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PS 3.3 Changing Environment

Comprehensive evaluation on healthcare function of the typical recreational forests of Huishan national forest park in East China

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Background

Urbanization

Pollution

Pressure

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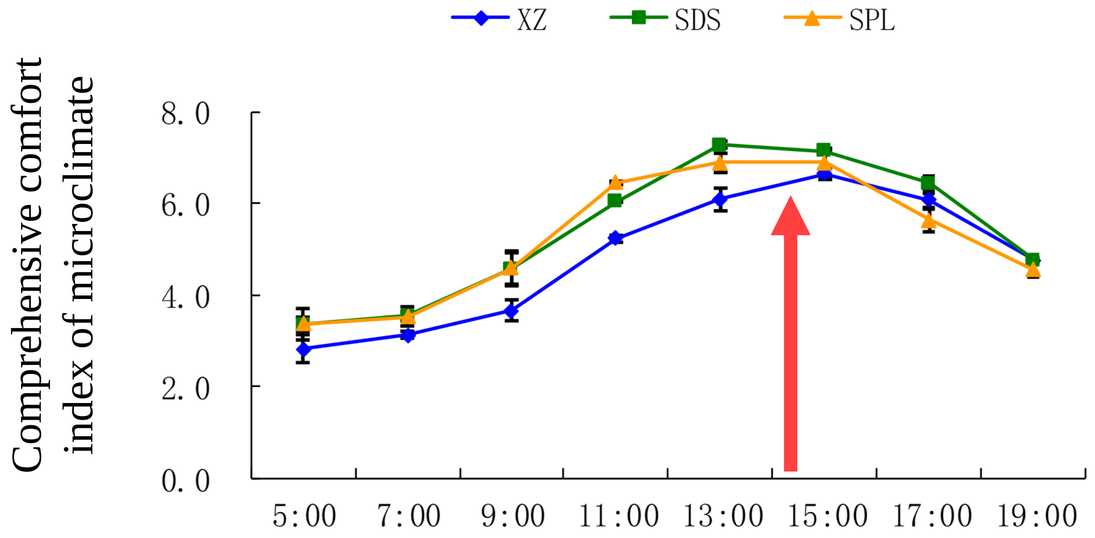
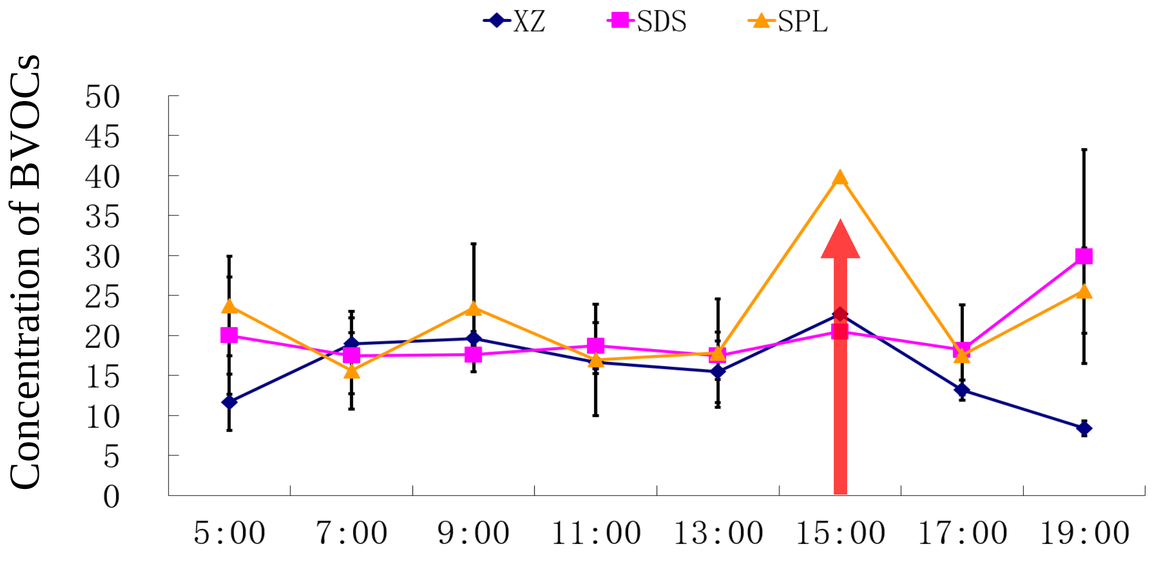
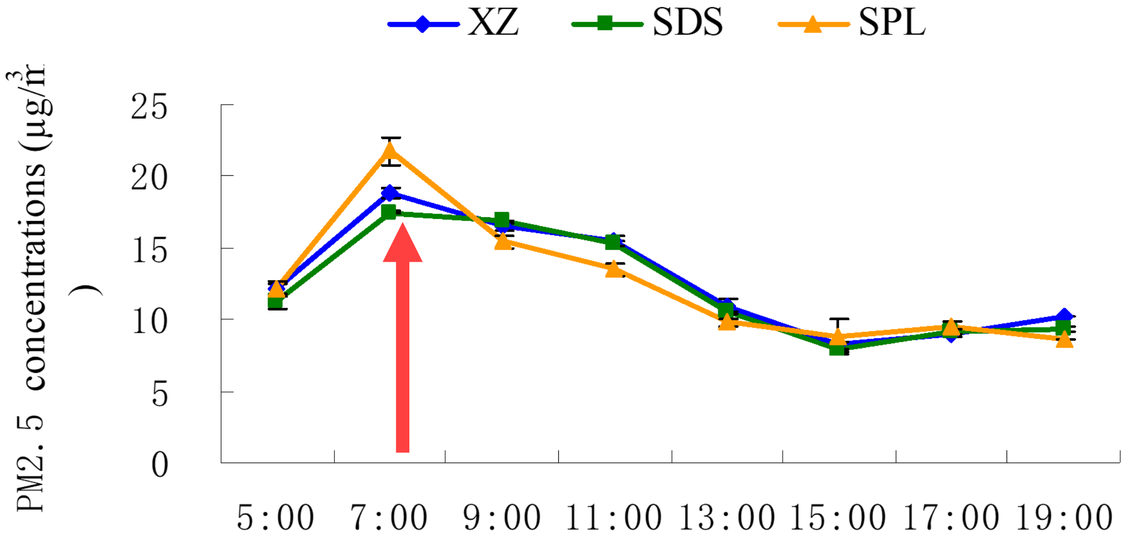
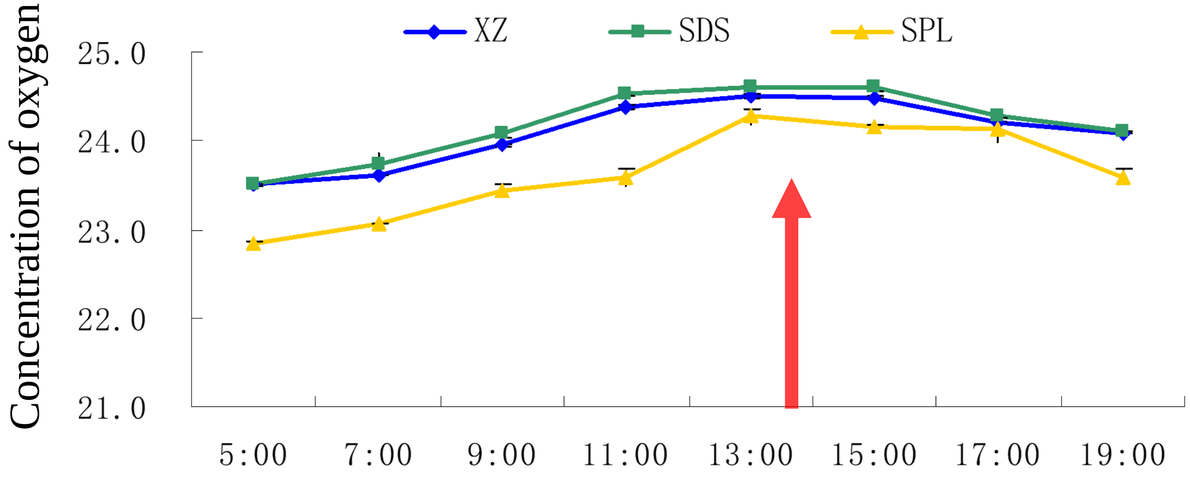
Take an example- in Summer









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Objective

- Air Healthcare Comprehensive Index (AHCI) of the recreational forests was established.
- Provide guidance for the development of recreational forest health function in Huishan park and even the southeast regions of China.
- Provide reference for local citizens to choose the befitting time and clothing to carry out forest recreational activities.

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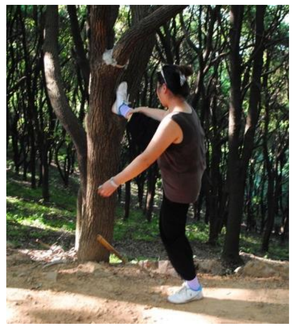
Experiment site



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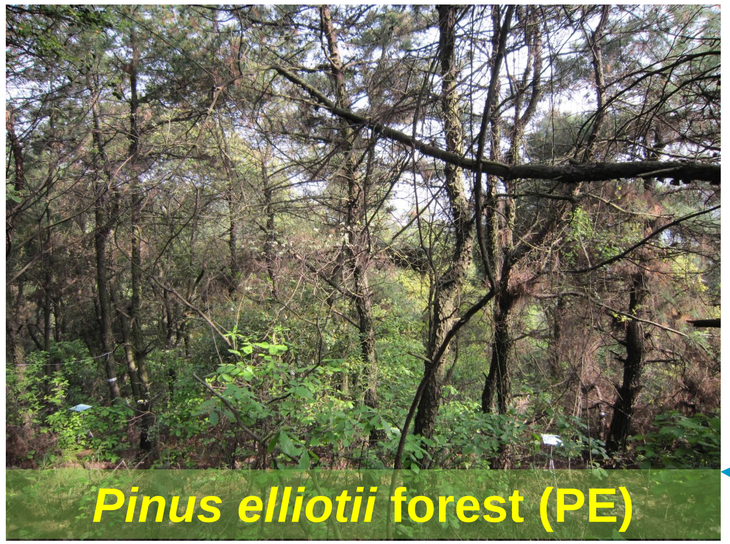
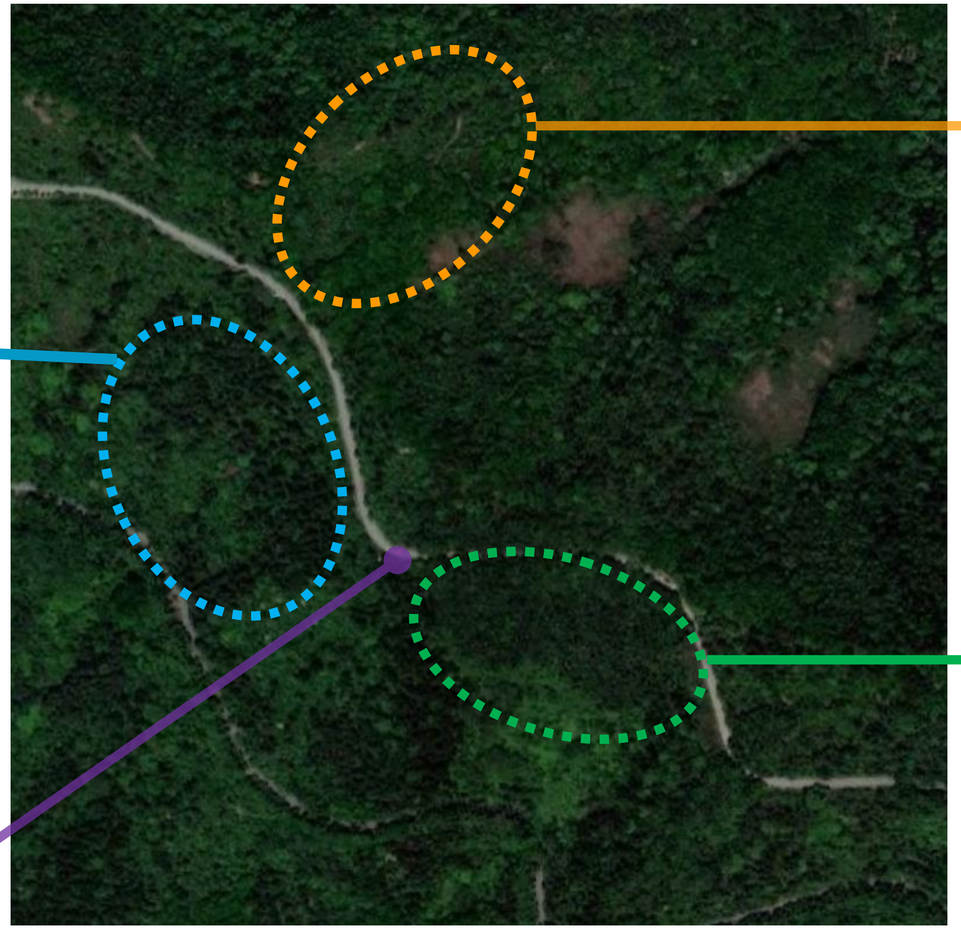
Forest plots



Pinus elliotii forest (PE)



Quercus variabilis forest (QV)

Road

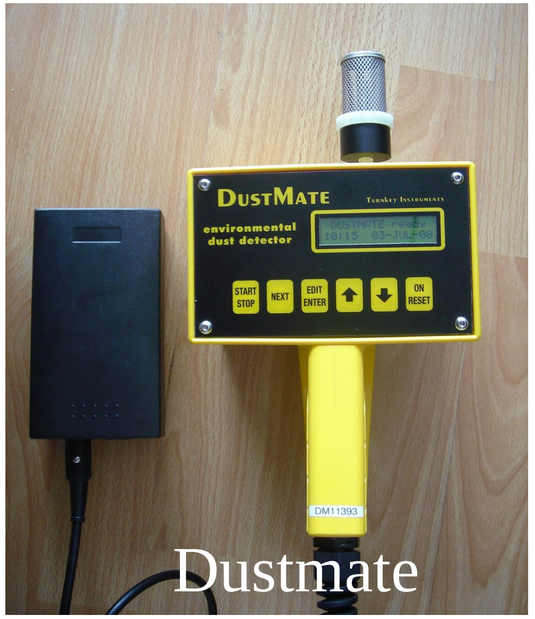
Cinnamomum camphora forest (CC)

What to monitor

Kestrel 4500


PTM400-O_2

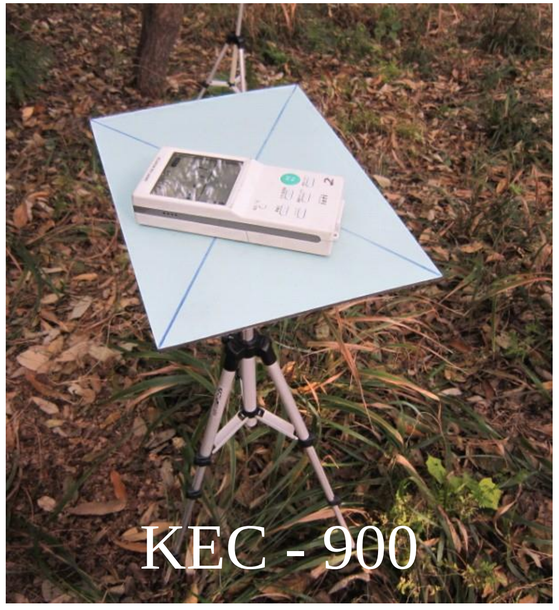

TES-1332A



Dustmate


QC - I


ATD - GC/ MS


KEC - 900

- **Micro-climate**

(Light intensity, Wind velocity, temperature, relative humidity)

- **BVOCs**
- **Negative ions**
- **Particulate matters**

(TSP, PM10, PM2.5, PM1)

- **Air oxygen**

When to monitor

4 seasons in a year

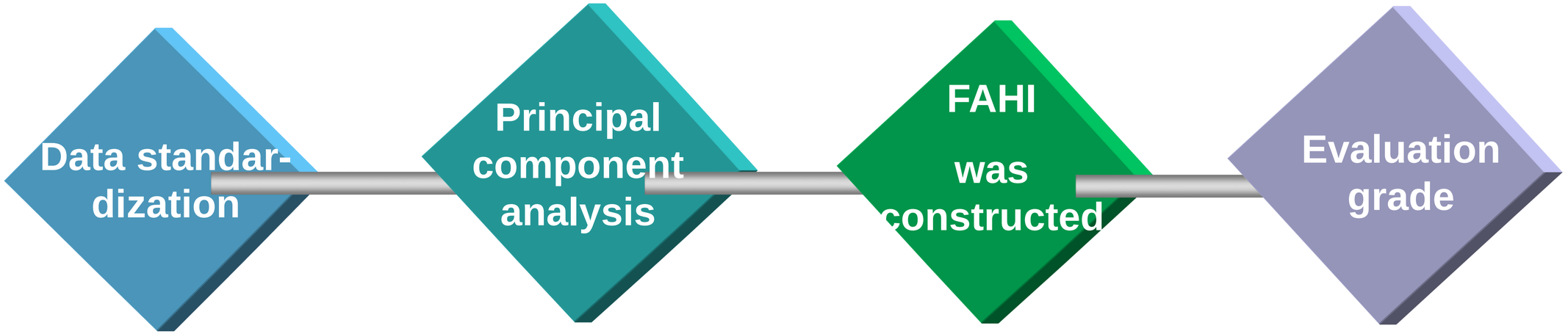
(5:00am, 7:00am,

9:00am, 11:00am,

13:00 pm, 15:00pm,

17:00pm, 19:00pm)

Constructing FAHI using mathematical statistics



Min-max standadization during [0,1]

- 3 principal components
- PMs were the most influential factor

Weighted summation

- Cluster analysis
- Five grades

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Results

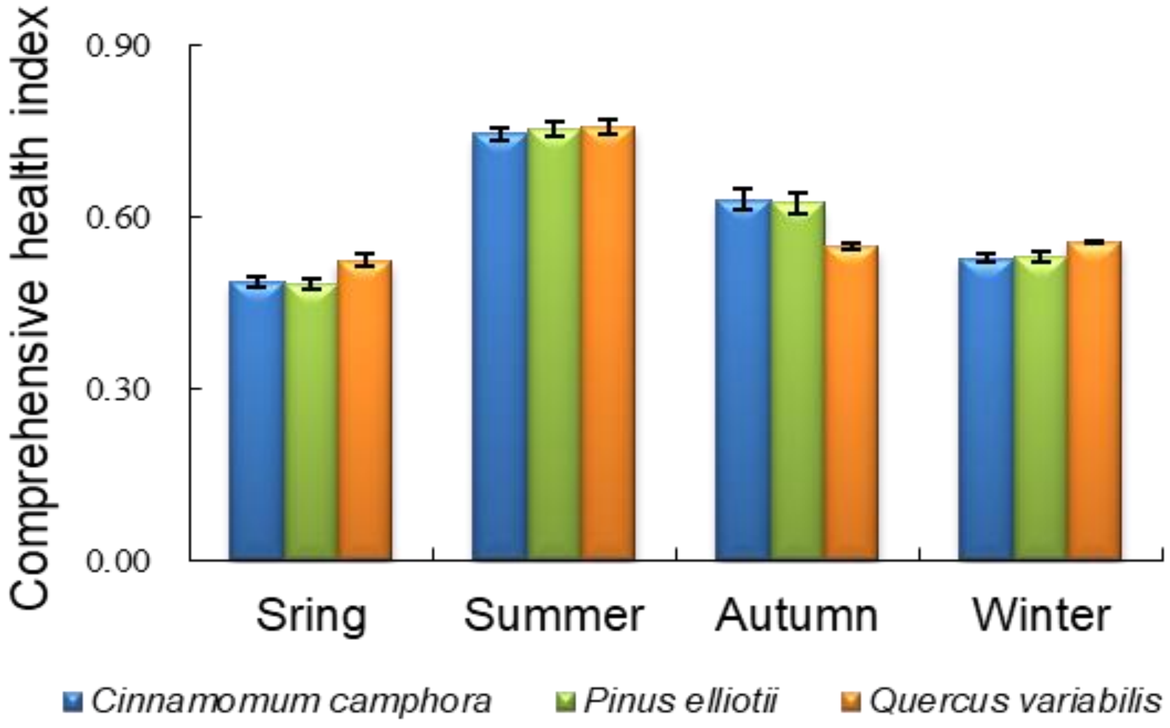

Fig.1 Seasonal variations of ecological comprehensive health index in three plots

Tab.1 Variance analysis of seasonal variation of ecological health comprehensive index in three sample plots

Forest plots	Spring	Summer	Autumn	Winter
Cinnamomum camphora forest	d (b)	a (a)	b (a)	c (b)
Pinus elliotii forest	d (b)	a (a)	b (a)	c (b)
Quercus variabilis forest	c (a)	a (a)	b (b)	b (a)

The different small letters in the same row column and the different small letters in brackets in the same column indicates significant difference ($P<0.05$).

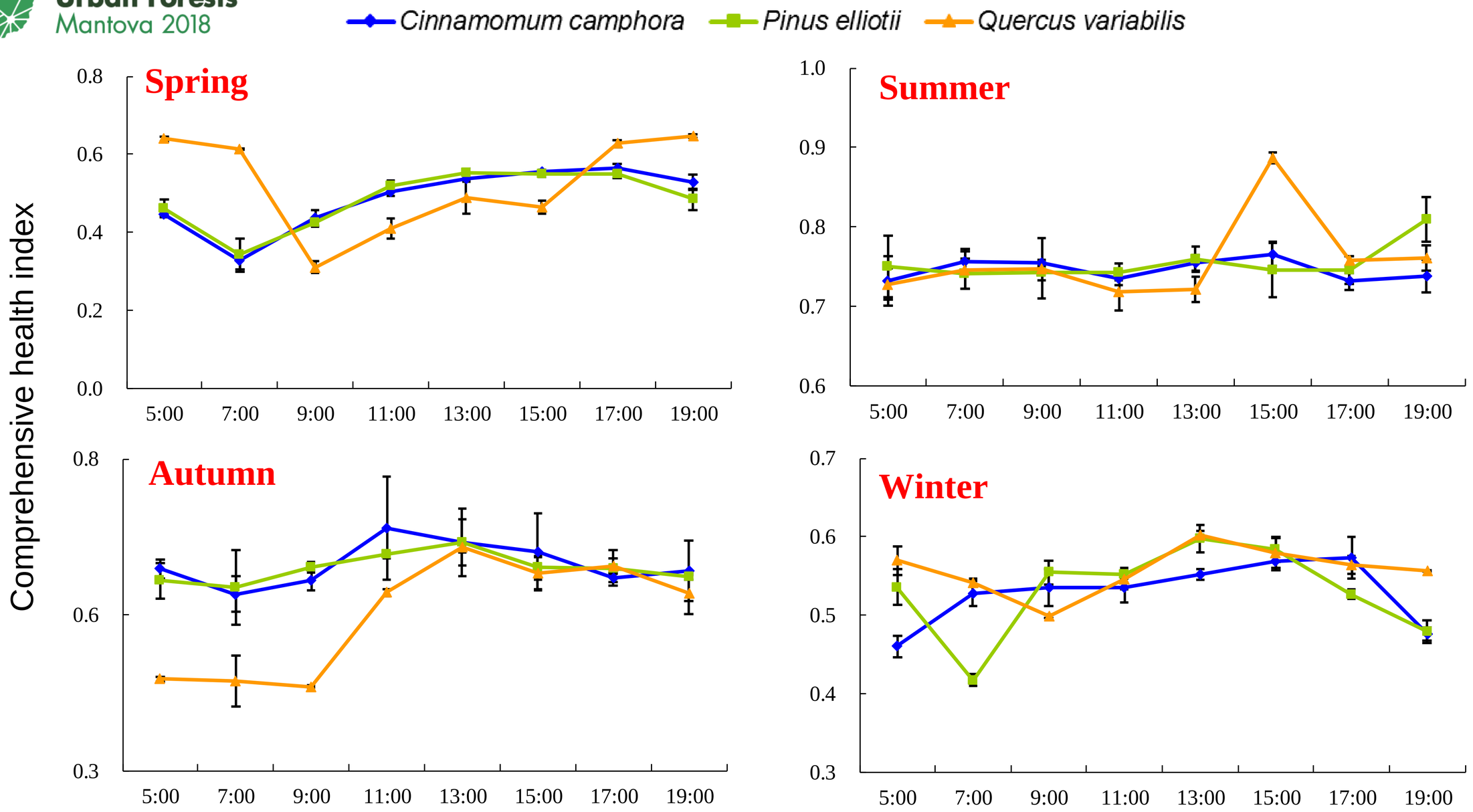

Fig.2 Diurnal variations of ecological comprehensive health index in three plots

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Tab.2 Evaluation of FAHI in three forests

Seasons	Plots	Time								Average
		5:00	7:00	9:00	11:00	13:00	15:00	17:00	19:00	
Spring	*Cinnamomum camphora* forest	Ⅳ	Ⅳ	Ⅳ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ
	Pinus elliotii forest	Ⅳ	Ⅳ	Ⅳ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ
	Quercus variabilis forest	Ⅲ	Ⅲ	Ⅳ	Ⅳ	Ⅲ	Ⅳ	Ⅲ	Ⅲ	Ⅲ
Summer	*Cinnamomum camphora* forest	Ⅱ	Ⅱ	Ⅱ	Ⅱ	Ⅱ	Ⅱ	Ⅱ	Ⅱ	Ⅱ
	Pinus elliotii forest	Ⅱ	Ⅱ	Ⅱ	Ⅱ	Ⅱ	Ⅱ	Ⅱ	Ⅰ	Ⅱ
	Quercus variabilis forest	Ⅱ	Ⅱ	Ⅱ	Ⅱ	Ⅱ	Ⅰ	Ⅱ	Ⅱ	Ⅱ
Autumn	*Cinnamomum camphora* forest	Ⅲ	Ⅲ	Ⅲ	Ⅱ	Ⅱ	Ⅲ	Ⅲ	Ⅲ	Ⅲ
	Pinus elliotii forest	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅱ	Ⅲ	Ⅲ	Ⅲ	Ⅲ
	Quercus variabilis forest	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ
Winter	*Cinnamomum camphora* forest	Ⅳ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅳ	Ⅲ
	Pinus elliotii forest	Ⅲ	Ⅳ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅳ	Ⅲ
	Quercus variabilis forest	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ

Ⅰ: Very good, Ⅱ: Good, Ⅲ: Moderate, Ⅳ: Bad, Ⅴ: Very bad.

Tab.3 Suitable recreation time of climate comfort in three kinds of recreational forests

Seasons	Kinds of recreational time	*Cinnamomum camphora* forest	*Pinus elliotii* forest	*Quercus variabilis* forest
Spring	Suitable recreational time	11:00~19:00	11:00~19:00	5:00~7:00，13:00，17:00~19:00
	The best recreational time	——	——	——
Summer	Suitable recreational time	5:00~19:00	5:00~19:00	5:00~19:00
	The best recreational time	5:00~19:00	5:00~19:00	5:00~19:00
Autumn	Suitable recreational time	5:00~19:00	5:00~19:00	5:00~19:00
	The best recreational time	11:00~13:00	13:00	——
Winter	Suitable recreational time	7:00~17:00	5:00，9:00~17:00	5:00~19:00
	The best recreational time	——	——	——

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Conclusions

- Seasonal averaged AHCI was the highest in the summer and lowest in the spring. In addition, the highest AHCI in spring, summer and winter, while the lowest within *Quercus variabilis* forest.

- The diurnal variation of AHCI in the 3 forests all showed nearly “one vale” in the spring, while changed gradual in summer and autumn. In winter, the diurnal variation of *Cinnamomum camphora* forest showed “one peak”, and the other two forests showed “one peak and one vale”.

- It suitable for forest recreation in the three forests during 5:00-11:00 am in summer and autumn, however, not be suitable during 5:00-11:00 am in spring nor 5:00-9:00 am and 19:00 pm in winter.

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Outlook

Combining physiological and psychological indicators of human to carry out comprehensive monitoring.

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Acknowledgments

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