concept of metabolism of political economy with three different meanings and continues to do so until *Capital*: "metabolic interaction between humans and nature," "metabolism of society," and "metabolism of nature." His sources of inspiration are not so apparent after his reading of Roland Daniels and Wilhelm Roscher because, following his own purpose of developing a system of political economy, Marx generalized and modified the concept as well. Precisely because of this generalization, Marx's concept of metabolism is exposed to the risk of arbitrary interpretations, discussed together with irrelevant theorists, whose ideas actually have nothing to do with Marx's theory of metabolism.

Saito, *Karl Marx's Ecosocialism* 2017: 78

Moleschott

Schmidt and his admirers should have seen that Moleschott's view, as elaborated in *The Cycle of Life* (*Kreislauf des Lebens*, 1852), is hardly compatible with Marx's alliance with Liebig.

Saito, *Karl Marx's Ecosocialism* 2017: 79

Moleschott was a Dutch doctor and physiologist who participated with Ludwig Büchner and Karl Vogt in a heated "materialism debate" in the 1850s. He advocated a radical materialist view

that every mental activity is “only a function of substances in the brain,” and that “the thought stands in the same relation to the brain as bile to the liver or urine to kidneys.”

Saito, *Karl Marx's Ecosocialism* 2017: 80

So Liebig was fully right when in his lecture in 1856 he called Moleschott one of the “**dilettantes who stroll at the edge of natural science**,” who act like “children in knowledge of natural laws.” One can expect the same reaction from Marx.

Saito, *Karl Marx's Ecosocialism* 2017: 81

Moleschott neglected the mediating role of labor in the production process and explains the totality of the world only in terms of the transhistorical movement of matter and force.

Saito, *Karl Marx's Ecosocialism* 2017: 82

Wendling

Amy E. Wendling's 2009 book, *Karl Marx on Technology and Alienation*, put forward another interpretation of Marx's theory of metabolism, again in support of Marx's alleged “natural scientific materialism.”

Despite Wendling's argument, there is no convincing reason to believe that Büchner's materialism was crucial to the *Grundrisse*.

Saito, *Karl Marx's Ecosocialism* 2017: 89

Capital can valorise itself only when all necessary raw and auxiliary materials are existent in addition to labour power and machines... The bigger the forces of production become and the faster and bigger amount of raw materials (wood and iron) and auxiliary materials (oil and coal) for renewal, the ore unstable the entire production becomes because it is more and more dependent on natural conditions.

Saito, *Karl Marx's Ecosocialism* 2017: 94

Economic Manuscript of 1861-63

Since the reproduction of raw material is not dependent solely on the labor employed on it, but on the productivity of this labor which is bound up with natural conditions, it is possible for the volume, the amount of the product of the same quantity of labor, to fall (as a result of bad seasons). The value of the raw material therefore rises.... More must be expended on raw material, less remains for labor, and it is not possible to absorb the same quantity of labor as before. Firstly this is physically impossible, because of the deficiency in raw material. Secondly, it is impossible because a greater portion of the value of the product has to be converted into raw material, thus leaving less for conversion into variable capital. Reproduction cannot be repeated on the same scale. A part of fixed capital stands idle and a part of the workers is thrown out on the streets.

Marx, *Economic Manuscript of 1861-63*. MECW 32: 145-46

Saito, *Karl Marx's Ecosocialism* 2017: 94

In the *Manuscripts of 1861-63*, Marx explains why capitalist production inevitably and boundlessly exploits nature. (MECW 33: 146)

But, apart from fixed capital, all those productive forces which cost nothing, i.e. those which derive from the division of labour, cooperation, machinery (in so far as this costs nothing, as is for example the case with the motive forces of water, wind, etc., and also with the ADVANTAGES which proceed from the SOCIAL ARRANGEMENT of the workshop) as well as forces of nature whose application does

not give rise to any costs—or at least to the degree to which their application does not give rise to any costs—enter into the labour process without entering into the valorisation process.

Marx, Economic Manuscript of 1861-63. MECW 32: 146

Saito, *Karl Marx's Ecosocialism* 2017: 130-31

Marx points to the possibility of an economic crisis partly due to the unfavourable factors imposed by the natural conditions of the production process and partly due to the unregulated desire of capital for accumulation. While the turnover of capital is a purely formal movement of value, in reality its actual valorization is necessarily conditioned by its material side, so that without adequate material equilibrium of fixed and circulating capital its valorization becomes “physically impossible.” Writing in this way, Marx is without doubt conscious of the potential for crisis immanent to capital's inability of the absolute mastery over nature. The crisis is nothing but the disturbance of the equilibrium in the social and natural metabolism.¹⁰²

Saito, *Karl Marx's Ecosocialism* 2017: 94

Paul Burkett: “To put it bluntly, capital can in principle continue to accumulate under any natural conditions, however degraded, so long as there is not a complete extinction of human life.”

Burkett, *Marx and Nature*, 1999: 196.

Saito, *Karl Marx's Ecosocialism* 2017: 97

Jason Moore argues that John Bellamy Foster's theory of the ‘metabolic rift’ inevitably ‘has reached an impasse’. (*Towards a Singular Metabolism*, 2014)

Saito, *Karl Marx's Ecosocialism* 2017: 99

Only a systematic analysis of Marx's theory of metabolism as an integral part of his critique of political economy can convincingly demonstrate, against the critics of his ecology, how the capitalist mode of production brings about various types of ecological problems due to its insatiable desire for capital accumulation.

Saito, *Karl Marx's Ecosocialism* 2017: 99

Capital Volume I

When man engages in production, he can only proceed as nature does herself, i.e. he can only change the form of the materials. Furthermore, even in this work of modification he is constantly helped by natural forces. Labor is therefore not the only source of material wealth, i.e. of the use-values it produces. As William Petty says, labor is the father of material wealth, the earth is its mother.

Marx, *Capital*, vol. 1, 133-34

Saito, *Karl Marx's Ecosocialism* 2017: 101

The labor process ... is purposeful activity aimed at the production of use values. It is an appropriation of what exists in nature for the requirements of man. It is the universal condition for the metabolic interaction [Stoffwechsel] between man and nature, the everlasting nature-imposed condition of human existence, and it is therefore independent of every form of that existence, or rather it is common to all forms of society in which human beings live.

Marx, *Capital*, vol. 1, 290

Saito, *Karl Marx's Ecosocialism* 2017: 101-02

Without examining the dynamics immanent to the capitalist mode of production, Marx's ecology would be reduced to a simple proposition that capitalism destroys the ecological system because capitalists seek to attain profits with no care all about environmental sustainability. This would be against Marx's ‘materialist method’.

Saito, Karl Marx's Ecosocialism 2017: 120

Capital threatens the continuation of humanity's metabolism with nature by radically reorganising it from a perspective of maximally squeezing out abstract labour.

Saito, Karl Marx's Ecosocialism 2017: 120

Economic Manuscript of 1864-1865 (Capital Volume III)

Marx planned to deal with the problem of natural powers in the chapter on 'ground rent' in volume 3 of *Capital*, but its manuscript remained unfinished.

Saito, Karl Marx's Ecosocialism 2017: 130

Remarkably, Marx in his later economic manuscripts pointed to cases where natural forces can no longer serve the valorisation process 'freely' because of their exhaustion.

Saito, Karl Marx's Ecosocialism 2017: 134

"The quantity of productive force of labour can increase in order to obtain the same or even decreasing produce, so that this increase of labour's productive force serves only as compensation of decreasing natural conditions of productivity—and even this compensation may be insufficient—as seen in certain cases of agriculture, extractive industry etc."

Marx, MEGA2 II/4.3, 80

Saito, Karl Marx's Ecosocialism 2017: 135

*Large-scale landownership, on the other hand, reduces the agricultural population to a constantly decreasing minimum and confronts it with a constantly growing industrial population conglomerated together in large towns; in this way it produces conditions that **provoke an irreparable rift in the interdependent process between social metabolism and natural metabolism prescribed by the natural laws of the soil.** The result of this is a squandering of the vitality of the soil, and trade carries this devastation far beyond the bounds of a single country (Liebig).*

83. MEGA2 II/4.2, 752-53, emphasis added. The new translation, Economic Manuscript of 1864-1865, unfortunately overlooks the fact that Engels modified the sentence and obscured the meaning: "In this way it produces conditions that **provoke an irreparable rift in the interdependent process of social metabolism, a metabolism prescribed by the natural laws of life itself**" (798).

Saito, Karl Marx's Ecosocialism 2017: 205-06

*large-scale landownership, on the other hand, reduces the agricultural population to a constantly decreasing minimum and confronts it with a constantly growing industrial population conglomerated together in large towns; in this way it produces conditions that provoke an **irreparable rift** in the interdependent process of social metabolism, a metabolism prescribed by the natural laws of life itself. The result of this is a squandering of the vitality of the soil, and trade carries this devastation far beyond the bounds of a single country.*

Marx, Economic Manuscript of 1864-65, 2015: 798

Marx (1894) *Capital*, Volume III. 1981: 949

At this point, it is possible to articulate a hypothesis addressing a remaining question of Marxism: Why did Marx so intensively study the natural sciences? Marx engaged in serious studies of a wide range of books in the fields of natural science, we can surmise, in order to analyse the contradictions of the material world as a result of its modifications by capital. To ground this hypothesis, the second part of this book investigates Marx's treatment of agriculture, focusing on agricultural chemistry, geology, and botany. In this context, the German agricultural chemist Justus von Liebig plays a central role.

Saito, Karl Marx's Ecosocialism 2017: 136-37

From the standpoint of a higher socioeconomic formation, the private property of particular individuals in the earth will appear just as absurd as the private property of one man in another man. Even an entire society, a nation, or all simultaneously existing societies taken together, are not the owners of the earth. They are simply its occupiers, its beneficiaries, and they have to bequeath it in an improved state to the succeeding generations as boni patres familias.

Marx, Economic Manuscript of 1864-65, 2015: 763, emphasis in original.

Marx (1894) Capital, Volume III. 1981: 911

Saito, Karl Marx's Ecosocialism 2017: 173

To people such as environmental sociologist Ted Benton, Marx's demand that humans behave as "boni patres familias" of the earth sounds like a Promethean hope for the domination of nature. However, it is clear that what Marx criticises is capitalism's alienated and reified domination over nature, which goes against humanity's potential to organise a universal and conscious interaction with nature. Accordingly, what is at stake is the future necessity for the conscious regulation of the metabolic exchange between humans and nature.

Saito, Karl Marx's Ecosocialism 2017: 174

*In fact, the realm of freedom begins only when labor determined by necessity and external expediency comes to an end; it lies by its very nature beyond the sphere of material production proper. Just as the savage must wrestle with nature to satisfy his needs, to maintain and reproduce his life, so must civilized man, and he must do so in all forms of society and under all possible modes of production. This realm of natural necessity expands with his development, because his needs do too; but the productive forces to satisfy these expand at the same time. Freedom, in this sphere, can consist only in this, that socialized man, the associated producers, **govern their metabolic interaction with nature rationally**, bringing it under their collective control instead of being dominated by it as a blind power; accomplishing this metabolism with the smallest expenditure of energy and in conditions most worthy and appropriate for their human nature. But this always remains a realm of necessity. The true realm of freedom, the development of human powers as an end in itself, begins beyond it, though it can only flourish with this realm of necessity as its basis. The reduction of the working day is the basic prerequisite.*

Marx, Economic Manuscript of 1864-65. 2015: 885-86

Saito, Karl Marx's Ecosocialism 2017: 213-14

*Freedom, in this sphere, can consist only in this, that socialised man, the associated producers, **govern their metabolic interaction with nature rationally**, bringing it under their collective control instead of being dominated by it as a blind power; accomplishing this metabolism with the smallest expenditure of energy and in conditions most worthy and appropriate for their human nature. But this always remains a realm of necessity. The true realm of freedom, the development of human powers as an end in itself, begins beyond it, though it can only flourish with this realm of necessity as its basis. The reduction of the working day is the basic prerequisite.)*

Moseley 2015: 885-86

the associated producers, govern the human metabolism with nature in a rational way, bringing it under their collective control, instead of being dominated by it as a blind power; accomplishing it with the least expenditure of energy and in conditions most worthy and appropriate for their human nature.

Marx, Capital Volume III, 1981: 959

Comments and critics

“The term, ‘metabolism’, (*Stoffwechsel*) appears frequently in Marx, and is frequently cited in works by Foster and others, such as Alfred Schmidt (1971), to show that Marx was at home with concepts of contemporary science, and as indications of the analogy between labor and transformations in nature. To this is frequently added the phrase, ‘metabolic rift’, as descriptive of aberrations in our relationship to nature. These terms may be used for descriptive purposes, but they belong to the dimensions of physiology and chemistry and are bound to the notion of material exchange, that is, they tend to reduce our vision to the quantitative movement of matter and energy through nature and between society and nature, rather than helping us understand the essentially structural and formal questions posed by ecosystems. Life is best defined as self-replicating form, and while metabolic processes are necessary for comprehending life, they are not sufficient. Terms like metabolism are not more than analogical metaphors, in my view, for the Heraclitean belief that change and transformation is the most fundamental feature of reality, whether in nature or society. Marx saw things this way, as should we all, but his theory of alienation went further, to demonstrate which kinds of transformation conduce to the flourishing evolution of society and nature, and which spell doom. Mere recitation of ‘metabolism’, or ‘metabolic rift’, to indicate the presence of ecological damage finesses the key questions. It indicates, to my view, the limitations of Marx within the framework of 19th Century Science.”

Joel Kovel (2011) ‘Ecology’, *Ecosocialist Horizons*, 25 November,
<http://ecosocialisthorizons.com/2011/11/marx-and-ecology/>

“Marx’s early background led him to undertake no less than an analysis of what would now be called ‘environmental sustainability’. In particular he developed the idea of a ‘rift’ in the metabolic relation between humanity and nature, one seen as an emergent feature of capitalist society... The notion of an ecological rift, one separating humanity and nature, and violating the principles of ecological sustainability, continues to be helpful for understanding today’s social and environmental risks. These risks are becoming increasingly global in extent. This is partly because they directly impact on environmental mechanisms operating on a global scale.”

Peter Dickens (2004) *Society and Nature: Changing Our Environment, Changing Ourselves*, 80-81

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Session 3: Metabolism applied

The central figure of our current investigation is Justus von Liebig, whose *Chemistry and Its Application to Agriculture and Physiology* (7th ed., 1862) had a great impact upon Marx's theory. While earlier research on the intellectual relationship between Marx and Liebig clearly demonstrated their ecological critique of modern agriculture, it is noteworthy that the original reason for Marx's reading of Liebig was an economic one. It would be an exaggeration to say that Marx was ecological from the start, because there are sometimes naïve Promethean indications in his earlier texts, which are similar to the one found in Engels's quoted passage. Thus it is worth inquiring how Marx came to recognise the environmental unsustainability of the capitalist mode of production as the contradiction of capitalism, and to urge realising sustainable production in the future society.

Saito, *Karl Marx's Ecosocialism* 2017: 142

The concept of "metabolism" was first employed in physiology at the beginning of the nineteenth century, even though it is often claimed that Liebig's "book on Organic Chemistry in Its Application to Physiology and Pathology (1842) was the first formal treatise on the subject, introducing the concept of 'metabolism' (*Stoffwechsel*)." The famous German chemist is today known as the "father of organic chemistry"...

In one of the earliest usages of the term metabolism Liebig depicted the constant interactive process of formation, transformation, and excretion of various compounds within an organic body:

It cannot be supposed that metabolism in blood, the changes in the substance of the existing organs, by which their constituents are converted into fat, muscular fibre, substance of the brain and nerves, bones, hair &c., and the transformation of food into blood, can take place without the simultaneous formation of new compounds which require removal from the body by the organs of excretion.... every motion, every manifestation of organic properties, and every organic action being attended by metabolism, and by the assumption of a new form by its constituents.

Liebig, *Die Organische Chemie in ihrer Anwendung auf Agriculture und Physiologie* (1840) 332

Saito, *Karl Marx's Ecosocialism* 2017: 68-69

However, in the seventh edition of *Agricultural Chemistry* published in 1862, Liebig put forward another view. He recognised that there are natural limits to agricultural improvements, particularly due to the finite amount of available mineral nutrients in the soil and the finite absorption ability of roots and leaves...

A double amount of labour cannot insure the availability of twice the material nutrients that ordinary tillage would have provided in a given amount of time. The quantity of these material soil constituents is not equal in all fields, and even in those fields where there is sufficient supply their transformation into an immediately effective form is not directly dependent on labour but on external agencies, which like the air are limited in their oxygen and carbonic acid contents, and which, in accordance with their quantity, must be increased in the same proportion as the increase of labour if the latter is to bring about a proportionally useful result.

Marx-Engels Archive (MEA), International Institute of Social History, Amsterdam, Sign. B 106, 32-33

Liebig, *Einleitung in die Naturgesetze des Feldbaues* (Braunschweig: Vieweg & Sohn, 1862), 143.

Saito, *Karl Marx's Ecosocialism* 2017: 156

Liebig points to "the terrifying fact that Great Britain is not producing food necessary for her **29 million population**," and argues that "the introduction of **water-closets** into most parts of England results in the irrecoverable loss of the materials capable of producing food for three and a half million people every year." Liebig thus argues that "the progress of cultivation and civilisation" are dependent on the problem of **urban toilets**.

Saito, *Karl Marx's Ecosocialism* 2017: 198

Great Britain robs all countries of the conditions of their fertility. She has already ransacked the battlefields of Leipzig, Waterloo and the Crimea for bones. She has ploughed up and used the skeletons of many generations accumulated in the catacombs of Sicily. And she still destroys yearly the food for a future generation of three and a half million people. We may say to the world that she hangs like a vampire on the throat of Europe, and even the world, and sucks out its life-blood, without any real necessity or permanent gain to herself.

Marx-Engels Archive (MEA), International Institute of Social History, Amsterdam, Sign. B 106, 58
 Liebig, *Einleitung in die Naturgesetze des Feldbaues* (Braunschweig: Vieweg & Sohn, 1862).
 Saito, *Karl Marx's Ecosocialism*. 2017: 198-99

Apart from the daily more threatening advance of the working-class movement, the limiting of factory labour was dictated by the same necessity that forced the manuring of English fields with **guano**. The same blind desire for profit that in the one case exhausted the soil had in the other case seized hold of the vital force of the nation at its roots.

Marx (1867) *Capital*, Volume I. 1976: 348; MECW 35: 247
 Saito, *Karl Marx's Ecosocialism*. 2017: 202

In fact, Marx changed his understanding of the law of diminishing returns through his study of Liebig's agricultural chemistry in 1865-66. He remained convinced of the overall theoretical validity of his own theory of ground rent, but as a result of his reception of newer natural sciences Marx refuted the ungrounded assumption of classical political economy from a new perspective and began a more nuanced treatment of the problem of natural limits.
 Saito, *Karl Marx's Ecosocialism*. 2017: 151

In 1865, Marx returned to studying natural sciences in order to bestow a more up-to-date scientific foundation for his own investigation of ground rent. After reading various books and writing his manuscript for volume 3 of *Capital*, Marx told Engels, in a letter of February 13, 1866, about his fascination with the rapid development of chemistry:

*As far as this "damned" book [Capital] is concerned, the position now is: it was ready at the end of December. The treatise on ground rent alone, the penultimate chapter, is in its present form almost long enough to be a book in itself. I have been going to the Museum in the daytime and writing at night. I had to plough through the new agricultural chemistry in Germany, **in particular Liebig and Schönbein, which is more important for this matter than all the economists put together**, as well as the enormous amount of material that the French have produced since I last dealt with this point. I concluded my theoretical investigation of ground rent two years ago. And a great deal had been achieved, especially in the period since then, fully confirming my theory.*

Marx (13 February 1866) Letter to Engels. MECW 42: 227
 Saito, *Karl Marx's Ecosocialism*. 2017: 152

Accordingly, Marx's demand for the conscious regulation of the metabolic interaction between humans and nature consists in the insight that precisely due to natural limits social production must be radically reorganised, with particular attention paid to the interaction of humans with their environment. Marx clearly recognised the merits of the development in modern natural sciences and technologies as fundamental material conditions for establishing the future society, but they must be applied to the production process in a fundamentally different way from that in capitalist society, not in order to overcome the limits of nature, but to conduct a sustainable metabolic interaction between humans and nature. This rational intercourse with nature is, however, not possible in capitalism because the whole of social production is organised by private labour, and, accordingly, the social-metabolic interaction is mediated by value.

Saito, *Karl Marx's Ecosocialism*. 2017: 161-62

Marx, as the latter also affirmatively refers to Liebig, in volume 1 of *Capital*: “To have developed from the point of view of natural science the negative, i.e., **destructive side of modern agriculture**, is one of **Liebig's immortal merits**. His historical overview of the history of agriculture, although not free from gross errors, contains more flashes of insight than all the works of modern political economists put together.” MEGA2 II/5, 410
Saito, *Karl Marx's Ecosocialism*. 2017: 163

The more Marx becomes conscious, through his study of natural science, of the deterioration of the natural conditions of production as a fundamental contradiction of capitalism, the more strategic importance the transformation of our social intercourse with nature acquires for his project. Consequently, his political economy attains a clear ecological dimension. His demand is formulated particularly through his recognition of the limit of material modifications, which capital cannot recognise but only keep trying to overcome.
Saito, *Karl Marx's Ecosocialism*. 2017: 174

Without doubt, Marx owed to Liebig's *Agricultural Chemistry* the development of his concept of metabolism as a critique of modern capitalist agriculture.
Saito, *Karl Marx's Ecosocialism*. 2017: 177

During the preparation of *Capital* in the 1860s, Marx again intensively studied natural sciences, reading Liebig at least twice. In June 1863, Marx made excerpts from *On Theory and Practice in Agriculture* (1856) and in 1865-66 from the seventh edition of *Agricultural Chemistry* (1862). Both excerpts are of great importance because they document the development of Marx's project, mediated by Liebig's critical turn.
Saito, *Karl Marx's Ecosocialism*. 2017: 191-92

Thus it is safe to conclude that Marx's reading of Liebig before 1863 does not include a truly critical attitude toward modern agriculture. However, this changes in *Capital*. This indicates how decisive the seventh edition of *Agricultural Chemistry* was for Marx's development of his critique of the metabolic rift.
Marx's excerpts of 1856-66 document why the seventh edition of *Agricultural Chemistry* must have been particularly insightful for his purposes, because Liebig also altered his arguments in the new Introduction and reinforced his critique of the robbery system of modern agriculture.
Saito, *Karl Marx's Ecosocialism*. 2017: 195-97

As a reaction to Hamm's praise of intensive farming in England—Hamm translated Lavergne's work into German—Marx calls “feeding in the stable” the “system of cell prison” and asks himself: *In these **prisons animals** are born and remain there until they are killed off. The question is whether or not this system connected to the breeding system that grows animals in an abnormal way by aborting bones in order to transform them to mere meat and a bulk of fat —whereas earlier (before 1848) animals remained active by staying in free air as much as possible—will ultimately result in serious deterioration of life force?* MEA, Sign. B 106, 336.
Saito, *Karl Marx's Ecosocialism*. 2017: 209

*The moral of the tale, which can also be extracted from other discussions of agriculture, is that the **bourgeois system runs counter to a rational agriculture**, or that a rational agriculture is incompatible with the bourgeois system even if, technologically speaking, it promotes its development and needs either the touch of the small private cultivator or the control of the associated producers.* Marx, Economic Manuscript of 1864-1865, 229
Saito, *Karl Marx's Ecosocialism*. 2017: 212-13

Session 4: Metabolism extended

The notebooks Marx made in the winter of 1868 reveal how his theoretical horizon enlarged after confronting the heated debate on the validity of Liebig's theory of soil exhaustion, which prompted him to pursue research in the field of natural sciences such as chemistry, botany, geology, and mineralogy in the following years. A forgotten figure on the current topic is **Carl Nikolaus Fraas, an agronomist in Munich in the mid-nineteenth century**. Fraas is of importance because his books possess a unique position in Marx's notebooks. Though this German scientist was a harsh critic of Liebig's *Agricultural Chemistry*, which Marx affirmatively quoted in the first edition of *Capital*, Marx praised Fraas's contribution and even found in his work a "socialist tendency."

In the previous literature, Fraas was neglected, as well as his theoretical influence on Marx. Here we will examine Fraas's books and Marx's excerpt notebooks to understand why Fraas's "agricultural physics," which, in opposition to Liebig's "agricultural chemistry," emphasised the "climatic influences" on vegetation and on human civilisation, was important for Marx's project of political economy. Fraas's theory was so important to the development of Marx's theory of metabolism and agriculture that Marx even altered his evaluation of Liebig in the second edition of *Capital*. This change reflects the opening of his new field of research. One can observe another "emergence of a theory" in his notebooks of 1868.

Saito, *Karl Marx's Ecosocialism*. 2017: 218

In reading the sentences on Liebig just quoted, a careful reader may immediately notice a difference between the first edition and later editions, although it was pointed out only recently by a German MEGA editor, Carl-Erich Vollgraf. Marx modified this sentence in the second edition of *Capital* published in 1872–73. Consequently, we usually only read: "His historical overview of the history of agriculture, although not free from gross errors, **contains flashes of insight**." Marx deleted the statement that **Liebig was more insightful "than all the works of modern political economists put together**." Though he still continued to praise Liebig's contribution, the tone definitely became more sober. Why did Marx soften his endorsement of Liebig's contributions relative to classical political economy?

Vollgraf, "Einführung," in MEGA 2 II/4.3, 461. 8. MEGA 2 II/6, 477, emphasis added. This is one of the clearest examples of how Marx actually changed his sentences in different editions of *Capital*. The problem of any editions based on Marx-Engels-Werke, including Marx Engels Collected Works, is that they only publish the Engels version.

Saito, *Karl Marx's Ecosocialism*. 2017: 219

FRAAS

Fraas's name first appears in Marx's notebook between December 1867 and January 1868, when he notes the title of Fraas's 1866 book *Agrarian Crises and Their Remedies* (*Die Ackerbaukrisen und ihre Heilmittel*), a polemic against Liebig's theory of soil exhaustion. 37 When Marx wrote to Engels in January 1868 that "since I last looked into the subject, all sorts of new things have appeared in Germany," he was likely thinking of Fraas's book. Though Marx did not make excerpts from this book and his personal copy is lost, he read a series of books by Fraas, including *Climate and the Plant World Over Time, a Contribution to the History of Both* (*Klima und Pflanzenwelt in der Zeit, ein Beitrag zur Geschichte beider*) (Landshut, 1847), *The History of Agriculture* (*Die Geschichte der Landwirtschaft*) (Prague, 1852), and *The Nature of Agriculture* (*Die Natur der Landwirtschaft*) (Munich, 1857). Other books by Fraas are preserved in his personal library such as *HistoricalEncyclopedic Outline of Agricultural Theory* (*Historisch-encyklopädischer Grundriß der Landwirtschaftslehre*) (Stuttgart, 1848) and *Root Life of Cultivated Plants and Increasing Returns* (*Das Wurzelleben der Kulturpflanzen und die Ertragssteigerung*) (Leipzig, 1872). 38

38. MEGA 2 IV/32, no. 435–37. Fraas's *Agrarian Crises and Their Remedies* is included in the list of lost books from the personal library of Marx and Engels.

Saito, *Karl Marx's Ecosocialism*. 2017: 228

A remark by Marx in his letter to Engels on March 25, 1868, confirms this:

*Very interesting is the book by Fraas (1847): Climate and the Plant World Over Time: A Contribution to the History of Both, namely as proving that climate and flora change in historical times. He is a Darwinist before Darwin, and admits even the species developing in historical times. But he is at the same time an agronomist. He claims that with cultivation— depending on its degree—the “moisture” so beloved by the peasants gets lost (hence also the plants migrate from south to north), and finally steppe formation occurs. The first effect of cultivation is useful, but finally devastating through deforestation, etc. This man is both a thoroughly learned philologist (he has written books in Greek) and a chemist, agronomist, etc. The conclusion is that cultivation—when it proceeds in natural growth and is not consciously controlled (as a bourgeois he naturally does not reach this point)— **leaves deserts behind it, Persia, Mesopotamia, etc., Greece.** So once again an **unconscious socialist tendency!** ... His history of agriculture is also important. He calls Fourier this “pious and humorous socialist” ... It is necessary to keep a close watch on the recent and very latest in agriculture. The physical school is pitted against the chemical.*

39. Marx and Engels, *Collected Works*, vol. 42, 558–59, emphasis in original. Fraas's reference to Fourier comes from *Die Geschichte der Landwirtschaft oder geschichtliche Übersicht der Fortschritte landwirtschaftlicher Erkenntnisse in den letzten 100 Jahren* (Prag: Calve, 1852), 12. Marx's text in *Marx-Engels-Werke* is not correctly deciphered and I have corrected the translation here

Saito, *Karl Marx's Ecosocialism*. 2017: 229

It is thus only after 1864 that Fraas began explicitly to criticise Liebig's theory, although he had, in the 1850s, pointed to a possible danger of overdependence on agricultural chemistry and had argued for the importance of “agricultural physics” for the development of agriculture.

Saito, *Karl Marx's Ecosocialism*. 2017: 230

Fraas's originality lay in his detailed treatment of the relationship between climate and plant growth. Saito, *Karl Marx's Ecosocialism*. 2017: 231

Fraas repeatedly argues that rational agriculture must seriously take climatic factors into account. Thus, even if inorganic constituent elements of the soil are “absolutely necessary,” their artificial supply with chemical fertiliser is not a condition sine qua non for ample plant growth, but rather, functions as a “climatic adjustment”:

To the extent that favourable climatic conditions are missing to the cultivated plants and cannot be replaced somehow, we must open up the sources of nutrition in the soil, that is, we must dung better. [It is] not because cereals consume more ash constituents (mineral constituents) than meadow plants, but because they are alien to our climate and do not have enough warmth to assimilate salts of the soil as well as gases of the air into our desired amount of organic substance within an artificially and naturally measured time of vegetation. MEA Sign. B 111, 2.

Saito, *Karl Marx's Ecosocialism*. 2017: 232

For Fraas, the problem of soil exhaustion must be modified accordingly, because it exists also in relation to climatic factors. In fact, soils without manure can provide successful crops over a long time period under certain conditions of climate, as Marx documents in his notebook:

In southern Europe cereals (barley) can be quite successfully cultivated on the same land every year for many years even without rotation and without manure, maybe not corn and cotton, but at least melons.... Cereals are thus soil-exhausting plants in the cold temperature zone as they strongly require favourable climate, particularly corn, durra, wheat, barley, rye and oat, legumes and buckwheat less so, and clovers, our pasture, asparagus etc. not at all. In the warm and moderate temperature zone cereals and legumes are no longer soil-exhausting plants with exception of corn, rice and durra, but hardly tobacco that is already cultivated often without manure. MEA Sign B 111 17

Saito, *Karl Marx's Ecosocialism*. 2017: 232-33

Fraas's research on climatic influences on vegetation opens up a fully new way to generate and maintain sustainable production. He calls the agriculture of increase "power agriculture" (*Kraftkultur*), which he envisions being introduced on the basis of traditional agriculture. As Marx noted in his letter to Engels, Fraas's "alluvial theory" is the most effective method for power agriculture, which makes a clear contrast to Liebig's recommendation to use chemical fertiliser. As a result, Marx finds another way to consciously regulate the metabolic interaction between humans and nature.

Saito, *Karl Marx's Ecosocialism*. 2017: 237

The renowned geologist Charles Lyell defines alluvion in the following way: "Earth, sand, gravel, stones, and other transported matter which has been washed away and thrown down by the rivers, floods, or other causes, upon land not permanently submerged beneath the waters of lakes or seas."

Saito, *Karl Marx's Ecosocialism*. 2017: 237

Marx's interest in Fraas's theory is not limited to his critique of Liebig's theory of soil exhaustion. His comments about an "unconscious socialist tendency" in his letter relates to another Fraas book, *Climate and the Plant World Over Time*. The reason Marx found the book important provides a helpful hint in terms of why he so intensively studied natural science in the 1870s. In this context Marx's excerpts prove useful again.

Fraas based his 1847 book on his experience and research during his stay in Greece as a director of the Royal Garden in Athens and professor of botany at the University of Athens (1835–1842). The work consists of various historical reports about the influence of climate changes on humans and plants over a long historical period. These reports grounded his thesis on the significance of climate as an essential material condition for plant growth. Fraas's provocative thesis is that cultivation conducted by humans brings a climate change, which in the end counts as the most important factor for the decay of civilisation

Saito, *Karl Marx's Ecosocialism*. 2017: 239

★ In contrast to the widespread undervaluation of human influence upon climate, Fraas describes the historical dynamics in which human practices in building civilisations are transformed by climate over a long period. **According to Fraas, it is not robbery of a certain mineral substance in the soil but changes in climate that cause such a great disturbance in the metabolic interaction between humans and nature.**

Saito, *Karl Marx's Ecosocialism*. 2017: 242

The impact of climate change is not to be underestimated. As Fraas writes:

*Great damage of natural vegetation in a region results in a deep transformation of its entire character, and this modified new state of nature is never so favourable to the region and its population as before; certainly, people change with it. Such great transformations of the natural state of the region can hardly remain without effects, or, if they occur extensively and together with many regions, never remain without effects, and, of course, the old state of affairs cannot be rehabilitated. Carl Fraas, *Klima und Pflanzenwelt in der Zeit, ein Beitrag zur Geschichte beider* (Landshut: J. G. Wölfe, 1847), xii*

Marx, *MEA, Sign. B 112*, 45-46

Saito, *Karl Marx's Ecosocialism*. 2017: 242

As Marx summarises in his letter to Engels, Fraas argues that "deforestation" is the most significant cause of desertification, in that it generates rising temperatures and lower humidity. For example, Marx documents the following passage in his notebook:

Deforestation of a region, particularly when it possesses a very arid and sandy or furthermore even calcareous soil, is counted as the most powerful cause for creating heat.... The composition of the soil [conditions] the rainfall, from which the climatic influences described above follow. The forested areas covered by vegetation retain moisture more firmly and are less heated up by sunlight than infertile areas. [As a result,] they also attract more rainfall, and thus these areas are not just cool but also distribute refreshing cool airstream to hot surrounding areas. The distribution of moisture in the air greatly changes temperature and various capacities of heat conduction of matter on the surface of the earth. MEA, Sign. B 112, 45-46, emphasis in original.

Saito, *Karl Marx's Ecosocialism*. 2017: 242-43

The great transformation of climate and change of vegetation are most convincingly proved by an escalating steppe formation and the transition to a complete desert in the places the ancient people knew as the most fruitful regions of the world. The unique, loose, saliferous soil in very fertile Mesene used to be covered by grus sand and mud in every flooding. But if this soil is not constantly irrigated, covered by mud and then drained, it is exposed to a unique transformation, one similar to the decomposition of mud of the Nile river in Egypt as [Joseph] Rußegger illustrated or the coasts in Greece as we observed. [Namely,] salt and grus sand become dominant, and steppe flora comes in. MEA, Sign. B 112, 49 [Mesopotamia, Egypt, Greece]

Saito, *Karl Marx's Ecosocialism*. 2017: 243-44

The difference between Fraas and Liebig is explicit. Both agree that a decrease of soil productivity due to irrational human interaction with their environment undermines the fundamental material conditions of civilisation. However, the ultimate cause of a decrease is, according to Fraas, not the exhaustion of mineral substances in the soil, but excessive deforestation.

Saito, *Karl Marx's Ecosocialism*. 2017: 247

★Human labour transforms the natural process of metabolism in two ways. First, it relates to nature purposefully and consciously in industry and agriculture. Nature provides human labour with materials for production, which can be modified in accordance with human needs and desires. This elasticity of nature strengthens humans' instrumentalist attitude toward nature. **Second, humans change nature unintentionally, as industry and agriculture modify the universal metabolism between humans and nature as a whole.** The cumulative result is, as Fraas illustrates in detail, exhaustion of the soil, the formation of steppes and desertification, which finally leads to the decay of civilisation. In other words, humans are not in a position to change and manipulate their environment at will.

Saito, *Karl Marx's Ecosocialism*. 2017: 247-48

★Fraas sums up his observation:

*Man in various ways changes his environment, on which he is quite dependent, and he changes nature more than one usually imagines. In fact, he is able to change nature to such an extent that later it completely malfunctions as the indispensable means for the realisation of a higher level of mental and physical development, forcing him to confront extreme physical obstacles.... There is no hope of overcoming this reality. Fraas, *Klima und Pflanzenwelt*, 59*

Saito, *Karl Marx's Ecosocialism*. 2017: 248

In relation to Marx's project of political economy as an analysis of dynamic entanglement between "form" and "material," Fraas's historical investigation opens up an even more expanded vision of ecology than the earlier reception of Liebig's theory of soil exhaustion. Climate change is a new and important element for Marx's investigation into the historical disturbances in natural metabolism caused by humans. Although Fraas focuses on ancient civilisations, *Climate and the Plant World Over Time* makes Marx aware that this development of modern capitalist production accelerates the

disturbance of metabolism between humans and nature due to a more massive deforestation than previously in human history. Marx documents a passage in his notebook in which Fraas laments the rapid forest decrease in Europe: "France now has no more than 1/12 of its earlier forest area; in England out of 69 woodlands there remain only 4 big forests; in Italy and the southeastern peninsula of Europe the stands of trees in the mountains are less than what was common even in the plains in the past." MEA, Sign. B 112, 45

Saito, Karl Marx's Ecosocialism. 2017: 248

*That is, **trees in mountain areas should never be cut down without the highest necessity because they are most influential.** Fraas, *Klima und Pflanzenwelt*, 136, emphasis in original*

Saito, Karl Marx's Ecosocialism. 2017: 248-49

Fraas admits that this warning will not be appreciated by the public because deforestation has built the economic foundation for the masses of people. Thus he concludes pessimistically that the **"biggest enemy" of nature is "cultivation accompanied by commerce and industry."** Fraas, *Klima und Pflanzenwelt*, 68

Saito, Karl Marx's Ecosocialism. 2017: 249

Fraas's theory contributes to understanding the deepening of metabolism rifts, as his analysis of historical transformations of climate and the plant world warns against shortsighted deforestation. Liebig's critique of the robbery system does not entirely cover the destructive tendency of modern production, and Marx, reading Fraas's work, rightly thinks it necessary to study much more thoroughly the negative aspect of the development of productive forces and technology and their disruption of natural metabolism with regard to other factors of production. Marx aims at strengthening Liebig's critique of the squandering of limited natural resources over the entire ecosystem, going beyond Liebig's analysis.

Saito, Karl Marx's Ecosocialism. 2017: 250

Although no direct reference to Fraas is found in Marx's later economic manuscripts, his interest in deforestation can be confirmed in his notebooks of 1868. In the beginning of 1868, he also read John D. Tuckett's *History of the Past and Present State of the Labouring Population*, noting the numbers of important pages...

Saito, Karl Marx's Ecosocialism. 2017: 251

The influence of the ideas of Fraas and Tuckett is visible in the second manuscript for volume 2 of *Capital*, written between 1868 and 1870. Marx had noted in the manuscript for volume 3 that forestry would not be sustainable under the system of private property, even if it could be more or less sustainable when conducted under state property. After 1868, Marx paid great attention to the problem of the modern robbery system, which he now expanded from crop production to include deforestation

Saito, Karl Marx's Ecosocialism. 2017: 251

In the manuscript to volume 2 of *Capital*, Marx commented on a passage from Kirchhof's book: "The development of culture and of industry in general has evinced itself in such energetic destruction of forest that everything done by it conversely for their preservation and restoration appears infinitesimal." MEGA 2 II/11, 203

Saito, Karl Marx's Ecosocialism. 2017: 252

Marx was certainly conscious of the danger that this deforestation will cause not only a wood shortage but also a changing climate, which is tied to a more existential crisis of human civilisation. Indeed, Kirchhof also pointed to the climatic influence of deforestation:

On the contrary, where forests disappeared, air becomes unfavourably dry and its flows are wilder and more violent. Springs of mountain valleys dry up, and many streams dry out. Many regions lost their fertility by cutting down trees, causing the balance of power to be disturbed.

Friedrich Kirchof, Handbuch der landwirtschaftlichen Betriebslehre: Ein Leitfaden für praktische Landwirthe zur zweckmäßigen Einrichtung und Verwaltung der Landgüter (Dessau: Katz, 1852), 57

Saito, *Karl Marx's Ecosocialism*. 2017: 252

Conclusion

The new historical edition of Marx-Engels-Gesamtausgabe enables us to reconstruct how, in the course of deepening his theory of political economy, Marx developed his ecological thought as a critique of capitalism. A more complete investigation of new materials published by the MEGA showed that a stereotypical (and false) critique of his indifference to the scarcity of natural resources and the burdening of our ecospheres, and another critique of his Promethean superstition on limitless economic and technological development, are not tenable. Furthermore, a more systematic investigation of excerpts and notes enables us to comprehend the central role of ecology in his critique of capitalism. We can derive ecological theory consistently from his theory of value, as an integral part of his system of political economy.

Saito, *Karl Marx's Ecosocialism*. 2017: 257

Modern discussions of ecology owe a great debt to Marx's deep insight into the fundamental nature of a society of generalised commodity production. He shows that value as the mediator of the transhistorical metabolism between humans and nature cannot generate the material conditions for sustainable production. Rather, it causes rifts in the process of material reproduction. When value becomes the dominant subject of social production as capital, it only strengthens the disturbances and disruptions of that metabolism, so that both humanity and nature suffer from various disharmonies.

Saito, *Karl Marx's Ecosocialism*. 2017: 258

Marx developed his value theory in a close systematic relation to the problem of metabolic rifts.

Saito, *Karl Marx's Ecosocialism*. 2017: 260

Instead, he was aware that the contradiction between capital and nature does not immediately lead to the collapse of the regime of capital. Thanks to material elasticity, capital can, for example, overcome its limitations by intensively and extensively exploiting workers, inventing new technologies, discovering new raw materials, and opening up global markets and colonies.

Saito, *Karl Marx's Ecosocialism*. 2017: 260

The investigation of Marx's ecology through his notebooks also showed that the common identification of the nineteenth century as a century of naïve Prometheanism proves one-sided, since a number of theorists such as Liebig, Johnston, and Fraas were seriously engaged with the problems of scarcity and exhaustion of natural resources. Also William Stanley Jevons's prediction about decreasing coal reserves in England in his famous book *The Coal Question* (1865) repeatedly refers to Liebig and caused heated discussions in the English Parliament.

Saito, *Karl Marx's Ecosocialism*. 2017: 261

14. Marx's ecological interest continued to expand in the 1870s. For example, in 1878 Marx notated in his notebook: "**The extinction of species is still going on (Man himself [is] the most active exterminator).**" MEGA 2 IV/26, 233, emphasis in original.

Saito, *Karl Marx's Ecosocialism*. 2017: 300

Further reading

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