Modul Bodenökologie WS 2017/18 :

Trophische Beziehungen

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Austrian Society of Soil Science

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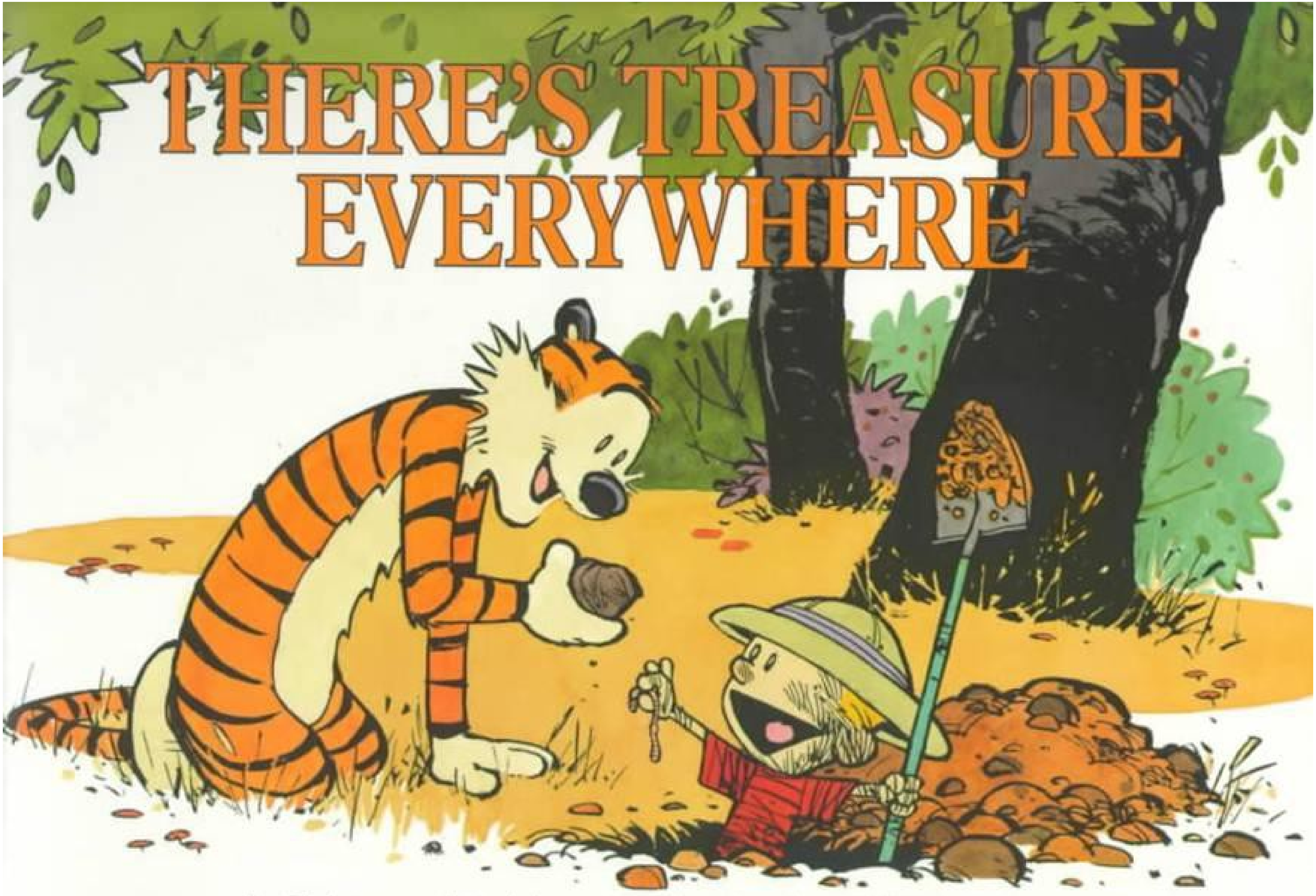
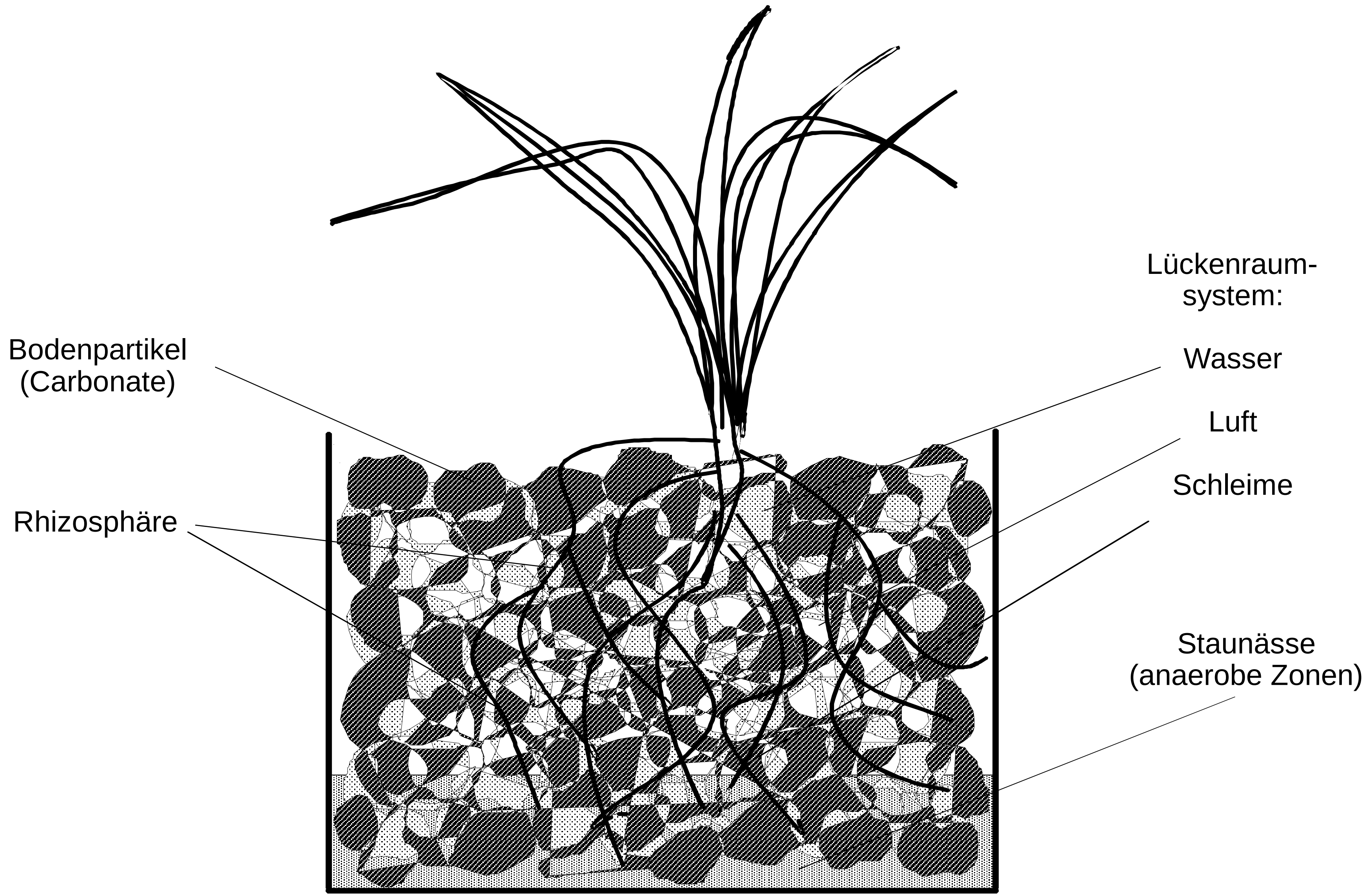

THERE'S TREASURE
EVERYWHERE

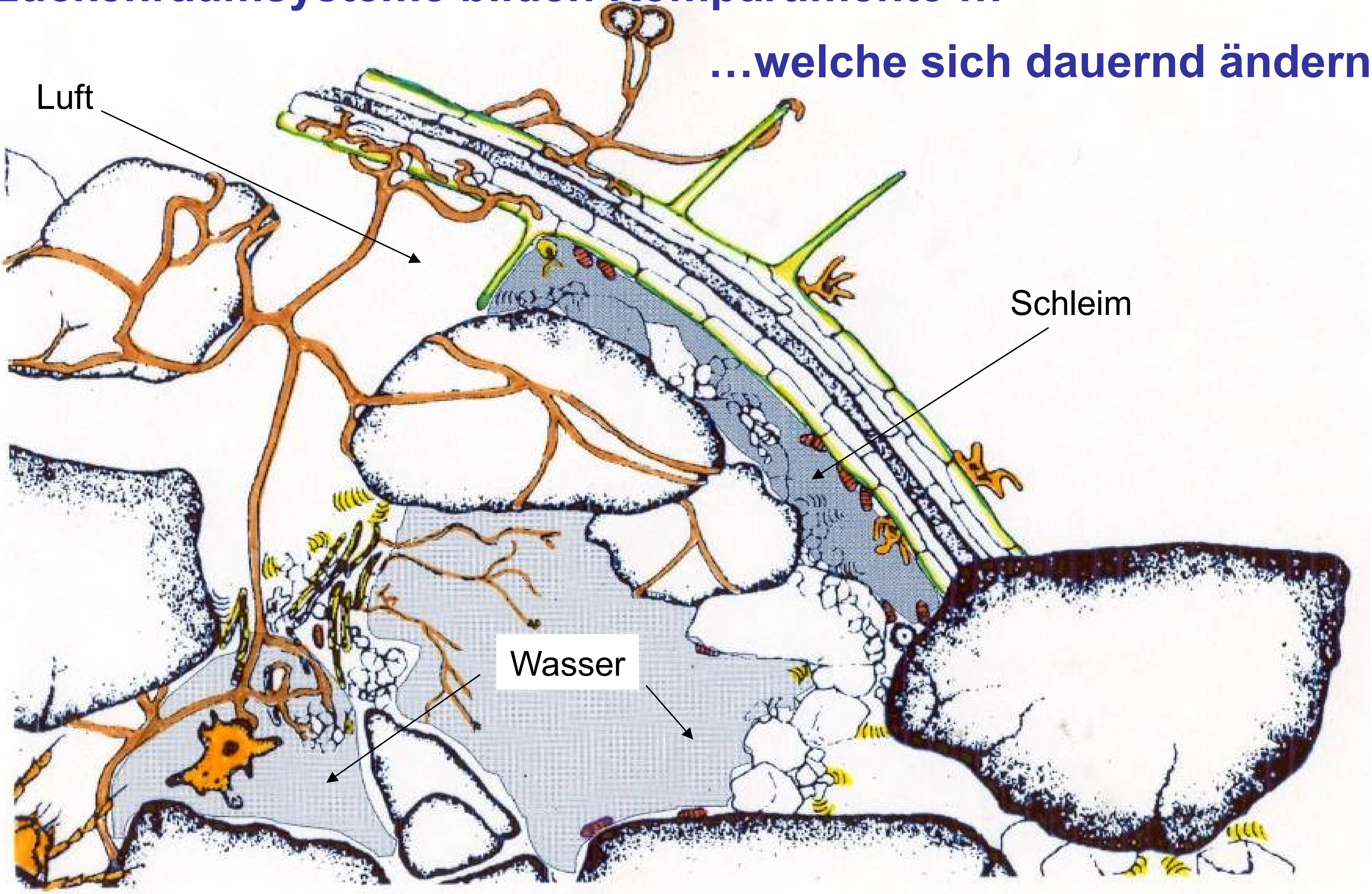
Microhabitate im Boden



- **Die Rhizosphäre**
- **Trophische Beziehungen**
- **Ressourcenmanagement**

Lückenraumsysteme bilden Kompartimente …

…welche sich dauernd ändern!

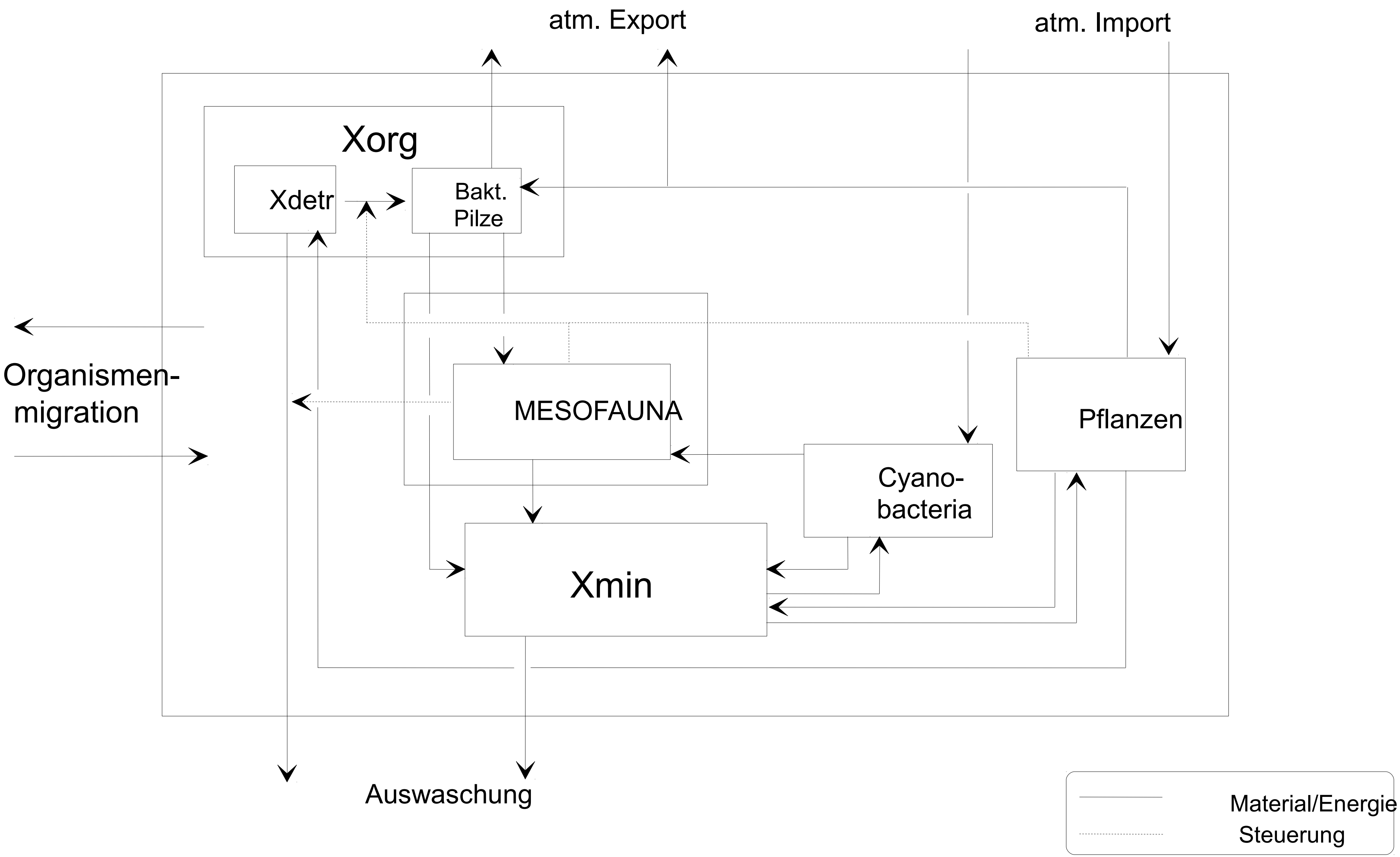


Definitionen: Bodenökologie, Bioaktivität

Bodenökologie

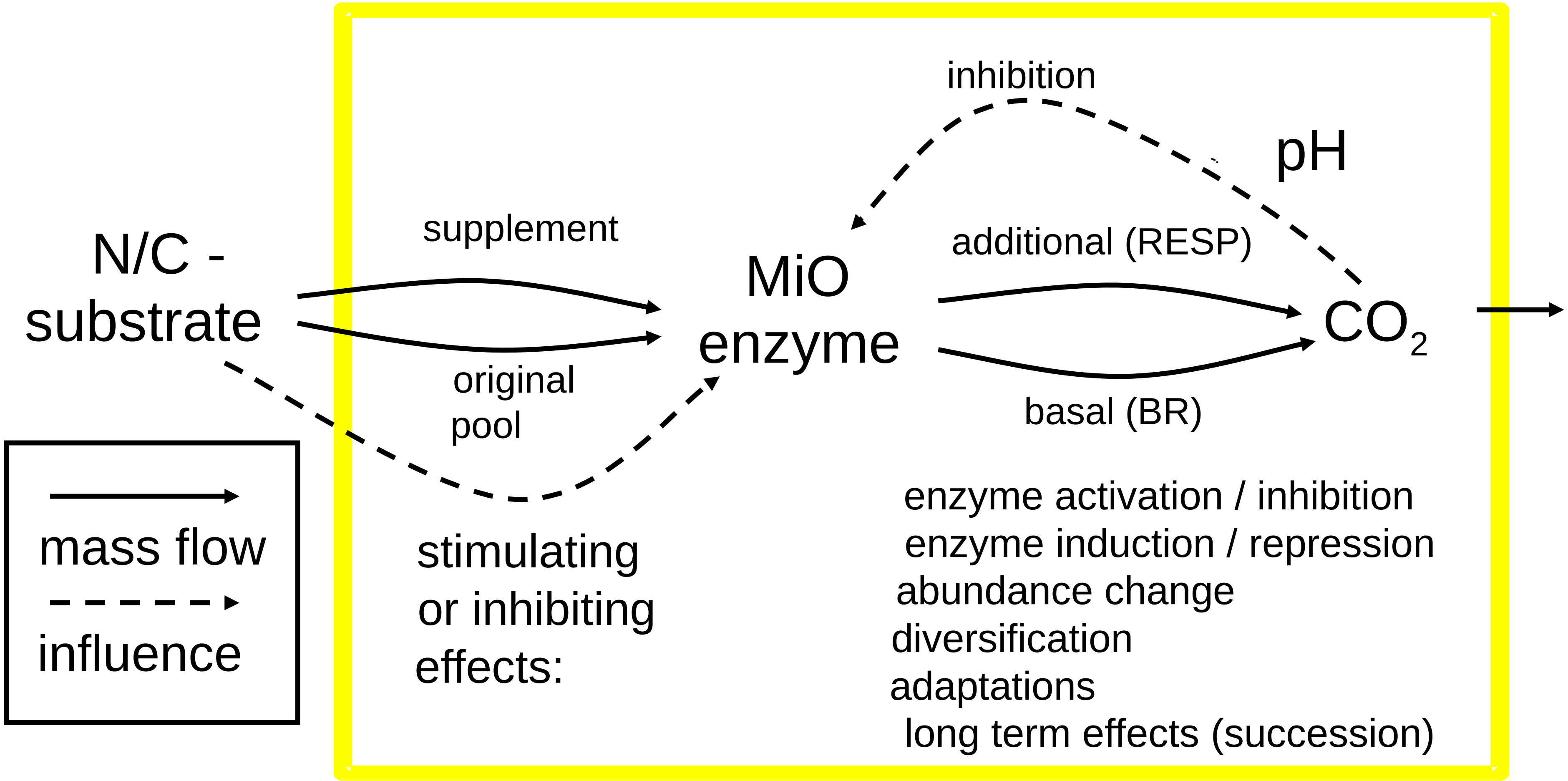
Rhizosphäre	Durchwurzelter Bodenraum, s.s. von der Wurzel direkt beeinflußter Boden.
Rhizoplane	Wurzeloberfläche, von Organismen besiedelt.
Rhizospährenorganismen	An der Wurzeloberfläche lebende Organismen.
Rhizodeposition	Deposition organischer fester und gelöster Substanz durch Wurzeln.
Wurzelexudation	Sekretion gelöster organischer Substanz durch die Wurzel.
Bioaktivität	Aktuelle meßbare metabolische Aktivität lebender Organismen oder Exoenzyme.
Biomasse	In g oder g C angegebene Masse lebender oder in Lysis befindlicher Organismen.
Potentielle Bioaktivität	Maximale induzierbare Bioaktivität.
Abundanz	Häufigkeit der Individuen einer Art.
Artenreichtum	Artenanzahl in einem System „species richeness“
Diversität	relative Anzahl vorhandener Arten bezogen auf….(Shannon Weaner u.v.a.m.)
Relative Bedeutung	Dominanz einzelner Arten bezogen auf Abundanz und Bioaktivität.
Poolgrößen	Mengen einzelner Metaboliten .
Flüsse	Umsatzraten einzelner Metaboliten.
Energiefluss	Translokation Potetieller Chemische Energie wie etwa ATP.
Materialfluss	Translokation von Substanz, s.s. potentieller Biosubstrate.
Residenzzeit	Verweilzeit einer Substanz in einem System.
Turnoverzeit	Zeitraum der vollständigen Rezyklierung einer Substanz in einem System.
Source_Quelle	Energie bzw. Kohlenstoffquelle
Sink_Senke	Ort, an dem eine Substanz bzw. Energie immobilisiert wird.

Basisinteraktionen, mechanistischer Ansatz



Destruenten, Detritivoren (Decomposers)

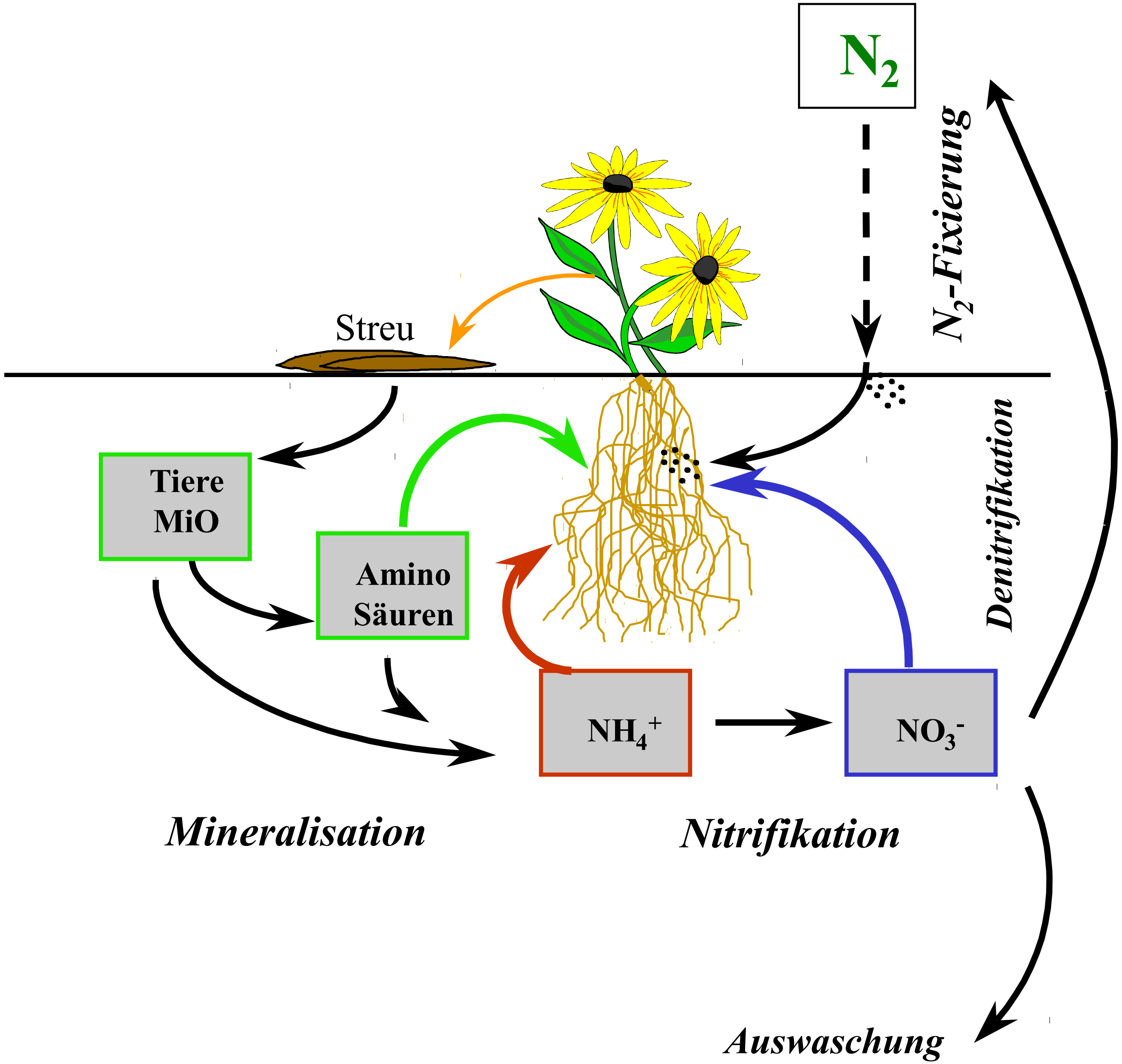
Level of Impact



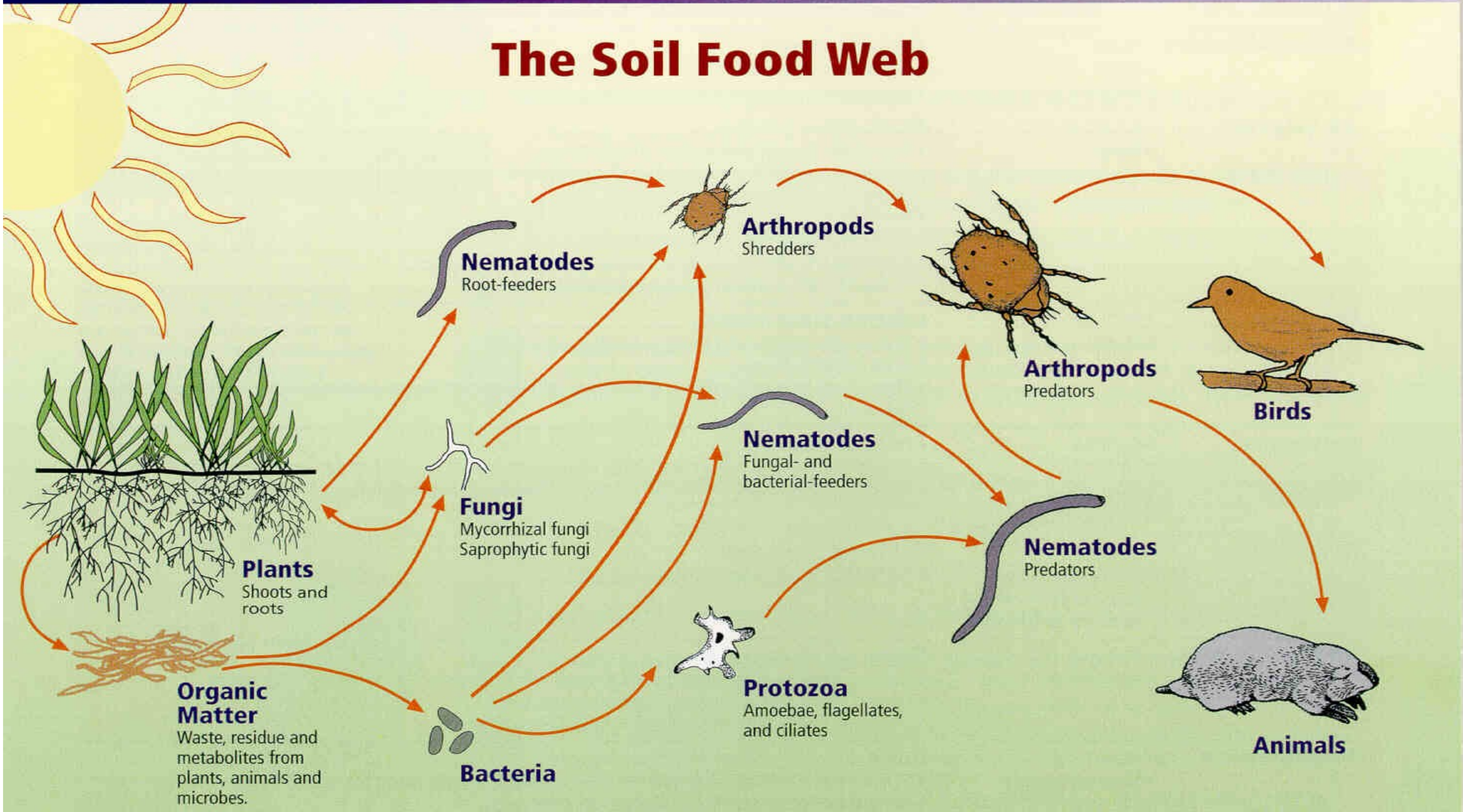
investigated system

- Die Rhizosphäre
- **Trophische Beziehungen**
- Ressourcenmanagement

Der Stickstoffkreislauf
im Ökosystem



The Soil Food Web



First trophic level:
Photosynthesizers

Second trophic level:
Decomposers
Mutualists
Pathogens, parasites
Root-feeders

Third trophic level:
Shredders
Predators
Grazers

Fourth trophic level:
Higher level predators

Fifth and higher trophic levels:
Higher level predators

Trophische Interaktionen im Boden

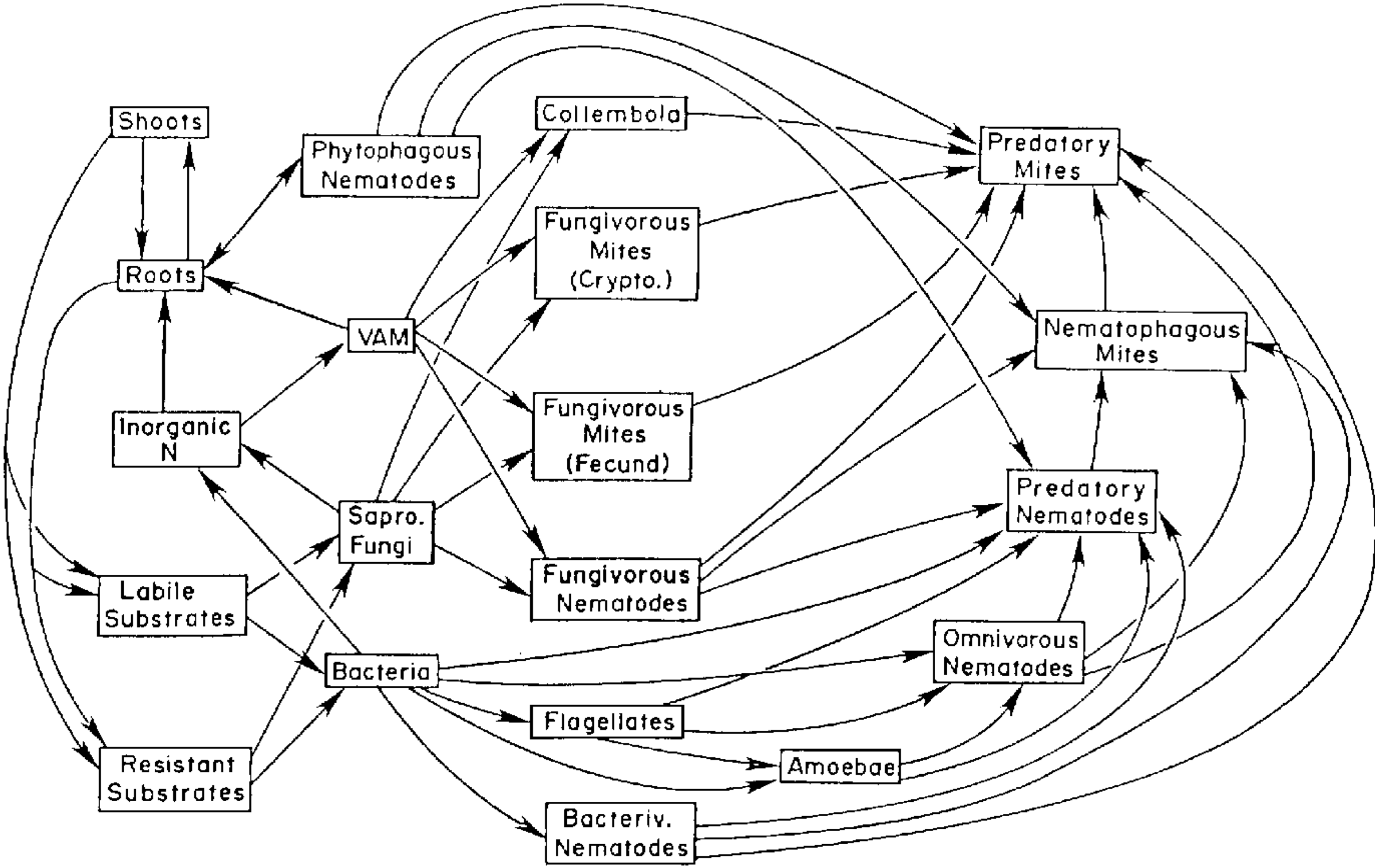
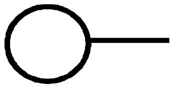
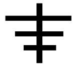


FIG. 9. A model of trophic interactions among plants, substrates, microflora, and fauna in a shortgrass prairie. (From Hunt *et al*. unpubl.)

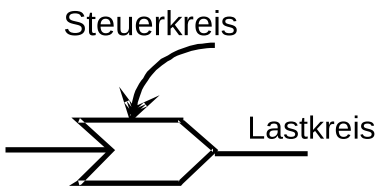
Formelsprache für Ökosysteme mit Symbolen



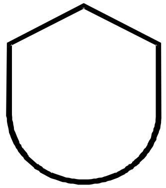
Energiequelle



E- Abfluß

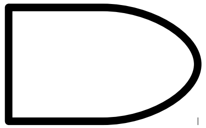


Regler

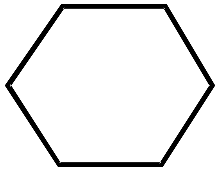


Passiver Speicher

Xorg....organisch geb. N/C
Xmin....remineralisierter N/C
POM....particulate org. matter
DOM....dissolved org. matter



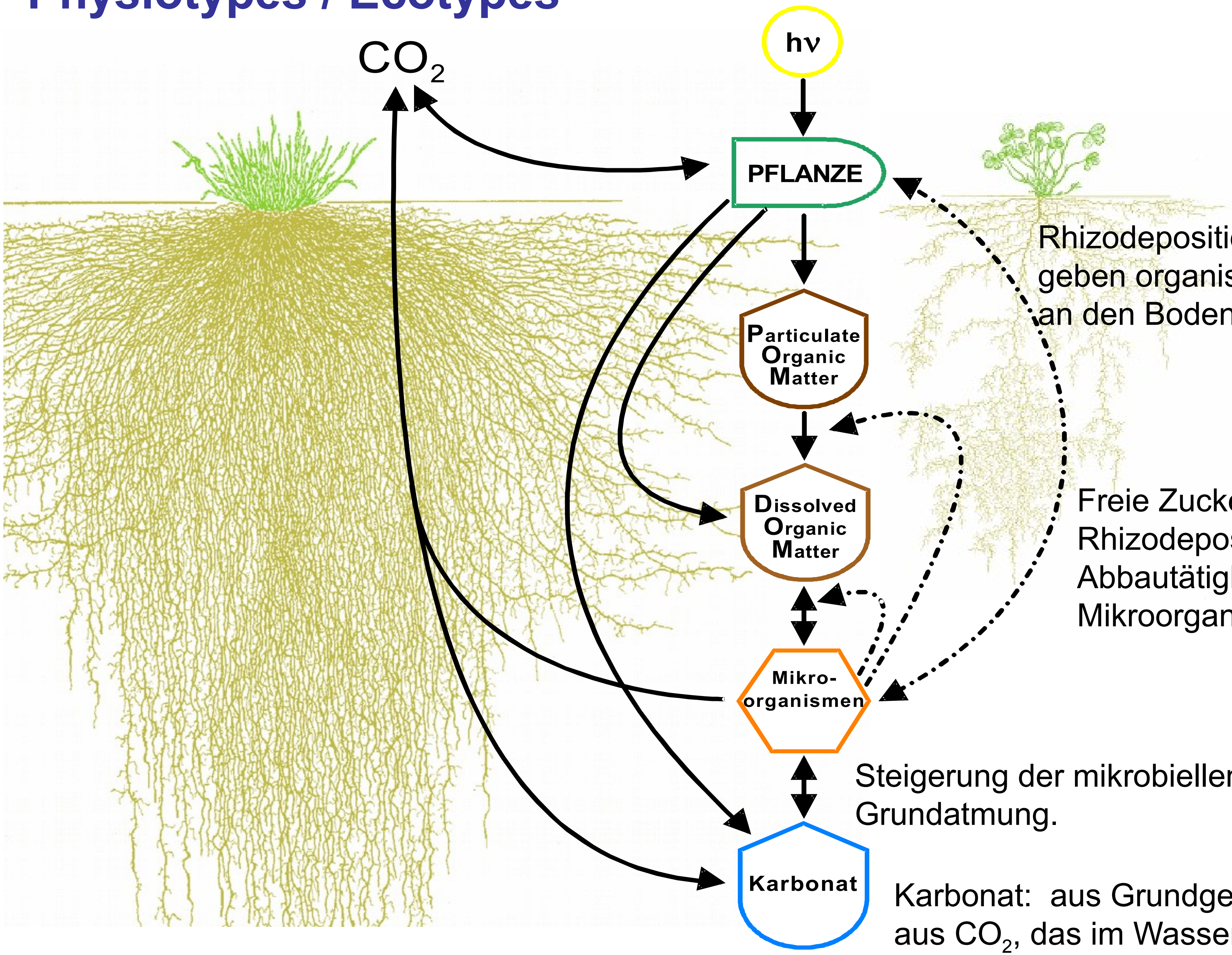
Produzent



Konsument

Nach H.T.Odum, 1971

Physiotypes / Ecotypes



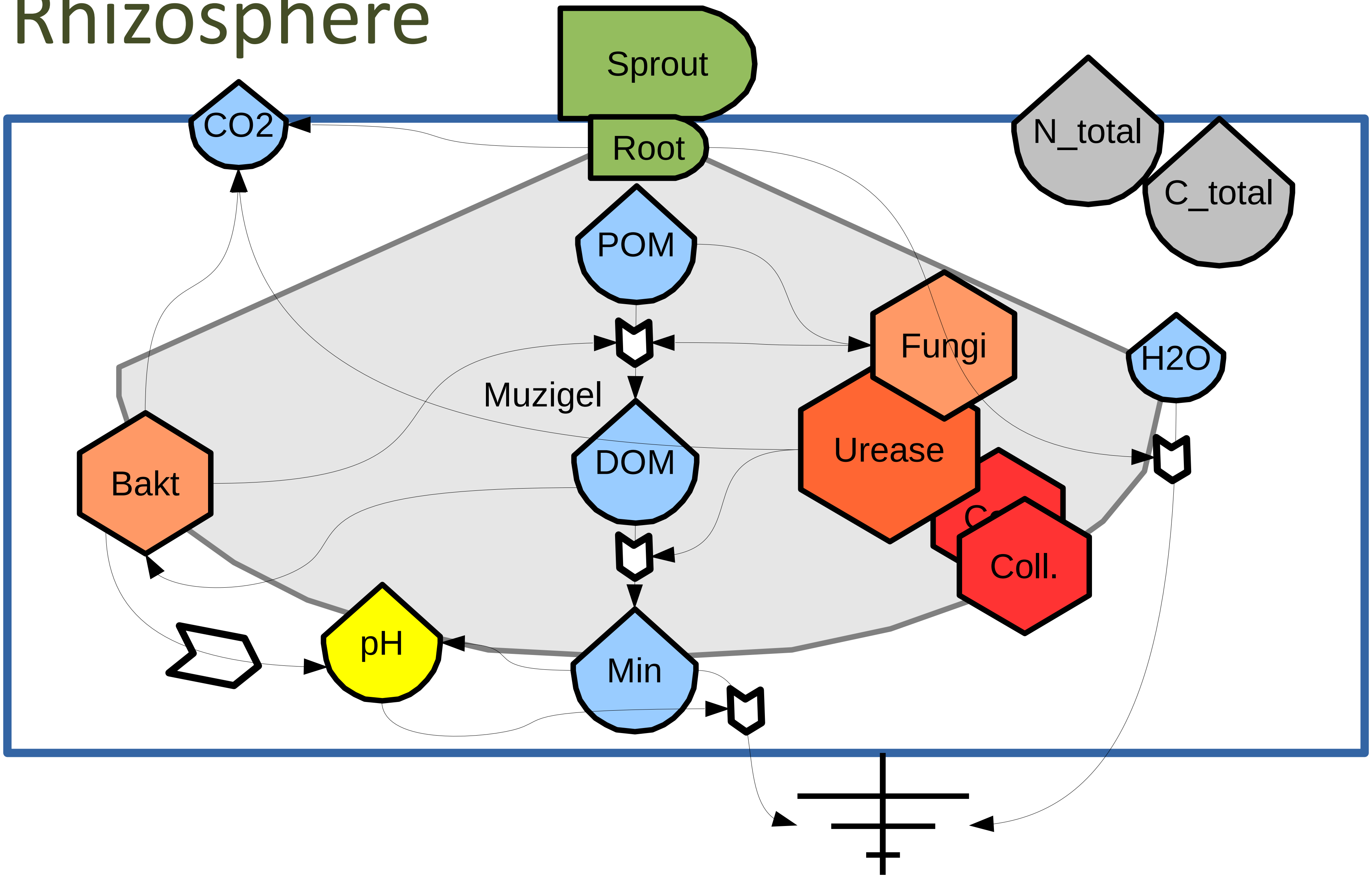
Rhizodeposition: Pflanzen geben organisches Material an den Boden ab.

Freie Zucker: Rhizodeposition, Abbautätigkeit von Mikroorganismen.

Steigerung der mikrobiellen Aktivität: Grundatmung.

Karbonat: aus Grundgestein oder aus CO_2, das im Wasser Kohlensäure bildet.

Rhizosphere



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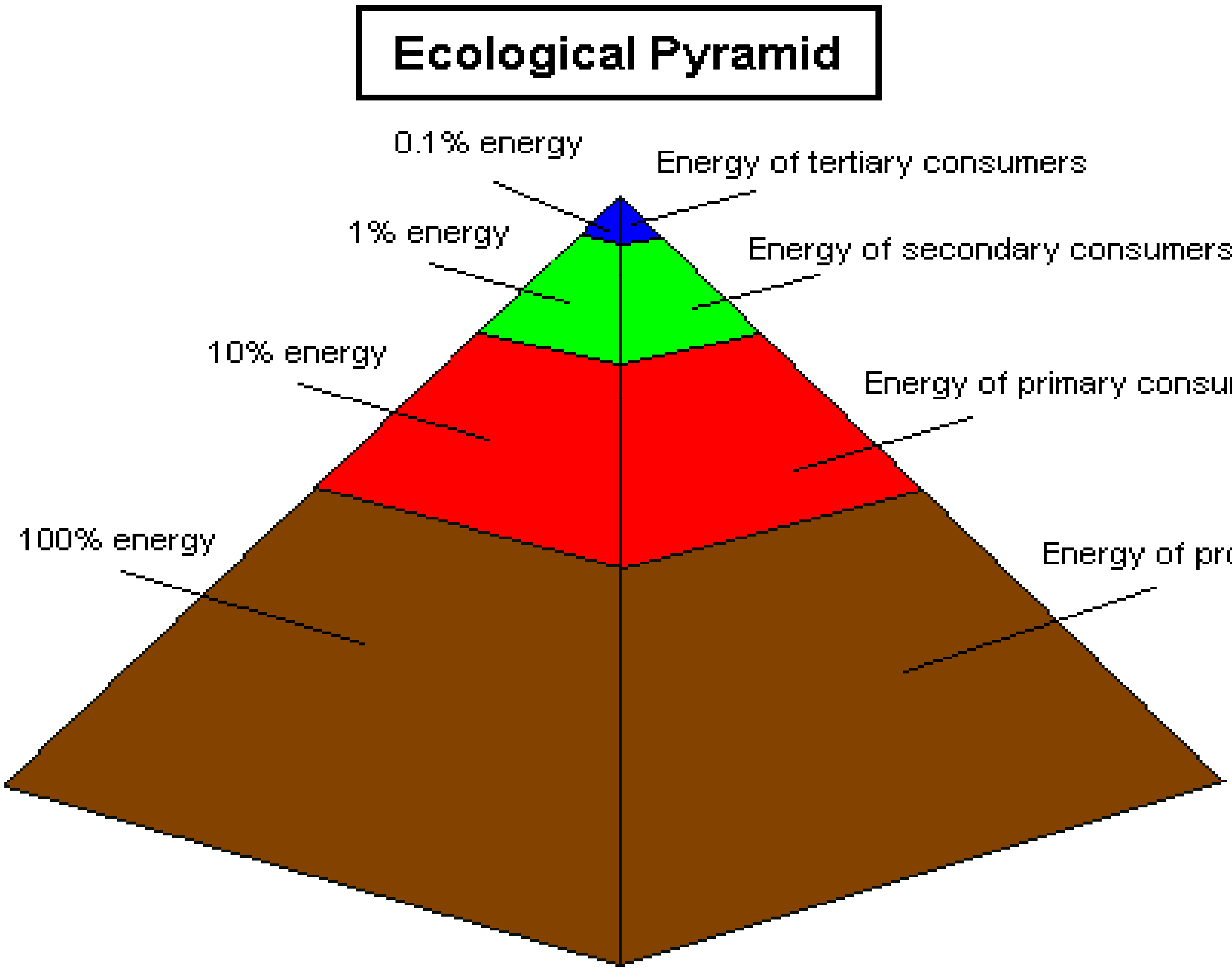
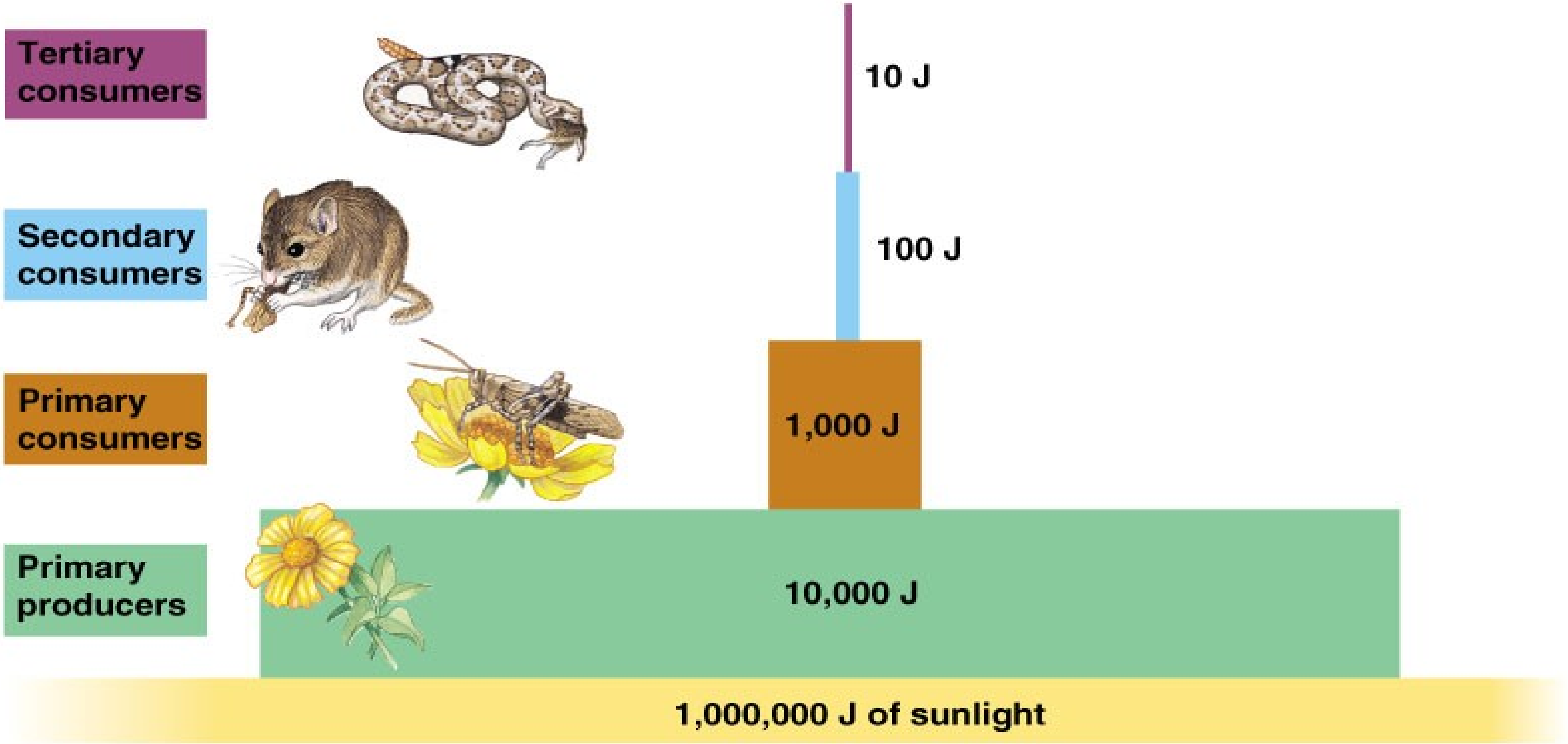

Ecological Pyramid
0.1% energy
Energy of tertiary consumers
1% energy
Energy of secondary consumers
10% energy
Energy of primary consumers
100% energy
Energy of producers

Energy Pyramid



Apparatus to study the quantitative relationships between root exudates and microbial populations in the rhizosphere

R. MARTENS*

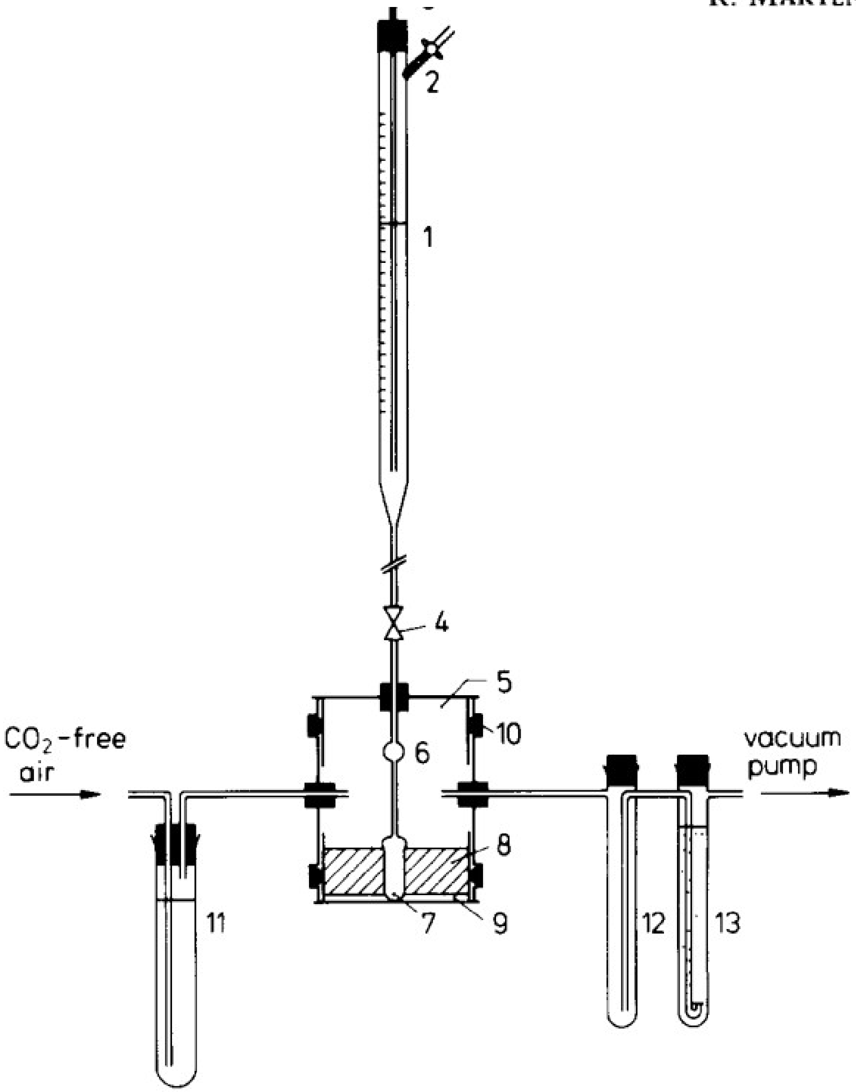


Fig. 1. Diagram of the apparatus. 1. Reservoir for artificial exudate; Connection to vacuum pump; 3. Inner glass tube; 4. Magnetic valve; 5. Incubation chamber; 6. Tygon tube and glass bulb; 7. Molecular filter; 8. Soil; 9. Plastic disc; 10. Greased rubber rings; 11. Tube with water; 12. Trap to prevent return flow; 13. CO_2-trap filled with ethanolamin and methanol or NaOH.

Table 1. Formation of microbial biomass (μg ^{14}C) from ^{14}C-labelled glucose added to soils during a 10-day period in an apparatus to measure quantitative aspects of the rhizosphere

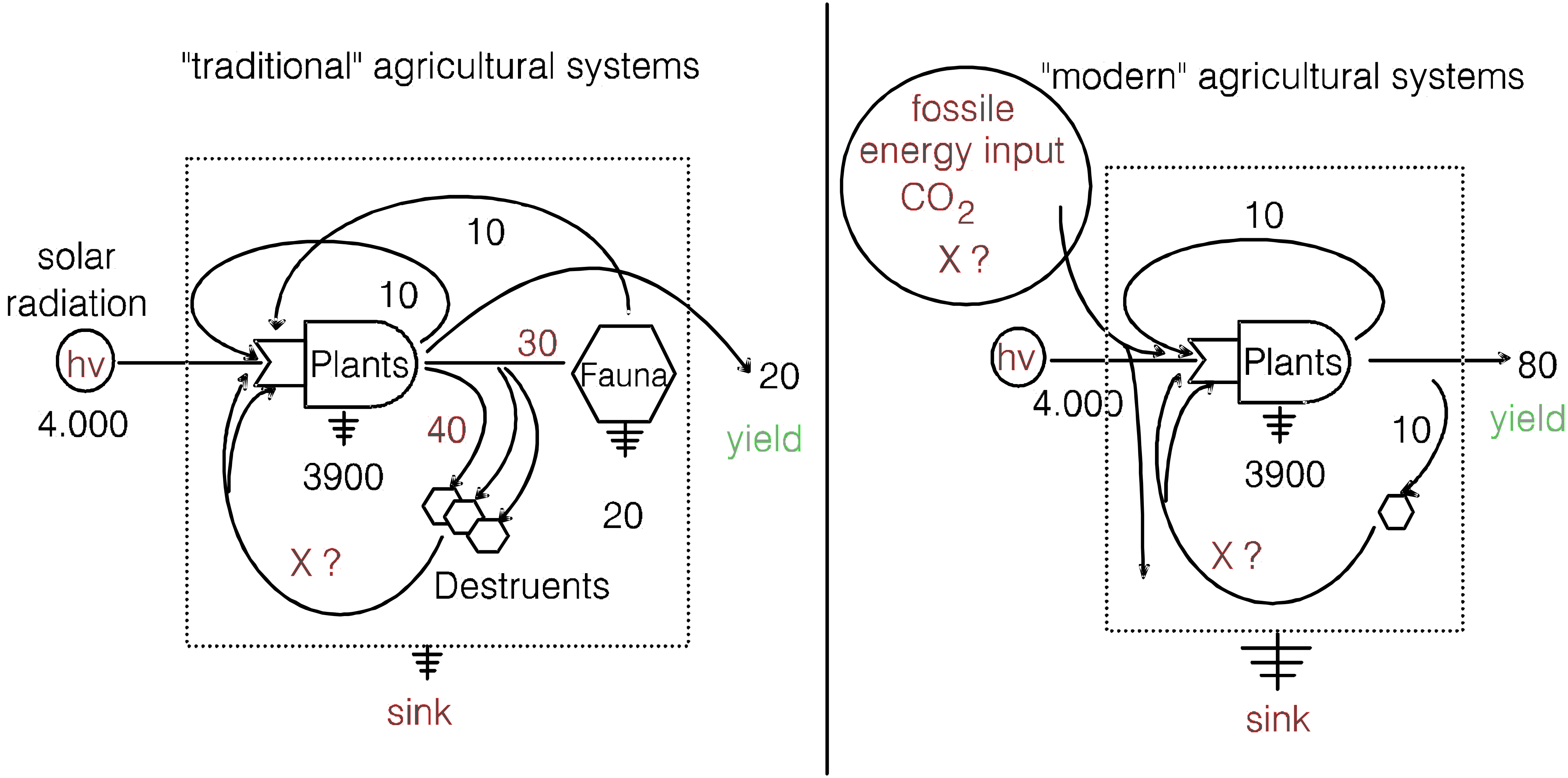
Distance of soil from surface of membrane (mm)	Amount of ^{14}C-glucose (μg C 10 days^{-1}) added to soil: 880		4400		22,000	
	A[a]	B[b]	A	B	A	B
0–2	54	81	226	262	382	325
2–4	1.5	7	34	49	271	327
4–6	0.4	0.6	3	6	30	126
6–8	0.6	0.5	1.1	1.5	5	26
8–10	0.2	0.4	1.0	1.9	8	6
10–14	0.3	0.5	1.3	2	10	8
14–19	0.3	0.7	1.5	3	12	13
19–52	3	6	13	24	89	96
Total in soil	60.3	96.7	280.7	349.2	807	927
CO_2–^{14}C (μg) respired	479	529	2516	2455	14,366	13,860
Biomass ^{14}C as a percentage of ^{14}C added to soil	6.9	11.0	6.4	7.9	3.9	4.3

[a]Arable soil from the north east of Scotland (Sand 74%, silt 19%, clay 7%; org. C 5.3%; pH 10 mM $CaCl_2$ 4.7).
[b]Arable soil from the eastern parts of West-Germany (Sand 43%, silt 51%, clay 6%; org. C 1.2%; pH 10 mM $CaCl_2$ 5.3).

A remarkable result of all experiments was the very low efficiency by which the microbial population used the available carbon source for its own proliferation. Between 54 and 65% of the added carbon was respired as CO_2 and only 4 to 11% was transformed into microbial biomass.

Soil Biol. Biochem. Vol. 14, pp. 315 to 317, 1982
Printed in Great Britain.

Description of Sustainability

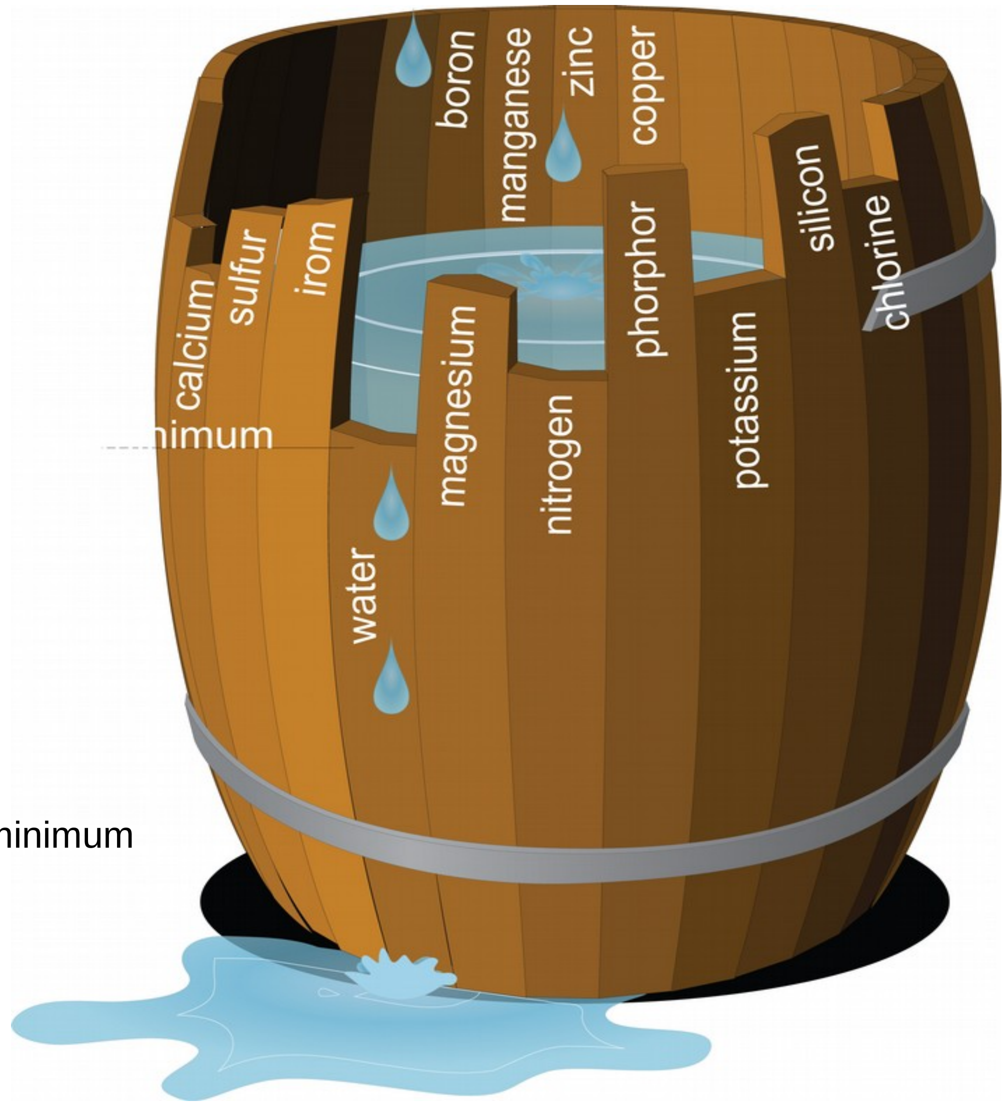


< soil structure >

energy balance in agriculturally used systems (after H.T.Odum, 1971).

Liebig´s law of the minimum

Liebig's law of the minimum, often simply called Liebig's law or the law of the minimum, is a principle developed in agricultural science by Carl Sprengel (1828) and later popularized by Justus von Liebig.
It states that growth is controlled not by the total amount of resources available, but by the scarcest resource (limiting factor).



https://en.wikipedia.org/wiki/Liebig%27s_law_of_the_minimum

Verfügbarkeit
Limitierung
Immobilisierung
Streß
Hormesis

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