



Supplement of

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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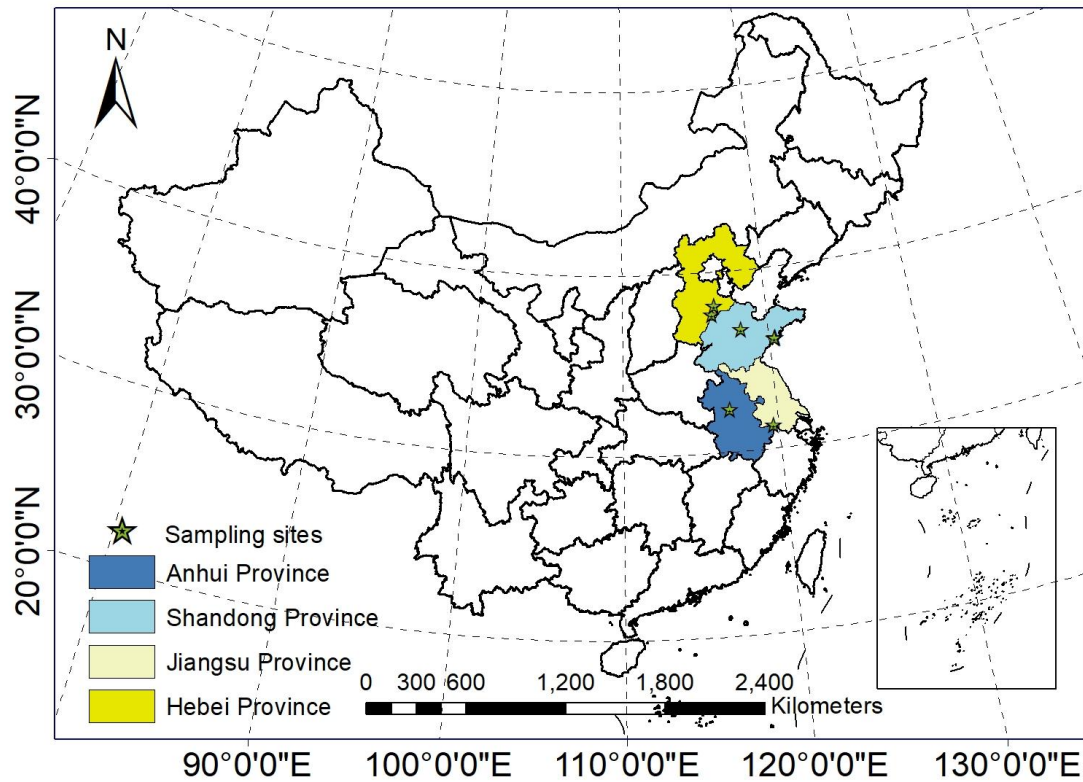
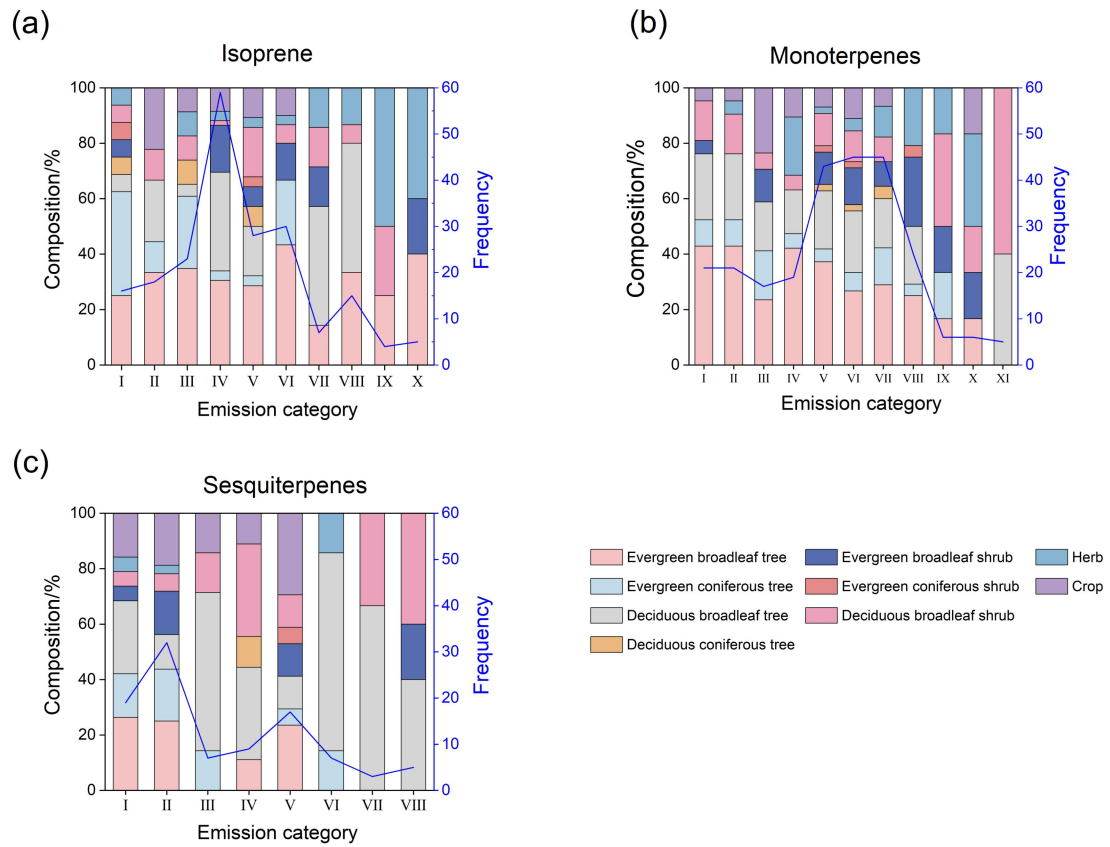


Figure S1. Location of observation sites. (Observation sites covered the south and north of China, including Shandong, Hebei, Jiangsu, and Anhui provinces. Their specific locations were shown as the five-pointed stars)



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20 **Figure S2.** Composition of vegetation types and frequency statistics of plant species within each

21 emission category of isoprene (a), monoterpenes (b), and sesquiterpenes (c).

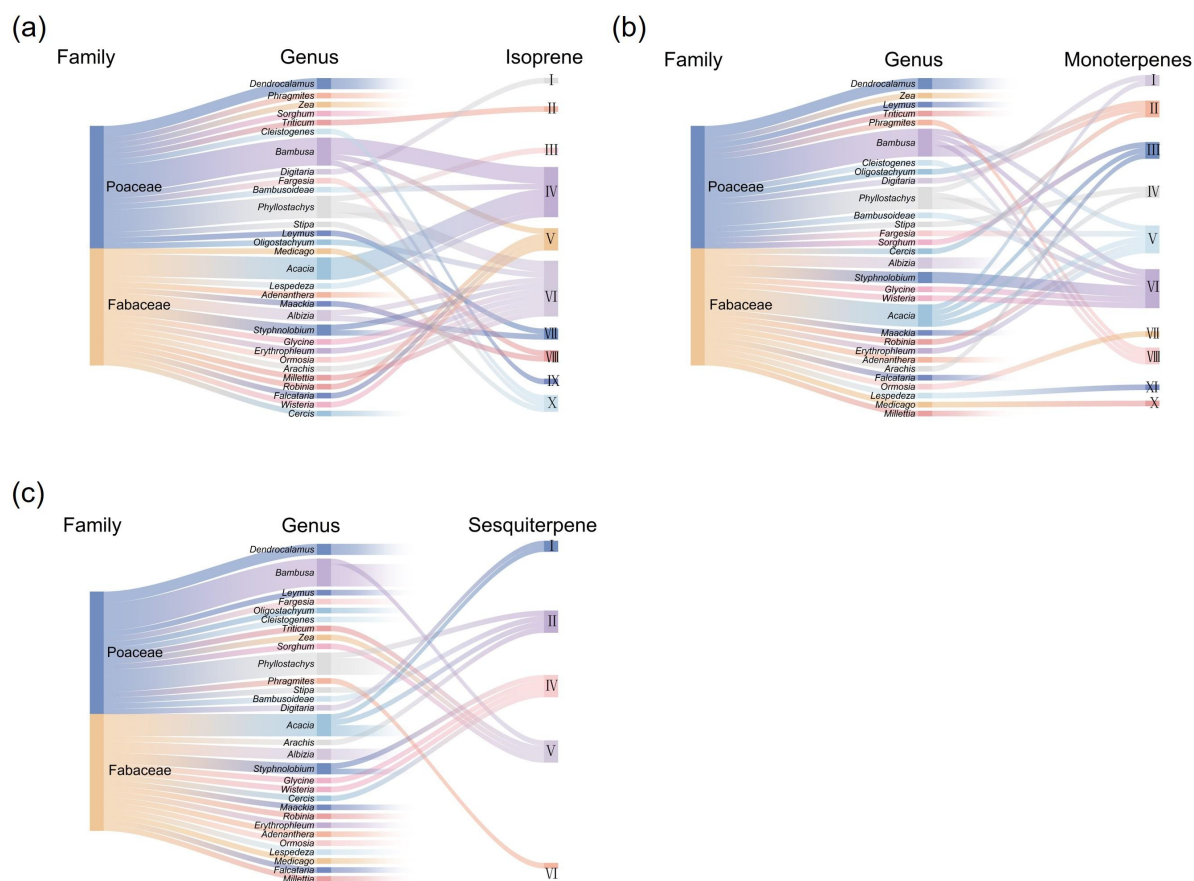


Figure S3. Emission categories of the plant species in different genus of families Poaceae and Fabaceae for isoprene (a), monoterpenes (b), and sesquiterpenes (c).

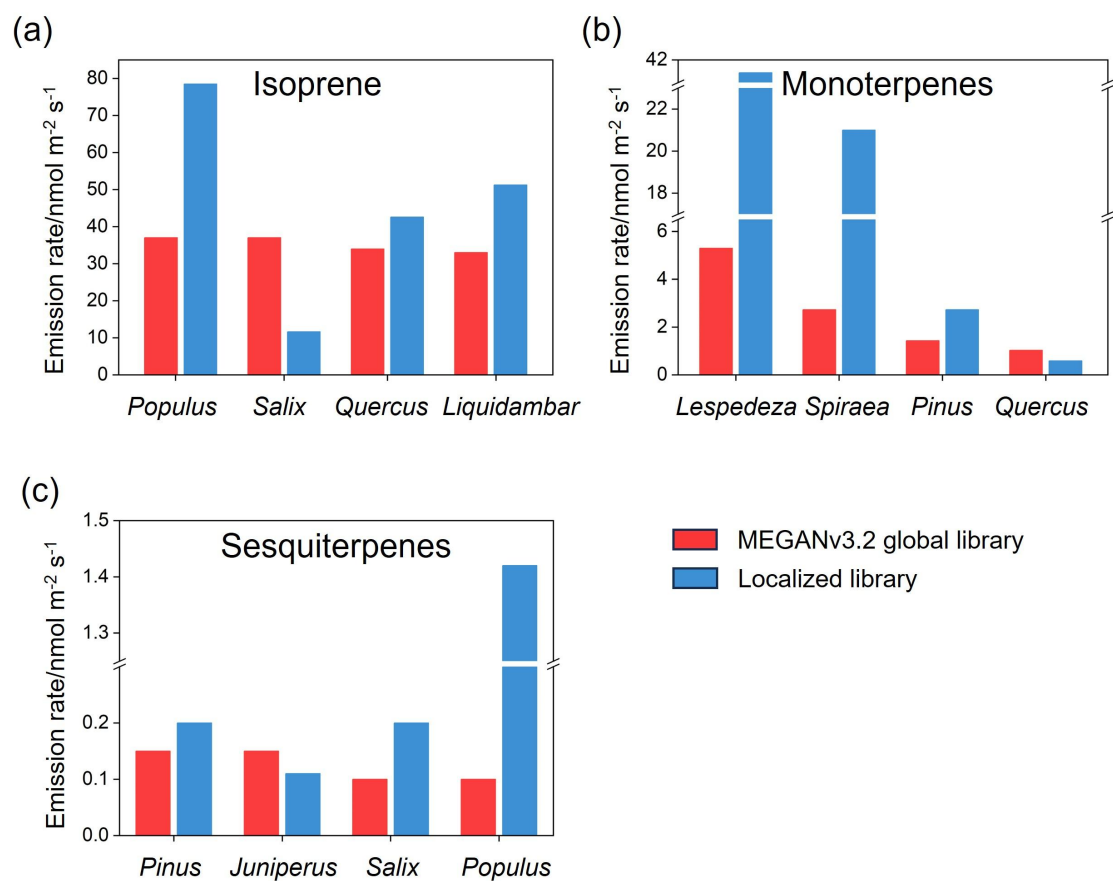


Figure S4. Comparison of emission rates at the genus level between the MEGANv3.2 global library and the localized library developed in this study.

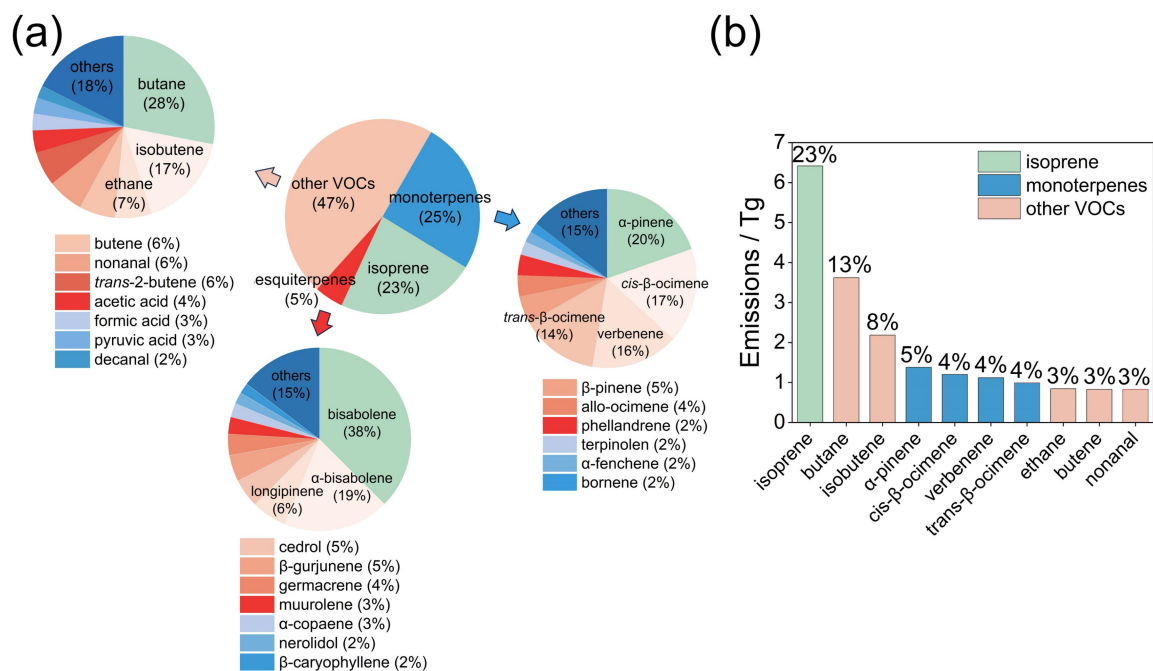


Figure S5. BVOC emission composition and top 10 compounds contributing the most to total emissions. (BVOC emission composition of four categories (isoprene, monoterpenes, sesquiterpenes, and other VOCs), and the top ten compounds of monoterpene, sesquiterpene, and other VOC categories (a); top 10 compounds and their belonging category contributing the most to total emissions(b). All percentages are derived from emissions expressed in Tg compound.)

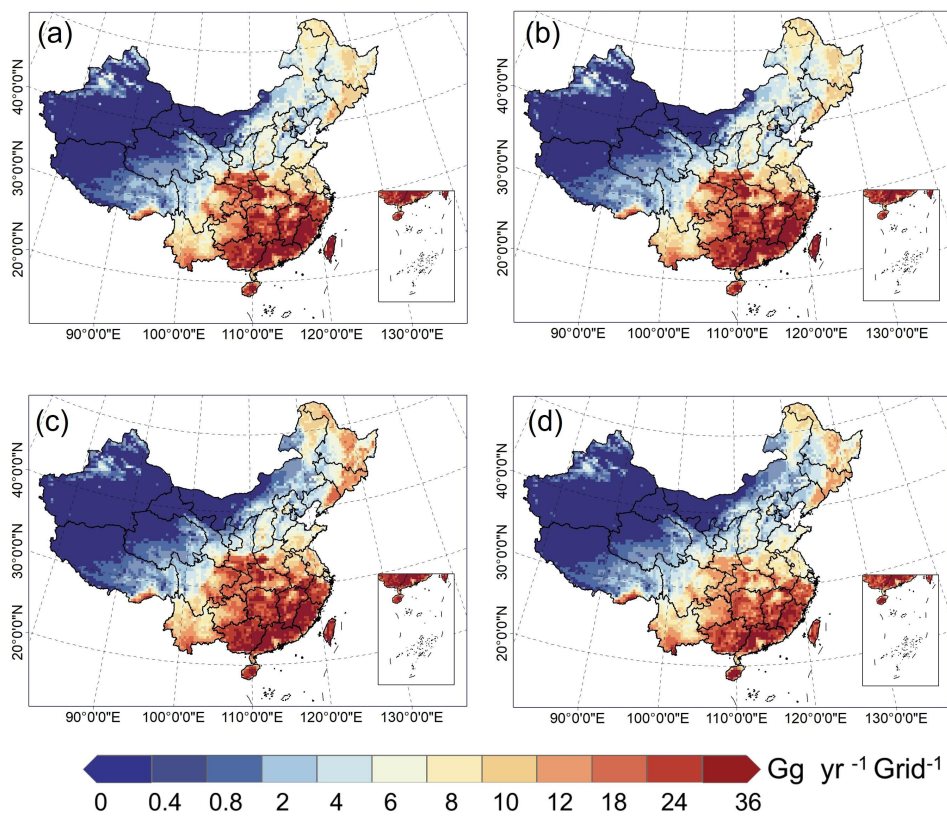


Figure S6. Spatial distribution of BVOC emissions in China estimated in various simulations. (a–d: Simulation 1 (a), Simulation 2 (b), Simulation 3 (c), and Simulation 4 (d).)

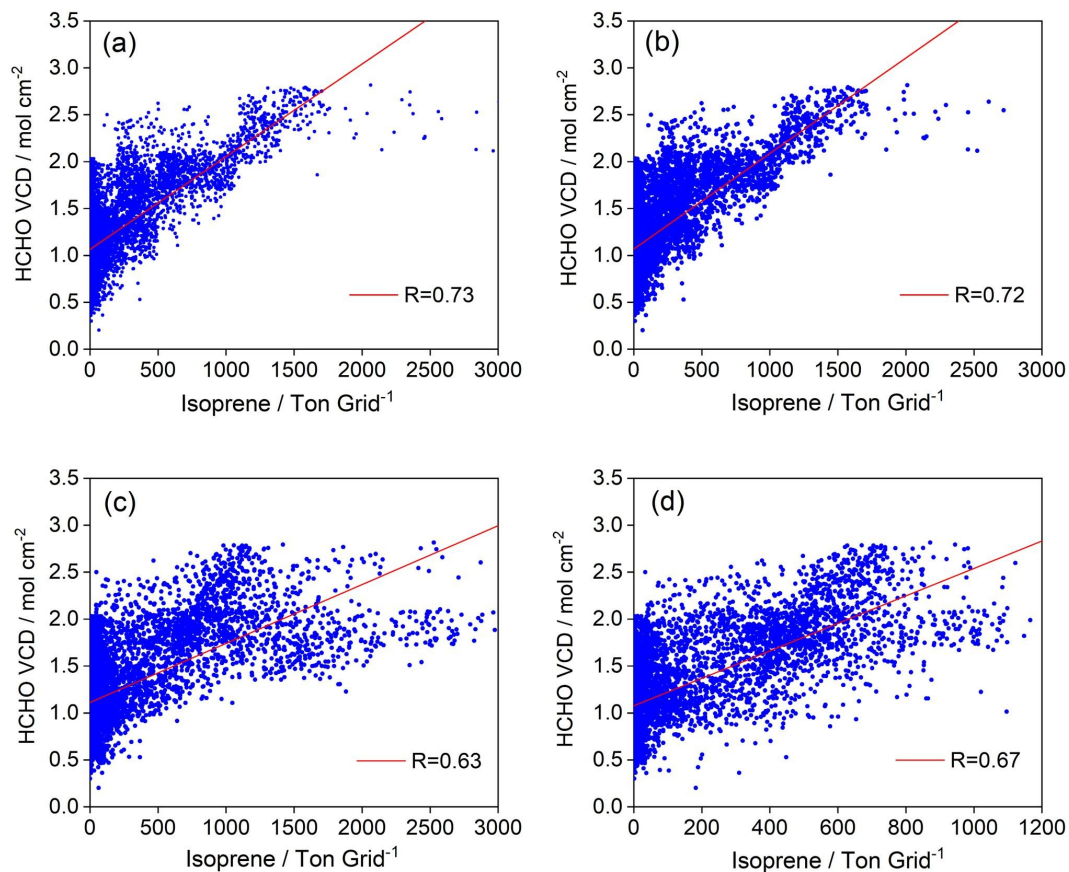


Figure S7. The correlation between isoprene emission and observed formaldehyde (HCHO) vertical column density (VCD) in July 2020 during various simulations. (a–d: Simulation 1 (a), Simulation 2 (b), Simulation 3 (c), and Simulation 4 (d).)

41 **Table S1.** Observed plants and environmental conditions.

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

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

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

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

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

42 *: “–” represents the pot experiments.

43 **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

45 **Table S3.** Emission rate intervals and representative values of each emission category.

Enclosure technique	BVOCs component	Emission category	Emission rate interval ($\mu\text{g g}^{-1} \text{h}^{-1}$)	Representative		
				emission rate ($\mu\text{g g}^{-1} \text{h}^{-1}$)	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%
	Sesquiterpenes	XI	>200.0	200.0	5	1%
		I	0.03–0.08	0.05	18	19%
		II	0.11–0.25	0.17	19	20%

Static	Isoprene	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%
		I	0.15–0.33	0.22	21	5%
		II	0.48–1.0	0.72	40	9%
	Monoterpenes	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%
		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%

47 **Table S4.** Emission rates of each BVOC component of Poaceae plants ($\mu\text{g g}^{-1} \text{h}^{-1}$)

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

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