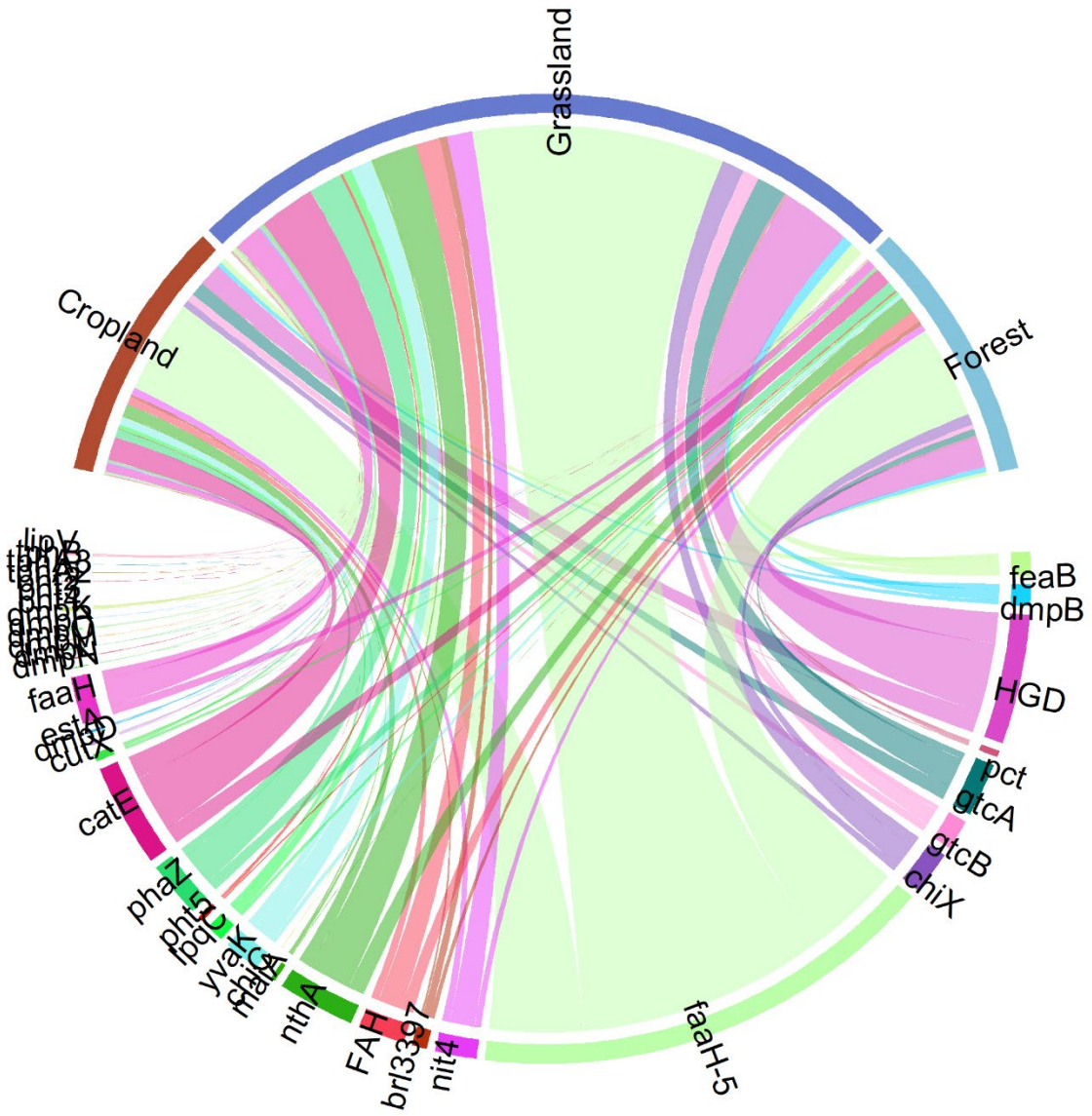

Figure S1. Microplastic degrading genes found in the microbial communities across the different soil type Cropland, Grassland and Forest.

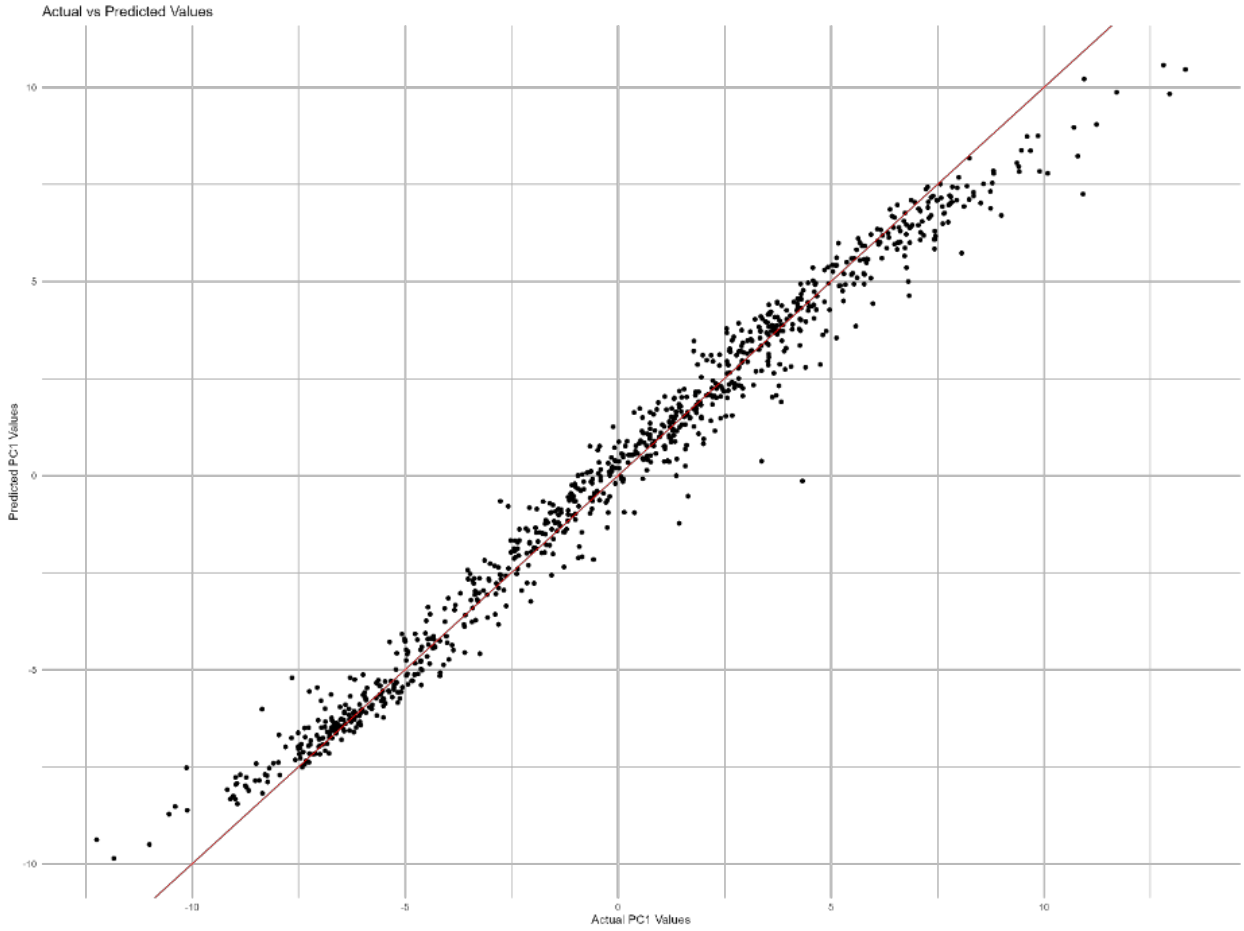

Figure S2. Random Forest actual vs predicted values.

Table S1. ANOVA Post-hoc Tukey of *catE* gene across the different soil type.

Samples	diff	lwr	upr	p adj
Grassland-Cropland	-0.00779	-0.02705	0.01146	0.608608
Woodland-Cropland	-0.09245	-0.11091	-0.07399	0
Woodland-Grassland	-0.08466	-0.10469	-0.06463	0

Table S2. List of DOIs from the systematic search conducted in the Scopus database, including DOI and corresponding links

DOI	Link
10.1201/9781003438236-18	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85205470205&doi=10.1201%2f9781003438236-18&partnerID=40&md5=866173bd717e23384ea854c8b470418f
10.1016/j.chemosphere.2023.139082	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85161281920&doi=10.1016%2fj.chemosphere.2023.139082&partnerID=40&md5=d4e00ac3168e65b1a7b15ee270cccaef
10.1016/j.etap.2022.103995	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85139734754&doi=10.1016%2fj.etap.2022.103995&partnerID=40&md5=a53129eb81ed762aebb6b914db8b4665
10.1016/j.chemosphere.2022.137235	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85141951221&doi=10.1016%2fj.chemosphere.2022.137235&partnerID=40&md5=1be2559ff23a51d1f0d58fa643eb9391
10.1016/j.envpol.2024.124591	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85199176792&doi=10.1016%2fj.envpol.2024.124591&partnerID=40&md5=801957d136d923a308e87e92b6906824
10.1016/j.scitotenv.2022.155771	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85129992077&doi=10.1016%2fj.scitotenv.2022.155771&partnerID=40&md5=f1dbb41e6f3e90e817909382cadf5a41
10.1016/j.scitotenv.2024.171464	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85186756125&doi=10.1016%2fj.scitotenv.2024.171464&partnerID=40&md5=b4b26fcb26fdfb38b1235ce290dda862
10.1016/j.jgar.2021.07.002	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85111496245&doi=10.1016%2fj.jgar.2021.07.002&partnerID=40&md5=92003277a841c924d729ce31059e3aa6
10.1016/j.jhazmat.2024.134728	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85194155633&doi=10.1016%2fj.jhazmat.2024.134728&partnerID=40&md5=c4e119a43b0daa0e6f3bff588760f7e4

10.1016/j.eehl.2023.09.005	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85176773006&doi=10.1016%2fj.eehl.2023.09.005&partnerID=40&md5=76f7b9ee04c6e064810747a0374573cb
10.3389/fmicb.2024.1360844	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85189501873&doi=10.3389%2ffmicb.2024.1360844&partnerID=40&md5=382e7ea4519c1bc0016c60d27c55321c
10.1016/j.marpolbul.2023.114592	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85146458223&doi=10.1016%2fj.marpolbul.2023.114592&partnerID=40&md5=1facf192229ad1c0d733ea7977d11583
10.1016/j.meegid.2020.104611	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85096226585&doi=10.1016%2fj.meegid.2020.104611&partnerID=40&md5=e9babc0394c3c8c225bb1c52244602e3
10.1016/j.scitotenv.2022.154596	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85126561503&doi=10.1016%2fj.scitotenv.2022.154596&partnerID=40&md5=9b2a9e77a030e4d0bd19f13902025159
10.1016/j.jwpe.2024.105395	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85192171430&doi=10.1016%2fj.jwpe.2024.105395&partnerID=40&md5=6a4094105ad6980de34e4c0253c7737e
10.1016/j.envpol.2022.120635	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85142182540&doi=10.1016%2fj.envpol.2022.120635&partnerID=40&md5=72071f4f075b56903739ac4af7c48715
10.1016/j.jhazmat.2023.132085	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85165424972&doi=10.1016%2fj.jhazmat.2023.132085&partnerID=40&md5=173a27ce4deb67063e07d0953b807419
10.1016/j.scitotenv.2023.164439	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85161034543&doi=10.1016%2fj.scitotenv.2023.164439&partnerID=40&md5=9efa0910cdcaf652e90699645da21fcd
10.1016/j.scitotenv.2022.159024	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85139329661&doi=10.1016%2fj.scitotenv.2022.159024&partnerID=40&md5=4fb49c013f6fb6b6b830168f664aa5e4
10.1016/j.jece.2024.113698	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85199799929&doi=10.1016%2fj.jece.2024.113698&partnerID=40&md5=77b294273247855953492fceaa5c9fa0
10.1016/j.jconhyd.2024.104380	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85195692050&doi=10.1016%2fj.jconhyd.2024.104380&partnerID=40&md5=d4c7202e66099aa1a0b9d83743a8b8d6
10.1016/j.scitotenv.2023.164523	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85161652060&doi=10.1016%2fj.scitotenv.2023.164523&partnerID=40&md5=994b68805fdcae2369d14775393cf623

10.1080/17451000.2021.1990960	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85120560610&doi=10.1080%2f17451000.2021.1990960&partnerID=40&md5=256adda91be1be0a4349e89fdaa25853
10.4274/tjps.galenos.2019.46548	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85094595282&doi=10.4274%2ftjps.galenos.2019.46548&partnerID=40&md5=677b9660e90126b2c908a79315ab85a7
10.1016/j.scitotenv.2022.156805	https://www.scopus.com/inward/record.uri?eid=2-s2.0-85132700369&doi=10.1016%2fj.scitotenv.2022.156805&partnerID=40&md5=e6d635223847d249bf6fb1574fbad72a

Table S3. Bigrams co-occurrence network data of the most frequent words in screened abstracts from the systematic search conducted in the Scopus database.

Node	Cluster	Betweenness	Closeness	PageRank
human health	1	108,687	0,01	0,022
bacterial pathogens	1	0	0,007	0,005
environment causing	1	0	0,008	0,006
environmental degradation	1	0	0,007	0,005
microplastics mps	2	149,271	0,012	0,053
aquatic ecosystems	2	52,517	0,01	0,012
mp biofilm	2	0	0,009	0,01
treatment plants	2	1,528	0,01	0,016
wastewater treatment	2	11,981	0,011	0,023
antibiotic-resistant bacteria	2	3,764	0,009	0,014
bacteria arb	2	0,35	0,009	0,012
bacteria arbs	2	0	0,01	0,011
mp pollution	2	0	0,007	0,004
treatment systems	2	0	0,01	0,01
antibiotic resistance	3	309,068	0,015	0,087
resistance genes	3	334,325	0,015	0,085
genes args	3	378,36	0,016	0,089
microbial community	3	7,9	0,01	0,018
plastic particles	3	10,234	0,01	0,022
bacterial hosts	3	0,367	0,01	0,014
pathogenic bacteria	3	0	0,01	0,011
terrestrial environment	3	0	0,009	0,008
elements mges	3	0,195	0,01	0,021
genetic elements	3	0,195	0,01	0,021
mobile genetic	3	0,195	0,01	0,021
arg subtypes	3	0	0,009	0,006
gene transfer	3	0	0,009	0,009

horizontal gene	3	0	0,009	0,009
metagenomic sequencing	3	0,367	0,01	0,014
microbial communities	3	0,671	0,01	0,013
plastic waste	3	2,646	0,01	0,019
risk assessment	3	0	0,008	0,004
aged mps	3	0	0,009	0,006
agricultural soils	3	0	0,009	0,005
environmental risks	3	0	0,009	0,006
mp surfaces	3	0	0,01	0,009
nano-sized plastic	3	0	0,01	0,013
organic carbon	3	0	0,008	0,005
significantly changed	3	0	0,009	0,009
soil microbial	3	0	0,009	0,007
terrestrial environments	3	0	0,009	0,006
mp biofilms	4	31,379	0,011	0,03
transformation frequencies	4	0	0,01	0,018
natural transformation	4	0	0,01	0,018
biofilm formation	4	0	0,01	0,018
ns biofilms	4	0	0,01	0,018
arg spread	4	0	0,01	0,018
dna edna	4	0	0,01	0,018
extracellular dna	4	0	0,01	0,018
heterogeneous biofilm	4	0	0,01	0,018
microplastic mp	4	0	0,009	0,005
natural substrate	4	0	0,01	0,018
substrate ns	4	0	0,01	0,018
particle size	5	0	1	0,018
alpha diversity	5	0	1	0,018
aquatic environments	6	0	0,006	0,005

20

21