Supporting Information

A localized plant species-specific BVOC emission rate library of China established using a developed statistical approach based on field measurements

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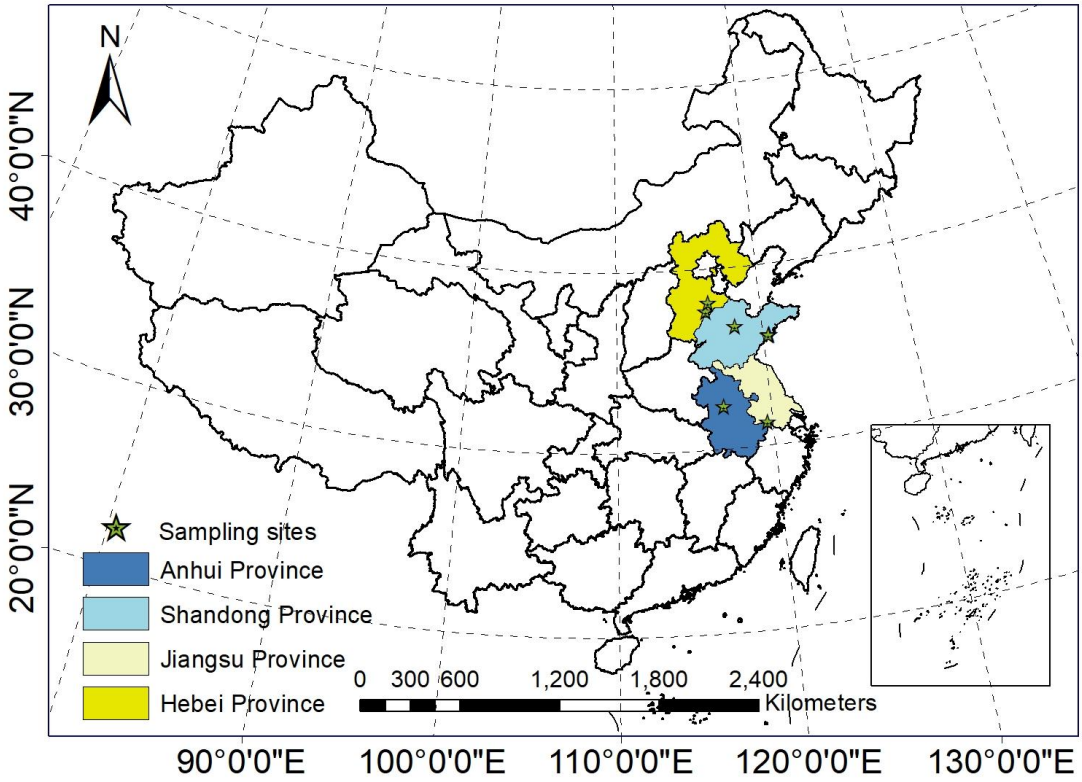


Figure S1. Location of observation sites. (Observation sites covered the south and north of China, including Shandong, Hebei, Jiangsu, and Anhui provinces. Their specific locations were shown as the five-pointed stars)

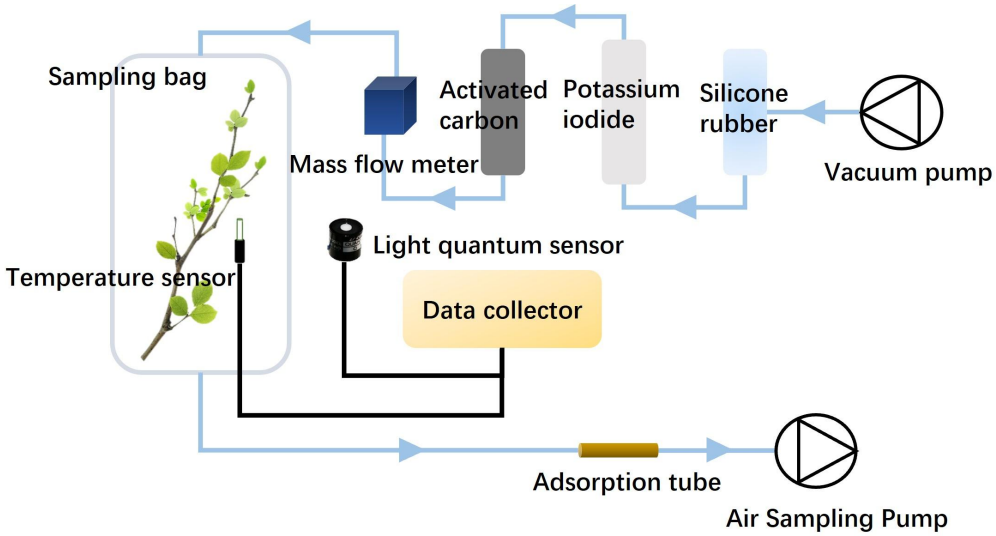
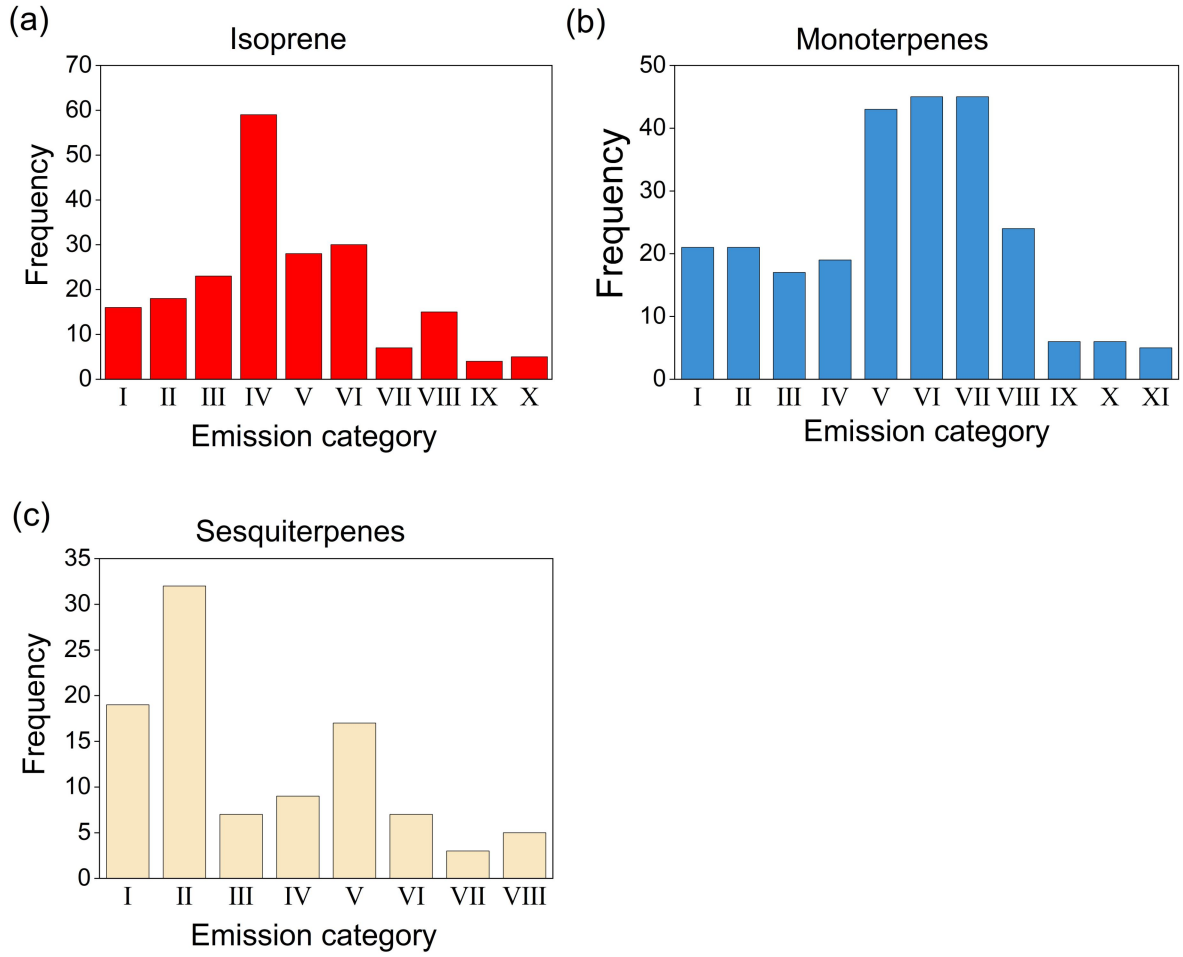


Figure S2. Schematic of dynamic enclosure technique. (Vacuum pump was used to introduce air to the system; silicone rubber, potassium iodide, and activated carbon were used to remove O_3, and VOCs in the air. Mass flow meter was used to control flow rate; temperature sensor and light quantum sensor were used to record temperature and photosynthetically active radiation; after equilibrium, the gases in the bag were collected into adsorption tubes using an air-sampling pump)



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29 **Figure S3.** Frequency statistics of plant species within each emission category. (a–c: Frequency of

30 plant species among various isoprene emission categories(I–X) (a); Frequency of plant species among

31 various monoterpene emission categories(I–XI) (b); Frequency of plant species among various

32 sesquiterpene emission categories(I–VIII) (c).)

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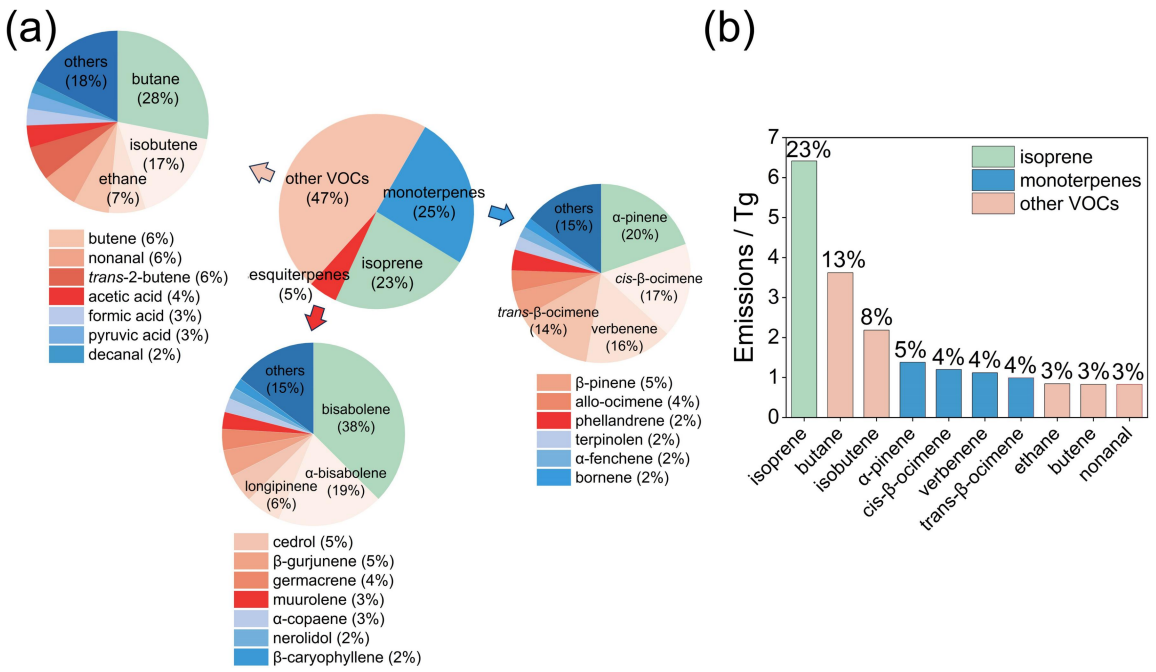

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35 **Figure S4**. BVOC emission composition and top 10 compounds contributing the most to total
36 emissions. (BVOC emission composition of four categories (isoprene, monoterpenes, sesquiterpenes,
37 and other VOCs), and the top ten compounds of monoterpene, sesquiterpene, and other VOC
38 categories (a); top 10 compounds and their belonging category contributing the most to total
39 emissions(b).)

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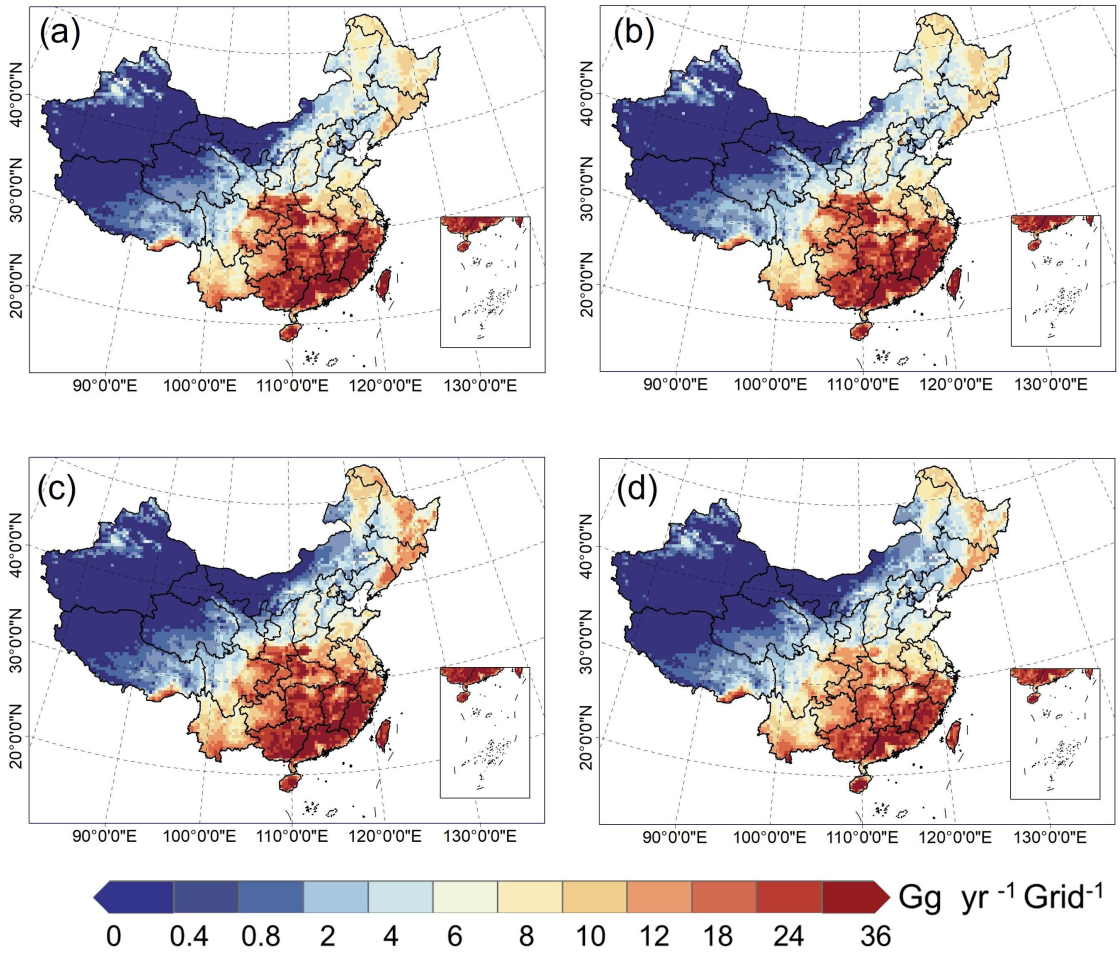

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42 **Figure S5.** Spatial distribution of BVOC emissions in China estimated in various simulations. (a–d:

43 Simulation 1 (a), Simulation 2 (b), Simulation 3 (c), and Simulation 4 (d).)

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Table S1. Observed plants and environmental conditions.

Plant species	Vegetation type	Sampling date	Temperature/°C	Photosynthetically active radiation/μmol m^{-2} s^{-1}	Location*
Acer pictum	broadleaf tree	2021.9.13	26.8	422	Qingdao City, Shandong Province
Amygdalus persica	broadleaf tree	2022.9.6	37.1	1048	Hengshui City, Hebei Province
Broussonetia papyrifera	broadleaf tree	2022.7.25	32.6	1175	Qingdao City, Shandong Province
Camphora officinarum	broadleaf tree	2023.5.13	29.8	9128	Yixing City, Jiangsu Province
Celtis sinensis	broadleaf tree	2022.7.21	30.4	1229	Qingdao City, Shandong Province
Cerasus serrulata	broadleaf tree	2020.7.29	28	793	Qingdao City, Shandong Province
Eucommia ulmoides	broadleaf tree	2022.9.8	35.5	1053	Hengshui City, Hebei Province
Firmiana platanifolia	broadleaf tree	2020.10.9	36.7	1372	Qingdao City, Shandong Province
Fraxinus chinensis	broadleaf tree	2022.7.25	29.8	546	Qingdao City, Shandong Province
Ilex chinensis	broadleaf tree	2023.3.17	33.3	1060	–
Koelreuteria bipinnata	broadleaf tree	2020.7.28	33.8	1004	Qingdao City, Shandong Province
Koelreuteria bipinnata	broadleaf tree	2023.9.3	32.9	858	Huaian City, Jiangsu Province
Ligustrum sinense	broadleaf tree	2023.5.10	25.9	780	Yixing City, Jiangsu Province
Magnolia grandiffora	broadleaf tree	2020.10.6	22.9	785	Qingdao City, Shandong Province

Morus alba	broadleaf tree	2022.9.12	32.1	1027	Qingdao City, Shandong Province
Paulownia tomentosa	broadleaf tree	2022.9.12	32.2	1063	Qingdao City, Shandong Province
Phoebe zhennan	broadleaf tree	2021.12.30	25.7	800	–
Phyllostachys heterocycla	broadleaf tree	2022.7.24	36.6	556	Qingdao City, Shandong Province
Platanus acerifolia	broadleaf tree	2022.9.2	29	371	Hengshui City, Hebei Province
Populus davidiana	broadleaf tree	2022.9.5	32.9	1063	Hengshui City, Hebei Province
Populus simonii	broadleaf tree	2022.9.5	32.9	1063	Hengshui City, Hebei Province
Prunus cerasifera	broadleaf tree	2022.7.18	35.1	1086	Qingdao City, Shandong Province
Quercus wutaishansea	broadleaf tree	2022.7.22	28.4	649	Qingdao City, Shandong Province
Robinia pseudoacacia	broadleaf tree	2021.9.14	29.7	411	Qingdao City, Shandong Province
Salix babylonica	broadleaf tree	2022.6.2/3	37.8	961	Zibo City, Shandong Province
Sophora japonica	broadleaf tree	2021.9.24/30	32.3	1158	Qingdao City, Shandong Province
Styphnolobium japonicum	broadleaf tree	2022.5.18/22/26	30.5	1109	Qingdao City, Shandong Province
Trachycarpus fortunei	broadleaf tree	2023.8.30	27.9	855	Huaian City, Jiangsu Province
Triadica sebifera	broadleaf tree	2023.9.2	31.2	887	Huaian City, Jiangsu Province
Ulmus pumila	broadleaf tree	2022.5.31	34.7	1057	Zibo City, Shandong Province
Cedrus deodara	coniferous tree	2020.10.15	26.3	921	–

Ginkgo biloba	coniferous tree	2022.7.17	27	900	–
Juniperus chinensis	coniferous tree	2022.8.28	25.2	1000	–
Metasequoia glyptostroboides	coniferous tree	2022.7.19	27.6	1000	–
Platycladus orientalis	coniferous tree	2021.11.28	29	900	–
Pinus armandi	coniferous tree	2022.9.4/5	33.0	1010	–
Pinus densiflora	coniferous tree	2023.3.2	28.5	1104	–
Pinus massoniana	coniferous tree	2021.4.7/9	25.1	931	–
Pinus parviflora	coniferous tree	2023.5.14	32.3	1322	Yixing City, Jiangsu Province
Pinus tabulaeformis	coniferous tree	2020.11.5	30.8	1376	–
Pinus thunbergii	coniferous tree	2022.9.28	31.6	900	–
Sabina chinensis	coniferous tree	2021.10.16/17	26	995	–
Berberis thunbergii	broadleaf shrub	2022.9.6	32.7	984	Hengshui City, Hebei Province
Buxus megistophylla	broadleaf shrub	2021.6.23/24/28	29.1	1000	–
Buxus sinica	broadleaf shrub	2022.9.4	35.9	780	Hengshui City, Hebei Province
Cercis chinensis	broadleaf shrub	2020.7.30	34.4	951	Qingdao City, Shandong Province
Clerodendrum bungei	broadleaf shrub	2023.9.1	30.4	1072	Huaian City, Jiangsu Province

Forsythia suspensa	broadleaf shrub	2021.7.3	28.8	1000	–
Forsythia viridissima	broadleaf shrub	2023.5.16	32.3	889	Yixing City, Jiangsu Province
Hibiscus syriacus	broadleaf shrub	2022.4.21/22	24.8	900	–
Lagerstroemia indica	broadleaf shrub	2022.5.20/24	30.5	1280	Qingdao City, Shandong Province
Ligustrum lucidum	broadleaf shrub	2021.7.2	29.2	1167	–
Lonicera japonica	broadleaf shrub	2022.9.3	26	389	Hengshui City, Hebei Province
Loropetalum chinense var. rubrum	broadleaf shrub	2023.5.12	31.4	1084	Yixing City, Jiangsu Province
Malus spectabilis	broadleaf shrub	2022.8.4	32.6	360	Qingdao City, Shandong Province
Nerium oleander	broadleaf shrub	2023.5.15	31.3	1101	Yixing City, Jiangsu Province
Osmanthus fragrans	broadleaf shrub	2021.12.29	25.9	1000	–
Photinia serratifolia	broadleaf shrub	2021.9.9/11/12	32	1075	Qingdao City, Shandong Province
Pittosporum tobira	broadleaf shrub	2023.8.31	31.0	990	Huaian City, Jiangsu Province
Syringa oblata	broadleaf shrub	2022.9.7	31.6	1152	Hengshui City, Hebei Province
Wisteria sinensis	broadleaf shrub	2022.5.16/17	30.1	1159	Qingdao City, Shandong Province
Juniperus chinensis ‘Aurea’	coniferous shrub	2022.9.6/7	33.8	1062	–
Acorus calamus	herb	2022.9.7	34.5	1065	Hengshui City, Hebei Province

Phragmites australis	herb	2022.5.9/11/12	25.8	1322	Qingdao City, Shandong Province
Triticum aestivum	crop	2023.5.6/7/8	30.1	1258	Qingdao City, Shandong Province
Zea mays	crop	2023.6.9	32.9	1083	Qingdao City, Shandong Province

*: "–" represents the pot experiments.

Table S2. Quantified BVOC compounds in this study.

Category	Compounds
Isoprene	Isoprene
Monoterpenes	Tricyclene, α- Pinene, Camphene, Sabinene, β-Pinene, Myrcene, α-Phellandrene, 3-Carene, α-Terpinene, Limonene, cis-β-Ocimene, trans-β-Ocimene, γ-Terpinene, Terpinolene
Sesquiterpenes	Isolongifolene, Longifolene, α-Cedrene, β-Caryophyllene, Aromadendrene, α-Farnesene
Alkanes	Cyclopentane, 2,2-Dimethylbutane, 2,3-Dimethylbutane, 2,4-Dimethylpentane, 2,3-Dimethylpentane, 3-Methylhexane, n-Heptane, 2,3,4-Trimethylpentane, 2-Methylheptane, 3-Methylheptane, n-Octane, Methylcyclopentane, 3-Methylpentane, n-Hexane, 2,2,4-Trimethylpentane, n-Nonane, n-Decane, n-Undecane, Dodecane, Methylcyclohexane, Cyclohexane
Alkenes	n-Hexene, n-Pentene, trans-2-Pentene, cis-2-Pentene
Aromatics	Benzene, Toluene, Ethylbenzene, m-Xylene, p-Xylene, o-Xylene, n-Propylbenzene, Styrene, iso-Propylbenzene, m-Ethyltoluene, p-Ethyltoluene, 1,3,5-Trimethylbenzene, o-Ethyltoluene, 1,2,4-Trimethylbenzene, 1,2,3-Trimethylbenzene, m-Diethylbenzene, p-Diethylbenzene

Table S3. Emission categories and their emission rate range and the statistical results for each BVOC component.

Enclosure technique	BVOC component	Emission category	Range of emission rate (μg g^{-1} h^{-1})	Frequency	Mean (μg g^{-1} h^{-1})	Standard deviation
Dynamic	Isoprene	I	0–0.05	47	0.02	0.01
		II	0.05–0.50	80	0.21	0.14
		III	0.50–2.0	38	1.23	0.42
		IV	2.0–7.0	68	4.20	1.35
		V	7.0–15.0	37	10.33	1.95
		VI	15.0–45.0	52	28.35	7.68
		VII	45.0–75.0	14	60.79	7.89
		VIII	75.0–200.0	21	127.66	31.92
		IX	200.0–500.0	10	276.17	52.56
		X	>500.0	5	–	–
	Monoterpenes	I	0–0.15	53	0.08	0.04
		II	0.15–0.30	32	0.24	0.04
		III	0.30–0.60	35	0.47	0.09
		IV	0.60–1.0	28	0.83	0.11
		V	1.0–2.0	59	1.45	0.29
		VI	2.0–4.0	63	3.00	0.52
		VII	4.0–8.0	68	5.87	1.04
		VIII	8.0–20.0	46	13.60	2.80
		IX	20.0–50.0	20	32.68	7.63
		X	50.0–200.0	16	96.15	34.66
		XI	>200.0	5	–	–
	Sesquiterpenes	I	0–0.1	51	0.05	0.03
		II	0.1–0.25	22	0.16	0.04

		III	0.25–0.50	10	0.37	0.07
		IV	0.50–0.90	11	0.71	0.10
		V	0.90–3.0	18	1.59	0.45
		VI	3.0–10.0	10	4.62	1.41
		VII	10.0–50.0	13	25.80	11.38
		VIII	>50.0	5	–	–
Static	Isoprene	I	0–0.45	43	0.21	0.12
		II	0.45–1.0	45	0.72	0.16
		III	1.0–2.5	101	1.74	0.44
		IV	2.5–4.5	94	3.55	0.58
		V	4.5–10.0	92	6.72	1.44
		VI	10.0–15.0	36	12.07	1.60
		VII	15.0–30.0	26	21.74	4.23
		VIII	30.0–90.0	25	54.92	19.39
		IX	90.0–160.0	8	122.54	19.53
		X	>160.0	3	–	–
	Monoterpenes	I	0–0.25	19	0.16	0.07
		II	0.25–0.65	44	0.47	0.10
		III	0.65–1.0	38	0.84	0.10
		IV	1.0–2.0	107	1.49	0.26
		V	2.0–3.0	60	2.51	0.29
		VI	3.0–4.5	52	3.77	0.44
		VII	4.5–10.0	57	6.78	1.38
		VIII	10.0–22.0	39	14.42	3.07
		IX	22.0–50.0	4	29.71	5.44
		X	>50.0	1	–	–

Table S4. Emission rate intervals and representative values of each emission category.

Enclosure technique	BVOCs component	Emission category	Emission rate interval (μg g^{-1} h^{-1})	Representative emission rate (μg g^{-1} h^{-1})	Frequency	Proportion
Dynamic	Isoprene	I	0.01–0.03	0.02	18	7%
		II	0.13–0.30	0.20	22	9%
		III	0.87–2.0	1.3	29	12%
		IV	2.8–6.3	4.2	52	21%
		V	7.0–15.0	10.3	37	15%
		VI	19.0–42.8	28.5	43	17%
		VII	45.0–75.0	59.5	14	6%
		VIII	83.6–188.1	125.4	20	8%
		IX	200.0–388.4	258.9	9	4%
		X	>500.0	500.0	5	2%
	Monoterpenes	I	0.05–0.12	0.08	26	7%
		II	0.16–0.30	0.24	31	8%
		III	0.31–0.60	0.46	35	9%
		IV	0.60–1.0	0.82	28	7%
		V	1.0–2.0	1.5	59	15%
		VI	2.0–4.0	2.9	63	16%
		VII	4.0–8.0	5.8	68	17%
		VIII	8.9–20.0	13.4	44	11%
		IX	22.5–50.0	33.8	19	5%
		X	58.3–131.3	87.5	12	3%
		XI	>200.0	200.0	5	1%
	Sesquiterpenes	I	0.03–0.08	0.05	18	19%
		II	0.11–0.25	0.17	19	20%

		III	0.25–0.50	0.36	10	11%
		IV	0.50–0.90	0.68	11	12%
		V	1.0–2.3	1.5	17	18%
		VI	3.0–6.5	4.3	9	10%
		VII	17.0–38.3	25.5	6	6%
		VIII	>50.0	50.0	5	5%
Static	Isoprene	I	0.15–0.33	0.22	21	5%
		II	0.48–1.0	0.72	40	9%
		III	1.1–2.5	1.7	92	21%
		IV	2.5–4.5	3.6	94	22%
		V	4.5–10.0	6.7	92	21%
		VI	10.0–15.0	12.2	36	8%
		VII	15.0–30.0	21.7	26	6%
		VIII	36.0–81.1	54.0	17	4%
		IX	90.0–160.0	116.2	8	2%
		X	>160.0	160.0	3	1%
	Monoterpenes	I	0.11–0.25	0.17	12	3%
		II	0.31–0.65	0.46	43	10%
		III	0.65–1.0	0.84	38	9%
		IV	1.0–2.0	1.5	107	26%
		V	2.0–3.0	2.5	60	15%
		VI	3.0–4.5	3.8	52	13%
		VII	4.5–10.0	6.8	57	14%
		VIII	10.0–21.3	14.2	38	9%
		IX	22.0–44.6	29.7	4	1%
		X	>50.0	50.0	1	0.2%

Table S5. Emission rates of each BVOC component of Poaceae plants (μg g^{-1} h^{-1})

Plant	Genus	Isoprene	Monoterpenes	Sesquiterpenes	Vegetation type
Bambusa vulgaris f. vittata	*Bambusa*	4.2	13.4	–	evergreen broadleaf tree
Bambusa vulgaris 'Wamin'	*Bambusa*	4.2	–	–	evergreen broadleaf tree
Bambusa ventricosa	*Bambusa*	4.2	1.5	1.5	evergreen broadleaf tree
Bambusa textilis	*Bambusa*	500.0	2.9	–	evergreen broadleaf tree
Bambusa multiplex 'Alphonse-Karr'	*Bambusa*	–	5.9	–	evergreen broadleaf tree
Bamboo	*Bambusoideae*	4.2	2.9	–	evergreen broadleaf tree
Dendrocalamus latiflorus	*Dendrocalamus*	19.4	–	–	evergreen broadleaf tree
Dendrocalamus asper	*Dendrocalamus*	19.4	–	–	evergreen broadleaf tree
Dendrocalamopsis oldhami	*Dendrocalamopsis*	10.3	–	–	evergreen broadleaf tree
Oligostachyum lubricum	*Oligostachyum*	28.5	0.24	–	evergreen broadleaf tree
Phyllostachys makinoi	*Phyllostachys*	1.3	–	–	evergreen broadleaf tree
Phyllostachys propinqua	*Phyllostachys*	28.5	0.08	0.17	evergreen broadleaf tree
Phyllostachys sulphurea var. viridis	*Phyllostachys*	28.5	2.9	0.17	evergreen broadleaf tree
Phyllostachys edulis	*Phyllostachys*	77.0	–	–	evergreen broadleaf tree
Fargesia spathacea	*Fargesia*	500.0	1.5	1.5	evergreen broadleaf shrub

Cleistogenes squarrosa	*Cleistogenes*	258.9	13.4	–	herb
Digitaria sanguinalis	*Digitaria*	0.02	0.24	0.05	herb
Leymus chinensis	*Leymus*	59.5	45.2	–	herb
Phragmites australis	*Phragmites*	16.4	13.4	4.3	herb
Stipa grandis	*Stipa*	–	0.82	–	herb
Stipa baicalensis	*Stipa*	125.4	0.82	–	herb
weed	–	258.9	87.5	–	herb
Oryza sativa	*Oryza*	–	5.8	1.5	crop
Sorghum bicolor 'Dochna'	*Sorghum*	16.4	0.46	1.5	crop
Triticum aestivum	*Triticum*	0.20	2.2	1.5	crop
Zea mays	*Zea*	16.4	0.35	1.5	crop