

Supplement of Biogeosciences, 16, 3047–3068, 2019
<https://doi.org/10.5194/bg-16-3047-2019-supplement>
© Author(s) 2019. This work is distributed under
the Creative Commons Attribution 4.0 License.



Supplement of

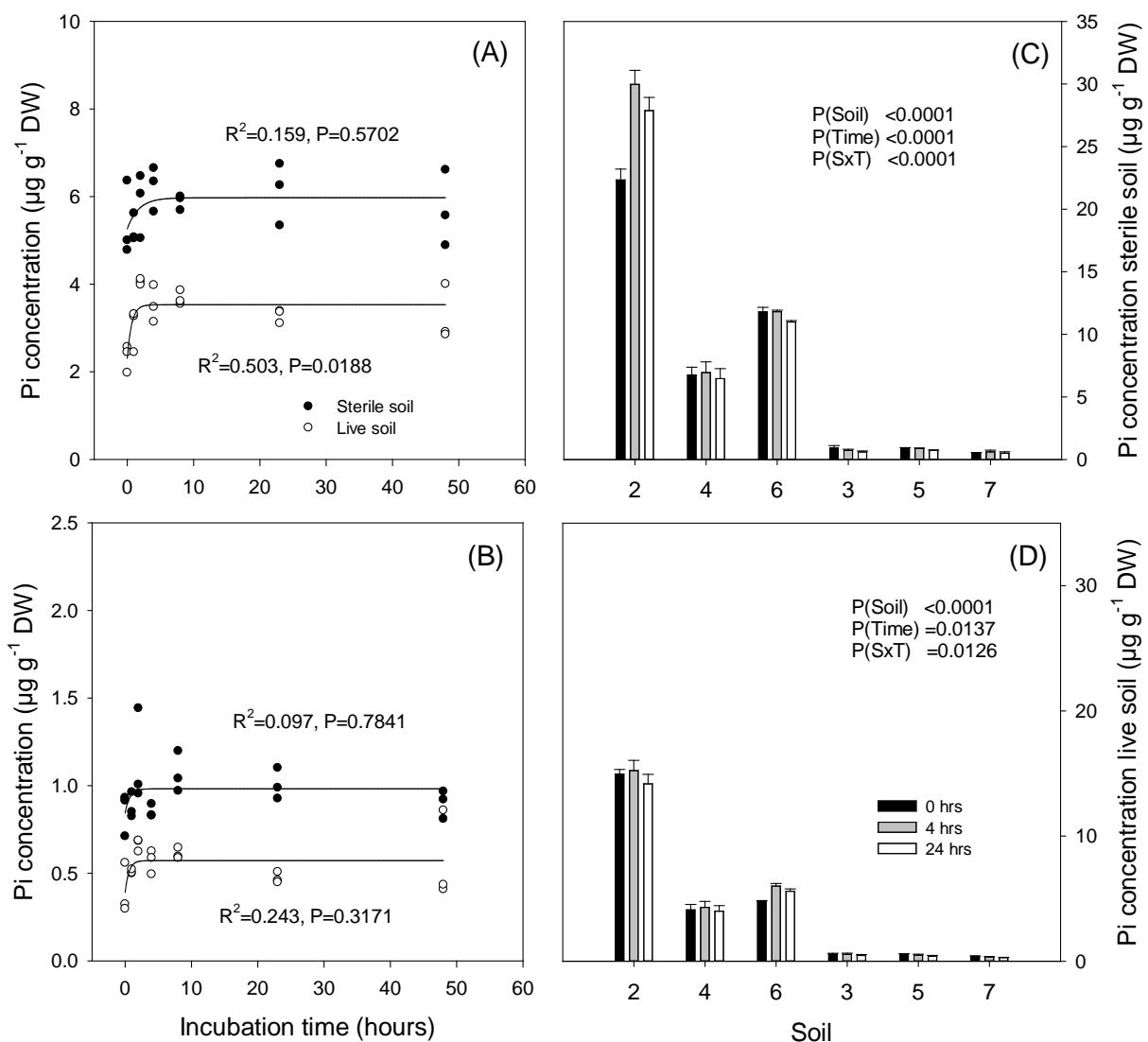
A novel isotope pool dilution approach to quantify gross rates of key abiotic and biological processes in the soil phosphorus cycle

Wolfgang Wanek et al.

Correspondence to: Wolfgang Wanek (wolfgang.wanek@univie.ac.at)

The copyright of individual parts of the supplement might differ from the CC BY 4.0 License.

Supplementary Figure S1. P_i concentrations in live soils (open symbols) and sterile soils (closed symbols) measured for a temperate grassland (A) and a tropical forest (B) after 0, 1, 2, 4, 8, 24 and 48 hours and for six soils measured after 0, 4 and 24 hours (sterile soils, C; live soils, D). Three temperate grassland soils (2, 4, 6) and three tropical forest soils (3, 5, 7) were investigated (C, D). Curvilinear regressions following the function “exponential rise to maximum” were performed on the data in (A, B). Statistical analyses of data in (C, D) were run by two-way ANOVA for the factors soil and time (0, 4 and 24 hours after tracer addition), and the interaction of both factors.



25 Supplementary Table S1. Results of correlation analysis for six soils investigated for gross and net P processes, as well as soil pH, texture, element contents, microbial biomass and phosphatase activity. P values <0.05 are given in red.

| Parameter | Stats | Gross Pi influx | | Gross Pi efflux | | Net Pi immobilization | | Biotic contribution | | Enzyme |
|-------------------------------|-------|-------------------------|---------------------|---------------------------|---------------------------|---------------------------|--------------------------|--------------------------------|--------------------------------|-------------|
| | | Gross Po mineralization | Gross Pi desorption | Gross microbial Pi uptake | Gross abiotic Pi sorption | Abiotic Pi immobilization | Biotic Pi immobilization | Biotic in % of total Pi influx | Biotic in % of total Pi efflux | Phosphatase |
| Gross Po mineralization | r | | 0.8956 | 0.9320 | 0.9109 | -0.9105 | 0.7403 | -0.3423 | -0.3228 | -0.7760 |
| | P | | 0.0158 | 0.0068 | 0.0115 | 0.0117 | 0.0924 | 0.5066 | 0.5326 | 0.0697 |
| Gross Pi desorption | r | 0.8956 | | 0.7498 | 0.9963 | -0.7872 | 0.4575 | -0.5638 | -0.5801 | -0.7811 |
| | P | 0.0158 | | 0.0861 | 0.0000 | 0.0631 | 0.3617 | 0.2439 | 0.2274 | 0.0666 |
| Gross microbial Pi uptake | r | 0.9320 | 0.7498 | | 0.7486 | -0.9863 | 0.9279 | -0.3329 | -0.1456 | -0.8457 |
| | P | 0.0068 | 0.0861 | | 0.0869 | 0.0003 | 0.0076 | 0.5191 | 0.7832 | 0.0339 |
| Gross abiotic Pi sorption | r | 0.9109 | 0.9963 | 0.7486 | | -0.7732 | 0.4507 | -0.5185 | -0.5685 | -0.7491 |
| | P | 0.0115 | 0.0000 | 0.0869 | | 0.0713 | 0.3698 | 0.2919 | 0.2391 | 0.0865 |
| Net abiotic Pi immobilization | r | -0.9105 | -0.7872 | -0.9863 | -0.7732 | | -0.9028 | 0.4531 | 0.2286 | 0.9021 |
| | P | 0.0117 | 0.0631 | 0.0003 | 0.0713 | | 0.0137 | 0.3669 | 0.6631 | 0.0139 |
| Net biotic Pi immobilization | r | 0.7403 | 0.4575 | 0.9279 | 0.4507 | -0.9028 | | -0.2078 | 0.0815 | -0.7328 |
| | P | 0.0924 | 0.3617 | 0.0076 | 0.3698 | 0.0137 | | 0.6928 | 0.8781 | 0.0975 |
| biot%total Pi release | r | -0.3423 | -0.5638 | -0.3329 | -0.5185 | 0.4531 | -0.2078 | | 0.8655 | 0.6330 |
| | P | 0.5066 | 0.2439 | 0.5191 | 0.2919 | 0.3669 | 0.6928 | | 0.0259 | 0.1774 |
| biot%total Pi efflux | r | -0.3228 | -0.5801 | -0.1456 | -0.5685 | 0.2286 | 0.0815 | 0.8655 | | 0.3492 |
| | P | 0.5326 | 0.2274 | 0.7832 | 0.2391 | 0.6631 | 0.8781 | 0.0259 | | 0.4975 |

| | | | | | | | | | | |
|------------------------|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Phosphate activity | r | -0.7760 | -0.7811 | -0.8457 | -0.7491 | 0.9021 | -0.7328 | 0.6330 | 0.3492 | |
| | P | 0.0697 | 0.0666 | 0.0339 | 0.0865 | 0.0139 | 0.0975 | 0.1774 | 0.4975 | |
| Soil pH | r | 0.8269 | 0.7770 | 0.9262 | 0.7449 | -0.9749 | 0.8454 | -0.5619 | -0.2767 | -0.9370 |
| | P | 0.0423 | 0.0690 | 0.0080 | 0.0893 | 0.0009 | 0.0340 | 0.2459 | 0.5956 | 0.0058 |
| Clay content | r | -0.3032 | -0.0739 | -0.4864 | -0.0718 | 0.4475 | -0.5961 | -0.0642 | -0.3720 | 0.5597 |
| | P | 0.5591 | 0.8894 | 0.3279 | 0.8925 | 0.3735 | 0.2118 | 0.9038 | 0.4677 | 0.2481 |
| Silt content | r | -0.4032 | -0.4568 | -0.5923 | -0.3905 | 0.7005 | -0.6150 | 0.6434 | 0.2635 | 0.7050 |
| | P | 0.4280 | 0.3624 | 0.2154 | 0.4440 | 0.1212 | 0.1938 | 0.1681 | 0.6139 | 0.1177 |
| Sand content | r | 0.4677 | 0.4349 | 0.7010 | 0.3749 | -0.7840 | 0.7597 | -0.5529 | -0.1054 | -0.8271 |
| | P | 0.3497 | 0.3888 | 0.1207 | 0.4640 | 0.0649 | 0.0797 | 0.2551 | 0.8425 | 0.0423 |
| Soil organic C | r | 0.1643 | 0.3496 | 0.3353 | 0.2687 | -0.4772 | 0.3364 | -0.6613 | -0.2594 | -0.6486 |
| | P | 0.7558 | 0.4970 | 0.5159 | 0.6066 | 0.3386 | 0.5144 | 0.1526 | 0.6197 | 0.1635 |
| Soil total N | r | 0.1181 | 0.4512 | 0.1517 | 0.3765 | -0.3109 | 0.0307 | -0.7614 | -0.5157 | -0.5483 |
| | P | 0.8236 | 0.3692 | 0.7742 | 0.4620 | 0.5486 | 0.9539 | 0.0786 | 0.2950 | 0.2599 |
| Soil total P | r | 0.9329 | 0.9845 | 0.8396 | 0.9779 | -0.8739 | 0.5911 | -0.5949 | -0.5458 | -0.8625 |
| | P | 0.0066 | 0.0004 | 0.0365 | 0.0007 | 0.0228 | 0.2166 | 0.2129 | 0.2626 | 0.0271 |
| Soil total organic P | r | 0.6590 | 0.9210 | 0.4590 | 0.9059 | -0.5364 | 0.1258 | -0.6938 | -0.7583 | -0.6557 |
| | P | 0.1546 | 0.0091 | 0.3599 | 0.0129 | 0.2725 | 0.8122 | 0.1263 | 0.0806 | 0.1574 |
| Soil total inorganic P | r | 0.9790 | 0.8768 | 0.9740 | 0.8772 | -0.9732 | 0.8227 | -0.4347 | -0.3144 | -0.8729 |
| | P | 0.0007 | 0.2180 | 0.0010 | 0.0217 | 0.0011 | 0.0444 | 0.3891 | 0.5440 | 0.0232 |
| Soil extractable Pi | r | 0.9111 | 0.9899 | 0.7347 | 0.9982 | -0.7516 | 0.4302 | -0.4766 | -0.5513 | -0.7185 |
| | P | 0.0115 | 0.0002 | 0.0962 | 0.0000 | 0.0849 | 0.3945 | 0.3393 | 0.2568 | 0.1077 |

| | | | | | | | | | | |
|--|---|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Relative contribution of organic to total soil P | r | -0.7997 | -0.5520 | -0.9537 | -0.5462 | 0.9306 | -0.9748 | 0.2137 | -0.0704 | 0.8212 |
| | P | 0.0561 | 0.2561 | 0.0032 | 0.2621 | 0.0071 | 0.0009 | 0.6844 | 0.8946 | 0.0451 |
| Soil C:N | r | 0.3985 | 0.3044 | 0.6732 | 0.2471 | -0.7409 | 0.7916 | -0.4301 | 0.0343 | -0.7319 |
| | P | 0.4338 | 0.5575 | 0.1427 | 0.6369 | 0.0920 | 0.0606 | 0.3946 | 0.9485 | 0.0982 |
| Soil C:Po | r | -0.1261 | -0.2992 | 0.2180 | -0.3491 | -0.2490 | 0.4998 | 0.0927 | 0.5250 | -0.1558 |
| | P | 0.8118 | 0.5646 | 0.6781 | 0.4976 | 0.6343 | 0.3127 | 0.8614 | 0.2848 | 0.7682 |
| Soil N:Po | r | -0.7246 | -0.8533 | -0.5625 | -0.8561 | 0.6007 | -0.2929 | 0.7197 | 0.7694 | 0.7356 |
| | P | 0.1033 | 0.0307 | 0.2452 | 0.0296 | 0.2073 | 0.5733 | 0.1068 | 0.0736 | 0.0956 |
| Microbial biomass P | r | 0.8250 | 0.6021 | 0.9728 | 0.5918 | -0.9641 | 0.9842 | -0.3271 | -0.0545 | -0.8260 |
| | P | 0.0433 | 0.2060 | 0.0011 | 0.2159 | 0.0019 | 0.0004 | 0.5268 | 0.9183 | 0.0428 |