Supplementary Information

Supplementary Methods

Labelling of the substrates

For the algal mixtures, 2 diatom algal species (Navicula sp. and Cyclotella sp.) and 5 green algal species (Nannochloropsis limnetica SAG18.99, Mychonastes jurisii SAG37.99, Coelastrum microsporum SAG2292, Actinastrum hantzschii SAG2015, and Parachlorella beijerinckii SAG2046) were used. The Navicula and Cyclotella species were grown in either Nicklisch (diatom) or Bonferroni media (green algae) under an 18:8 light:dark regime with about 100 µm photons m\(^{-2}\) s\(^{-1}\) fluorescence during the light conditions. To achieve algal materials of different cellular stoichiometries, the algae cultures were harvested by centrifugation at 1000 rpm for 20 min. The resulting pellet was then washed (resuspension in 0.9% NaCL + centrifugation) three times, resuspended in nutrient-free media, and split for cultivation on media containing two different inorganic N and P concentrations, herein referred to as repleted (0.5 mM NaNO\(_3\) and 0.05 µM KH\(_2\)PO\(_4\)) and depleted (0.16 mM NaNO\(_3\) and 0.005 µM KH\(_2\)PO\(_4\)) algal media. After 9 days of cultivation, the whole material of each strain was again harvested by centrifugation at 1000 rpm for 20 min and washed (resuspension in 0.9% NaCL + centrifugation) three times. All the strains grown on a common medium (depleted or repleted) were pooled together and fresh medium with the same nutrients was added to the culture, but with 20% of the NaHCO\(_3\) (δ=-20 ‰) replaced by Na\(^{13}\)C-HCO\(_3\) (99% purity, δ=1000 ‰) to increase the algae in δ\(^{13}\)C. After 24-48 hours, the algal mixtures were harvested by centrifugation at 1000 rpm for 20 min, washed three times (resuspension in 0.9% NaCL + centrifugation), and subsequently resuspended in artificial
stream water. The algal mixtures were frozen, freeze-dried, and stored at -20°C until needed.

As a second carbon source, $^{13}$C-enriched beech leaves (Fagus sylvatica, L.) from trees grown under $^{13}$CO$_2$ atmosphere in greenhouses in Nancy, France, were used (for more details see Weise et al., 2016). The beech leaves were leached in artificial water for 48 hours prior to the start of the experiment and cut into small pieces (1-3 mm) after removing the middle vein. The leaves were then sieved through a 90-µm mesh to remove fine OM and frozen to allow similar treatments for both the C sources. We analysed the $^{13}$C isotopy of the particulate samples as described by Nitzsche et al. (2016).

Measurement of the headspace CO$_2$

Headspace CO$_2$ was sampled automatically. Therefore, the headspace was pumped out of the chamber through an outlet tube and flushed with outside air for 14 minutes through an inlet tube connected to the chamber’s lid. A pressure-sensitive air-inlet valve in the chamber’s inlet enabled automatic opening and closing. A small tube (length=7 cm, diameter=0.7 mm) connected from the inside to the inlet revealed that the outside air entered the chamber very close to the water-air interface, which caused a delay in the mixing of the outside air with the headspace. A stable-isotope carbon dioxide analyser (CCIA, Los Gatos Research, CA, USA) was placed between the pump and the chambers for analysing the concentration and isotopy of the headspace CO$_2$. An automated system comprising four multiport selectors (10-universal multiport selectors, Vici Valco, Houston, TX, USA) placed between the chambers and the analyser allowed automatic measurement for each chamber every 6 hours, four times a day. The selector-analyser network was flushed with outside air between each measurement. Every 12-24 hours, we ran a reference gas (70% N$_2$, 30% O$_2$,
and 0.15% CO₂, Airliquide, Germany) to correct for isotope drifting of the instrument,
yielding a precision of 2 ‰ for δ¹³C and 1 ppm for CO₂ concentration. Data on isotopy is
expressed relative to the international standard Vienna Pee Dee Belemnite (VPDB).

**Detailed description on PLFA extraction**

After extraction, the PLFA were separated from other lipids on silic acid columns (BondElut®
LRC-Si, Altmann Analytic, Germany) using solid-phase extraction and methylated using mild
alkaline methanolysis. The resulting PLFA methyl esters were dried over a N headspace and
stored at -20°C until analyses. The concentration and δ¹³C enrichment of the different PLFA
were analysed by chromatography-combustion isotope ratio mass spectrometry (GC-C-
IRMS) at the Stable Isotope Facility, University of California-Davis, USA. The compounds were
separated chromatographically (Varian CP3800 gas chromatograph coupled to a Saturn 2200
ion trap MS/MS, Varian, Inc., Walnut Creek, CA U.S.A.), entirely combusted to gases (CO₂, N₂)
and subsequently introduced into the isotope ratio mass spectrometer. Analyses were
performed using a Thermo GC/C-IRMS system comprising a Trace GC Ultra gas
chromatograph (Thermo Electron Corp., Milan, Italy) coupled to a Delta V Advantage isotope
decomposition mass spectrometer through a GC/C-III interface (Thermo Electron Corp., Bremen,
Germany). A c12:0 fatty acid standard was added to each sample for quantification. The C
isotope ratio of each compound was reported relative to the Vienna Pee Dee Belemnite
standard (V-PDB) and corrected for the C-containing methyl group introduced during
derivatization according to the method of Boschker & Middelburg (1999).
Figure Legends

S1 Abundance of PLFA biomarker for heterotrophic (a) bacteria (i15:0) and (b) fungi at sampling day 46 relative to starting conditions (sampling day 0) given in %.

S2 Microbial respiration for single and mixed OM modifications with BEECH and ALGAL OM presented for the incubation period from day 30 to day 46. Data is presented as mean of replicates (n=3-4) with standard deviation. An orientation line for the comparison of figure panels a and b is given in red.