https://doi.org/10.15302/J-LAF-0-020027 Received Date | 2024-01-29 Accepted Date | 2024-11-29

Research on the Comprehensive Noise Reduction Effectiveness of Plant Communities in Urban Green Spaces

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EDITED BY Ying WANG, Jiayi ZHOU

Supplementary Table 1: Basic information of the sample sites

Site	Plant type		Plant species		Noise source	Pre-research sound pressure level (dB)
Terrestrial plant community						
Q0	Herbaceous	—	Herb	*Cynodon dactylon*	Traffic	57.60
Q1	Tree–shrub	Irregular low shrubs + trees	Tree	*Sapindus saponaria*	Traffic	58.40
			Shrub	*Lantana camara*, *Spiraea salicifolia*, *Ligustrum lucidum*, *Persicaria chinensis*		
Q2		Regular low shrubs + trees	Tree	*Camphora officinarum*	Traffic	59.74
			Shrub	*Ligustrum* × *vicaryi*, *Buxus microphylla*, *Chimonanthus praecox*		
Q3	Tree–herb	Trees + ground cover	Tree	*Trachycarpus fortune*, *Camphora officinarum*, *Erythrina variegata*, *Lagerstroemia indica*	Traffic	62.34
			Herb	*Ophiopogon japonicus*		
Q4	Shrub–herb	Regular tall shrubs + ground cover	Shrub	*Euonymus japonicus* 'Aurea-marginatus'	Traffic	59.98
			Herb	*Cynodon dactylon*		
Q5		Irregular tall shrubs + ground cover	Shrub	*Lantana camara*, *Nandina domestica*, *Nephrolepis cordifolia*, *Juniperus sabina*, *Ligustrum ovalifolium*, *Reynoutria sachalinensis*, *Phlomis fruticose*, *Elaeagnus pungens*, *Buxus sinica*	Traffic	69.84
			Herb	*Cynodon dactylon*		
Q6	Tree–shrub–herb	Sparse trees + shrubs + ground cover	Tree	*Cedrus deodara*	Traffic	57.02
			Shrub	*Rhododendron simsii*, *Vitex agnus-castus*		
			Herb	*Ophiopogon japonicas*, *Acorus gramineus*		
Q7		Sparse trees + shrubs + ground cover	Tree	*Camphora officinarum*, *Osmanthus fragrans*	Traffic	60.93
			Shrub	*Rosa chinensis*, *Hydrangea macrophylla*		
			Herb	*Ophiopogon japonicus*		
Q8		Dense trees + shrubs + ground cover	Tree	*Koelreuteria bipinnata* 'integrifoliola', *Camptotheca acuminata*	Traffic	60.15
			Shrub	*Pittosporum tobira*, *Fatsia japonica*, *Nandina domestica*		
			Herb	*Ophiopogon japonicus*		
Q9		Dense trees + shrubs + ground cover	Tree	*Camphora officinarum*, *Osmanthus fragrans*	Traffic	62.44
			Shrub	*Loropetalum chinense* var. *rubrum*, *Hypericum monogynum*		
			Herb	*Cynodon dactylon*, *Ophiopogon japonicus*		
Waterfront plant community						
Q10	Tree–herb	Sparse trees + ground cover	Tree	*Salix babylonica*	Traffic	57.16
			Herb	*Ophiopogon japonicus*		
Q11			Tree	*Prunus* × *yedoensis*	Traffic	57.16

		Moderately sparse trees + ground cover	Herb	*Ophiopogon japonicus*		
Q12		Dense trees + ground cover	Tree	*Metasequoia glyptostroboides*	Traffic	57.16
			Herb	*Ophiopogon japonicus*		
Q13	Shrub	Regular tall shrubs	Shrub	*Nerium oleander*	Traffic	60.26

Supplementary Table 2: SPLs of noise from the sample sites

Site	SPLs of noise at monitoring Point O (dB)					SPLs of noise at monitoring Point A (dB)				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Q0	55.8	56.3	55.9	56.0	56.3	56.1	54.2	54.5	54.3	52.4
Q1	59.6	57.6	56.6	59.8	58.4	55.6	56.6	54.9	54.5	56.8
Q2	61.9	60.9	59.0	58.3	62.5	56.1	56.7	55.5	55.5	56.8
Q3	63.8	61.6	60.4	62.3	63.6	61.1	60.3	61.3	59.3	59.2
Q4	61.0	60.3	60.7	61.8	59.6	48.4	50.8	49.9	50.0	49.4
Q5	71.4	70.7	70.5	72.2	72.3	61.3	60.9	61.0	61.2	61.0
Q6	54.8	56.2	56.2	55.4	55.5	53.6	54.5	53.0	52.6	53.2
Q7	62.3	63.7	61.5	62.3	61.9	58.6	55.5	56.1	53.2	55.6
Q8	58.1	58.1	58.8	62.3	57.9	52.9	51.7	52.3	53.0	53.4
Q9	64.6	63.9	63.8	63.9	64.1	53.2	52.5	52.9	52.5	52.5
Q10	55.0	56.1	57.5	56.5	56.3	52.0	52.6	52.9	52.7	52.3
Q11	55.0	56.1	57.5	56.5	56.3	52.2	52.1	52.3	52.6	52.8
Q12	55.0	56.1	57.5	56.5	56.3	51.2	51.5	51.7	51.6	51.8
Q13	58.8	62.1	58.0	57.6	59.5	52.5	52.7	53.0	52.5	53.1

Supplementary Table 3: Correlation analysis between the physical noise reduction effectiveness and the tree-layer factors of plant communities

Plant community	Correlation metric		TH	TC	TB	TD	TD × TB / TC
Physical noise reduction effectiveness	Correlation (Pearson's *r*)		–0.174	0.011	0.731	0.873*	0.846*
	p-value		0.709	0.982	0.062	0.010	0.017
	95% confidence interval (two-tailed)	Lower bound	–0.820	–0.607	–0.341	0.339	–0.031
		Upper bound	0.666	0.781	0.885	0.971	0.938

NOTES

1. TH = height, TC = clear bole height, and TB = diameter at breast height.
2. * indicates statistically significant correlation at the 95% confidence interval (two-tailed).
3. The confidence interval was estimated using Fisher's *r*-to-*z* transformation.

Supplementary Table 4: Correlation analysis between the physical noise reduction effectiveness and the shrub-layer factors of plant communities

Plant community	Correlation metric	SS	SC	SH	SH × SC / SS
Physical noise reduction effectiveness	Correlation (Pearson's *r*)	–0.467	0.079	0.506	0.801*
	p-value	0.243	0.852	0.201	0.017

	95% confidence interval (two-tailed)	Lower bound	−0.882	−0.662	0.892	0.222
		Upper bound	0.354	0.742	−0.309	0.963

NOTES

1. SS = spacing, SC = crown width, SH = height.
2. * indicates statistically significant correlation at the 95% confidence interval (two-tailed).
3. The confidence interval was estimated using Fisher's *r*-to-*z* transformation.

Supplementary Table 5: Correlation analysis between the physical noise reduction effectiveness and the overall factors of plant communities

Plant community	Correlation metric		Plant species richness	Vertical canopy density
Physical noise reduction effectiveness	Correlation (Pearson's *r*)		0.674*	0.906**
	p-value		0.033	< 0.001
	95% confidence interval (two-tailed)	Lower bound	0.0772	0.642
		Upper bound	0.915	0.9781

NOTES

1. * indicates statistically significant correlation at the 95% confidence interval (two-tailed); ** indicates statistically significant correlation at the 99% confidence interval (two-tailed).
2. The confidence interval was estimated using Fisher's *r*-to-*z* transformation.

Supplementary Table 6: Evaluation indicator weights for psychological noise reduction effectiveness of plant communities

Evaluation objective	Evaluation criterion	Weight	Evaluation indicator	Weight	Overall weight
Evaluating the overall psychological noise reduction effectiveness of plant communities	Visual perception	0.507	Sense of color	0.193	0.098
			Sense of space	0.198	0.100
			Sense of layering	0.190	0.096
			Sense of atmosphere	0.201	0.102
			Attractiveness	0.218	0.111
	Auditory perception	0.493	Quietness	0.199	0.098
			Harmony	0.206	0.102
			Liveliness	0.203	0.100
			Richness	0.182	0.090
			Pleasantness	0.210	0.103

Supplementary Table 7: Correlation analysis between the characteristic factors of plant communities and the visual perception indicators

Characteristic factors of plant communities	Correlation metric	Sense of color	Sense of space	Sense of layering	Sense of atmosphere	Attractiveness	Overall score
SS	Correlation (Pearson's *r*)	0.511	0.691*	0.609	0.596	0.676*	0.669*
	p-value	0.160	0.039	0.082	0.090	0.045	0.049

	95% confidence interval (two-tailed)	Lower bound	–0.232	0.050	–0.092	–0.112	0.022	0.009
		Upper bound	0.877	0.929	0.907	0.903	0.925	0.923
SC	Correlation (Pearson's *r*)		0.856**	0.681*	0.866**	0.553	0.805**	0.819**
	p-value		0.003	0.044	0.003	0.123	0.009	0.007
	95% confidence interval (two-tailed)	Lower bound	0.445	0.031	0.475	–0.176	0.303	0.338
		Upper bound	0.969	0.926	0.971	0.890	0.957	0.961
SH	Correlation (Pearson's *r*)		0.520	0.673*	0.760*	0.784*	0.814**	0.775*
	p-value		0.151	0.047	0.017	0.012	0.008	0.014
	95% confidence interval (two-tailed)	Lower bound	–0.220	0.015	0.194	0.250	0.327	0.228
		Upper bound	0.880	0.924	0.947	0.952	0.959	0.950
SH × SC / SS	Correlation (Pearson's *r*)		0.737*	0.544	0.827**	0.587	0.744*	0.750*
	p-value		0.024	0.130	0.006	0.096	0.022	0.020
	95% confidence interval (two-tailed)	Lower bound	0.142	–0.188	0.361	–0.126	0.157	0.170
		Upper bound	0.941	0.888	0.962	0.900	0.942	0.944

NOTES

1. For shrubs, SS = spacing, SC = crown width, SH = height.
2. * indicates statistically significant correlation at the 95% confidence interval (two-tailed); ** indicates statistically significant correlation at the 99% confidence interval (two-tailed).
3. The confidence interval was estimated using Fisher's *r*-to-*z* transformation.

Supplementary Table 8: Correlation analysis between the characteristic factors of plant communities and the auditory perception indicators

Characteristic factors of plant communities	**Correlation metric**		**Quietness**	**Harmony**	**Liveliness**	**Richness**	**Pleasantness**	**Noise annoyance**	**Overall score**
Vertical canopy density	Correlation (Pearson's *r*)		0.083	0.388	0.508	0.567*	0.477	0.318	0.549*
	p-value		0.787	0.191	0.076	0.043	0.099	0.288	0.042
	95% confidence interval (two-tailed)	Lower bound	–0.411	–0.275	–0.033	0.029	–0.028	–0.722	0.184
		Upper bound	0.632	0.716	0.817	0.837	0.819	0.264	0.759

NOTES

1. * indicates statistically significant correlation at the 95% confidence interval (two-tailed).
2. The confidence interval was estimated using Fisher's *r*-to-*z* transformation.

https://doi.org/10.15302/J-LAF-0-020027 收稿日期 | 2024-01-29 录用日期 | 2024-11-29 中图分类号 | TU984, S731.2 文献标识码 | A

城市绿地植物群落综合降噪效能研究

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附表1：样地基本信息

样地	植被类型		植物种类		噪声源	预调研噪声源声压级（dB）
陆域植物群落						
Q0	地被型	—	草本	狗牙根（*Cynodon dactylon*）	交通噪声	57.60
Q1	乔灌型	不规则低灌木+乔木	乔木	无患子（*Sapindus saponaria*）	交通噪声	58.40
			灌木	马缨丹（*Lantana camara*）、绣线菊（*Spiraea salicifolia*）、女贞（*Ligustrum lucidum*）、火炭母（*Persicaria chinensis*）		
Q2		规则低灌木+乔木	乔木	樟（*Camphora officinarum*）	交通噪声	59.74
			灌木	金叶女贞（*Ligustrum* × *vicaryi*）、日本黄杨（*Buxus microphylla*）、蜡梅（*Chimonanthus praecox*）		
Q3	乔草型	乔木+地被	乔木	棕榈（*Trachycarpus fortunei*）、樟（*Camphora officinarum*）、刺桐（*Erythrina variegata*）、紫薇（*Lagerstroemia indica*）	交通噪声	62.34
			草本	麦冬（*Ophiopogon japonicus*）		
Q4	灌草型	规则高灌木+地被	灌木	金边黄杨（*Euonymus japonicus* ‘Aurea-marginatus’）	交通噪声	59.98
			草本	狗牙根（*Cynodon dactylon*）		
Q5		不规则高灌木+地被	灌木	马缨丹（*Lantana camara*）、南天竹（*Nandina domestica*）、肾蕨（*Nephrolepis cordifolia*）、叉子圆柏（*Juniperus sabina*）、卵叶女贞（*Ligustrum ovalifolium*）、库页虎杖（*Reynoutria sachalinensis*）、木糙苏（*Phlomis fruticosa*）、胡颓子（*Elaeagnus pungens*）、黄杨（*Buxus sinica*）	交通噪声	69.84
			草本	狗牙根（*Cynodon dactylon*）		
Q6	乔灌草型	疏植乔木+灌木+地被	乔木	雪松（*Cedrus deodara*）	交通噪声	57.02
			灌木	杜鹃（*Rhododendron simsii*）、穗花牡荆（*Vitex agnus-castus*）		
			草本	麦冬（*Ophiopogon japonicus*）、金钱蒲（*Acorus gramineus*）		
Q7		疏植乔木+灌木+地被	乔木	樟（*Camphora officinarum*）、木樨（*Osmanthus fragrans*）	交通噪声	60.93
			灌木	月季花（*Rosa chinensis*）、绣球（*Hydrangea macrophylla*）		
			草本	麦冬（*Ophiopogon japonicus*）		
Q8		密植乔木+灌木+地被	乔木	黄山栾树（*Koelreuteria bipinnata* ‘integrifoliola’）、喜树（*Camptotheca acuminata*）	交通噪声	60.15
			灌木	海桐（*Pittosporum tobira*）、八角金盘（*Fatsia japonica*）、南天竹（*Nandina domestica*）		
			草本	麦冬（*Ophiopogon japonicus*）		
Q9		密植乔木+灌木+地被	乔木	樟（*Camphora officinarum*）、木樨（*Osmanthus fragrans*）	交通噪声	62.44
			灌木	红花檵木（*Loropetalum chinense* var. *rubrum*）、金丝桃（*Hypericum monogynum*）		
			草本	狗牙根（*Cynodon dactylon*）、麦冬（*Ophiopogon japonicus*）		

滨水植被群落						
Q10	乔草型	疏植乔木+地被	乔木	垂柳（*Salix babylonica*）	交通噪声	57.16
			草本	麦冬（*Ophiopogon japonicus*）		
Q11		较疏植乔木+地被	乔木	东京樱花（*Prunus × yedoensis*）	交通噪声	57.16
			草本	麦冬（*Ophiopogon japonicus*）		
Q12		密植乔木+地被	乔木	水杉（*Metasequoia glyptostroboides*）	交通噪声	57.16
			草本	麦冬（*Ophiopogon japonicus*）		
Q13	灌木型	规则高灌木	灌木	夹竹桃（*Nerium oleander*）	交通噪声	60.26

附表2：样地噪声声压级测量数据

样地	监测点 O 噪声声压级测量数据（dB）					监测点 A 噪声声压级测量数据（dB）				
	第 1 次	第 2 次	第 3 次	第 4 次	第 5 次	第 1 次	第 2 次	第 3 次	第 4 次	第 5 次
Q0	55.8	56.3	55.9	56.0	56.3	56.1	54.2	54.5	54.3	52.4
Q1	59.6	57.6	56.6	59.8	58.4	55.6	56.6	54.9	54.5	56.8
Q2	61.9	60.9	59.0	58.3	62.5	56.1	56.7	55.5	55.5	56.8
Q3	63.8	61.6	60.4	62.3	63.6	61.1	60.3	61.3	59.3	59.2
Q4	61.0	60.3	60.7	61.8	59.6	48.4	50.8	49.9	50.0	49.4
Q5	71.4	70.7	70.5	72.2	72.3	61.3	60.9	61.0	61.2	61.0
Q6	54.8	56.2	56.2	55.4	55.5	53.6	54.5	53.0	52.6	53.2
Q7	62.3	63.7	61.5	62.3	61.9	58.6	55.5	56.1	53.2	55.6
Q8	58.1	58.1	58.8	62.3	57.9	52.9	51.7	52.3	53.0	53.4
Q9	64.6	63.9	63.8	63.9	64.1	53.2	52.5	52.9	52.5	52.5
Q10	55.0	56.1	57.5	56.5	56.3	52.0	52.6	52.9	52.7	52.3
Q11	55.0	56.1	57.5	56.5	56.3	52.2	52.1	52.3	52.6	52.8
Q12	55.0	56.1	57.5	56.5	56.3	51.2	51.5	51.7	51.6	51.8
Q13	58.8	62.1	58.0	57.6	59.5	52.5	52.7	53.0	52.5	53.1

附表3：植物群落物理降噪效能与植物群落乔木层特征要素相关性分析

植物群落	相关性指标		高度	枝下高	胸径	种植密度	种植密度×胸径／枝下高
物理降噪效能	相关性（Pearson's *r*）		−0.174	0.011	0.731	0.873*	0.846*
	p 值		0.709	0.982	0.062	0.010	0.017
	95%置信区间（双尾）	下限	−0.820	−0.607	−0.341	0.339	−0.031
		上限	0.666	0.781	0.885	0.971	0.938

注

1. *表示在 95%置信区间（双尾）相关性显著。

2. 置信区间的估算采用费雪的 *r* 到 *z* 转换方法。

附表4：植物群落物理降噪效能与灌木层特征要素相关性分析

植物群落	相关性指标		间距	冠幅	高度	高度×冠幅／间距
物理降噪效能	相关性（Pearson's *r*）		−0.467	0.079	0.506	0.801*
	p 值		0.243	0.852	0.201	0.017
	95%置信区间（双尾）	下限	−0.882	−0.662	0.892	0.222
		上限	0.354	0.742	−0.309	0.963

注

1. *表示在 95%置信区间（双尾）相关性显著。

2. 置信区间的估算采用费雪的 *r* 到 *z* 转换方法。

附表5：植物群落物理降噪效能与综合特征要素相关性分析

植物群落	相关性指标		植物种类数量	垂直郁闭度
物理降噪效能	相关性（Pearson's *r*）		0.674*	0.906**
	p 值		0.033	< 0.001
	95%置信区间（双尾）	下限	0.0772	0.642
		上限	0.915	0.9781

注

1. *表示在 95%置信区间（双尾）相关性显著；**表示在 99%置信区间（双尾）相关性显著。

2. 置信区间的估算采用费雪的 *r* 到 *z* 转换方法。

附表6：植物群落心理降噪效能指标权重表

评价目标层	评价准则层	权重	评价指标层	权重	综合权重
植物群落心理降噪综合评价	视觉感知	0.507	色彩感	0.193	0.098
			空间感	0.198	0.100
			层次感	0.190	0.096
			氛围感	0.201	0.102
			吸引力	0.218	0.111
	听觉感知	0.493	安静	0.199	0.098
			和谐	0.206	0.102
			活跃	0.203	0.100
			丰富	0.182	0.090
			愉悦	0.210	0.103

附表7：植物群落特征要素与视觉感知评价指标相关性分析

植物群落特征要素	相关性指标	色彩感	空间感	层次感	氛围感	吸引力	综合评分
灌木间距	相关性（Pearson's *r*）	0.511	0.691*	0.609	0.596	0.676*	0.669*

	p 值		0.160	0.039	0.082	0.090	0.045	0.049
	95%置信区间（双尾）	下限	−0.232	0.050	−0.092	−0.112	0.022	0.009
		上限	0.877	0.929	0.907	0.903	0.925	0.923
灌木冠幅	相关性（Pearson's *r*）		0.856**	0.681*	0.866**	0.553	0.805**	0.819**
	p 值		0.003	0.044	0.003	0.123	0.009	0.007
	95%置信区间（双尾）	下限	0.445	0.031	0.475	−0.176	0.303	0.338
		上限	0.969	0.926	0.971	0.890	0.957	0.961
灌木高度	相关性（Pearson's *r*）		0.520	0.673*	0.760*	0.784*	0.814**	0.775*
	p 值		0.151	0.047	0.017	0.012	0.008	0.014
	95%置信区间（双尾）	下限	−0.220	0.015	0.194	0.250	0.327	0.228
		上限	0.880	0.924	0.947	0.952	0.959	0.950
灌木高度×冠幅 / 间距	相关性（Pearson's *r*）		0.737*	0.544	0.827**	0.587	0.744*	0.750*
	p 值		0.024	0.130	0.006	0.096	0.022	0.020
	95%置信区间（双尾）	下限	0.142	−0.188	0.361	−0.126	0.157	0.170
		上限	0.941	0.888	0.962	0.900	0.942	0.944

注

1. *表示在 95%置信区间（双尾）相关性显著；**表示在 99%置信区间相关性显著。

2. 置信区间的估算采用费雪的 *r* 到 *z* 转换方法。

附表8：植物群落特征要素与听觉感知评价指标相关性分析

植物群落特征要素	相关性指标		安静	和谐	活跃	丰富	愉悦	噪声烦恼度	综合评分
垂直郁闭度	相关性（Pearson's *r*）		0.083	0.388	0.508	0.567*	0.477	0.318	0.549*
	p 值		0.787	0.191	0.076	0.043	0.099	0.288	0.042
	95%置信区间（双尾）	下限	−0.411	−0.275	−0.033	0.029	−0.028	−0.722	0.184
		上限	0.632	0.716	0.817	0.837	0.819	0.264	0.759

注

1. *表示在 95%置信区间（双尾）相关性显著。

2. 置信区间的估算采用费雪的 *r* 到 *z* 转换方法。