



黑龙江省
科学院

自然与生态研究所
Institute of Natural Resources And Ecology.HAS



五大连池火山群的生态价值研究

Research on Wudalianchi Volcanic Cluster's Ecological Value

黄庆阳 博士

huangqingyang@163.com

12-14 September, 2016 huangshan China



UNESCO HIST-HB

- 哈尔滨分中心于2015年1月9日正式成立。
HIST-HB established in January 9, 2015
- 自然遗产评估与保护
Assessment and protection of natural heritage
- 全球变化生态
Global change ecology
- 火山植物进化与植被生态
Plant evolution and vegetation ecology in Volcano





Outline

□ 五大连池简介

Introduction for Wudalianchi

□ 生态研究价值

Study on the Ecological Value of Volcanoes

□ 目前开展的工作

Recetly work

□ 展望与未来

Future Prospects



五大连池简介 Introduction for Wudalianchi

- 五大连池位于黑龙江省黑河市。

In Heilongjiang province

- 在过去200万年间经历了7次大规模的火山喷发。

7 times of large-scale volcanic eruption here in last 2 million years

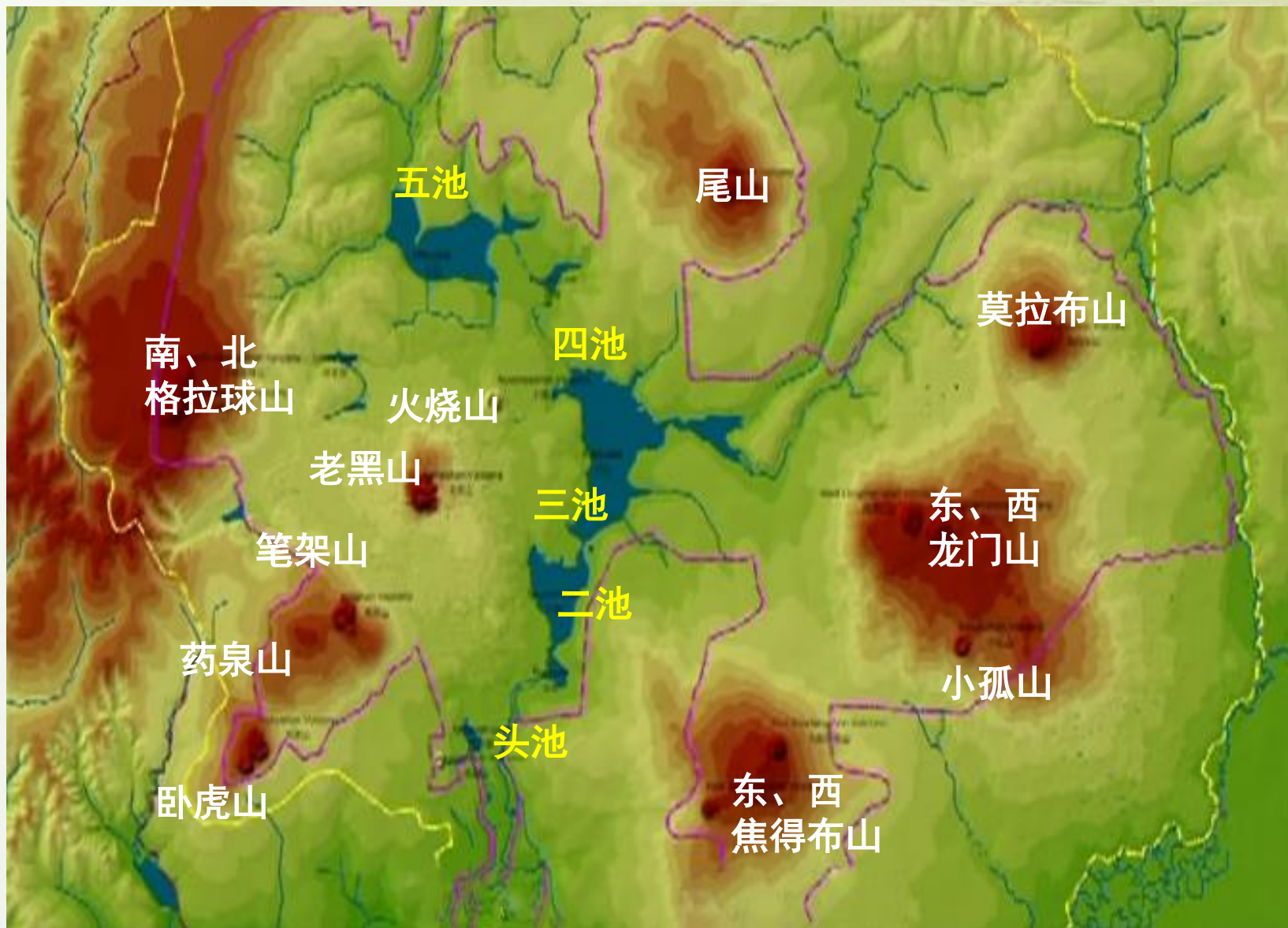
- 形成了14座不同历史年代(200万年—290年前)的火山。

14 volcano types in different periods

- 是中国保存最为完好的内陆火山遗迹。

The best-preserved inland volcano relic in China







新时期火山 New Volcano



老黑山



老黑山



老黑山



火烧山



火烧山



黑龙江省
科学院

自然与生态研究所
Institute of Natural Resources And Ecology.HAS



United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO



UNESCO HIST-HB

中期火山 Middle Volcanoes



北格拉球山



药泉山



西焦得布山



笔架山



小孤山



东焦得布山

老期火山 Old Volcanoes





黑龙江省
科学院
Institute of Natural Resources And Ecology HAS

自然与生态研究所
Institute of Natural Resources And Ecology HAS



1982年，国家重点风景名胜区

2001年，国家地质公园

2003年，世界人与生物圈保护区

2004年，世界地质公园

2006年，国家自然遗产

2010年，世界自然遗产提名地

2014年，国际绿色名录

Key scenic spots in China

Geological Park in China

Biosphere Reserve

Global Geological Park

Natural Heritage in China

World natural heritage nomination

IUCN Green List



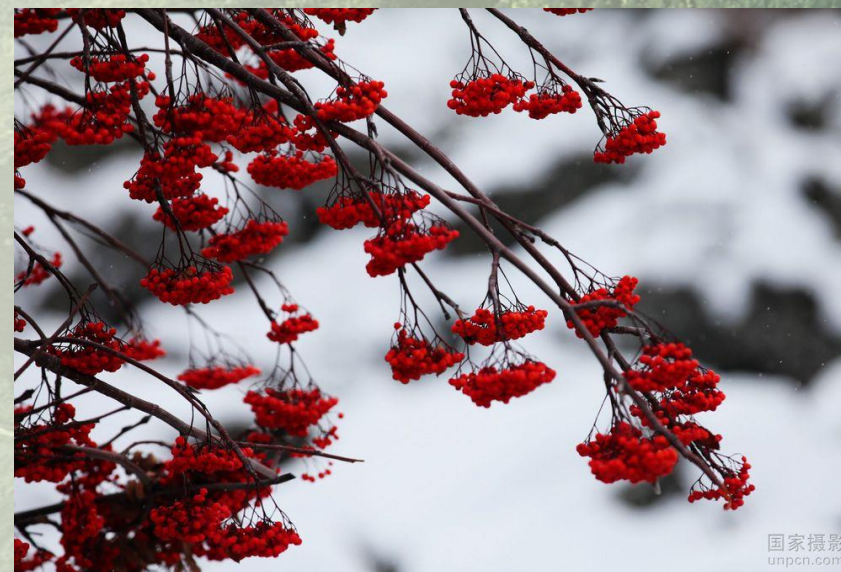


Criterion VII

It contains superlative and unique combinations of natural phenomena, combined in a setting that is beautiful to most humans.

“具有突出的自然美”



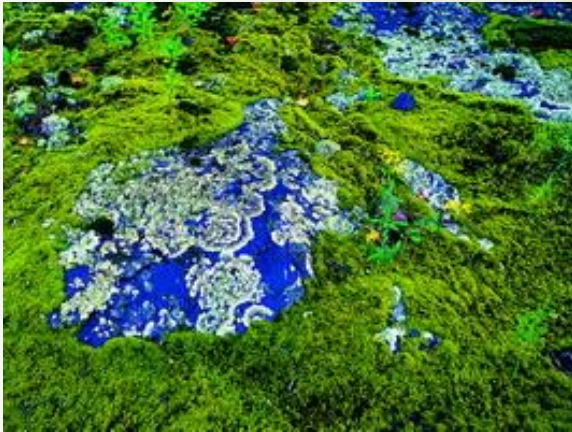




Criterion IX

Containing continuing ecological succession and the formation of new assemblies of plants and animals.

“是反映陆地生态系统和动植物群落进化和发展进程中正在进行的生态和生物演化过程的杰出范例。”





Criterion VIII

As it clearly contains examples of very recent and older volcanism, combined in an unusual setting (mid-continent). The presence of very recently formed lakes contributes to the geomorphologic interest.

“地球历史、地质地貌特征和作用的杰出范例”





□ 五大连池简介

Introduction for Wudalianchi

□ 生态研究价值

Study on the Ecological Value of Volcanoes

□ 目前开展的工作

Recetly work

□ 展望与未来

Future Prospects



生态研究价值 Study on the Ecological Value of Volcanoes

➤ 植物地理特征的交错性

Intersecting geographic characters of vegetation

➤ 植物的丰富性和多样性

Diversity and abundance in Plant

➤ 植被演替的原生性与完整性

The primary and the integrity of vegetation succession

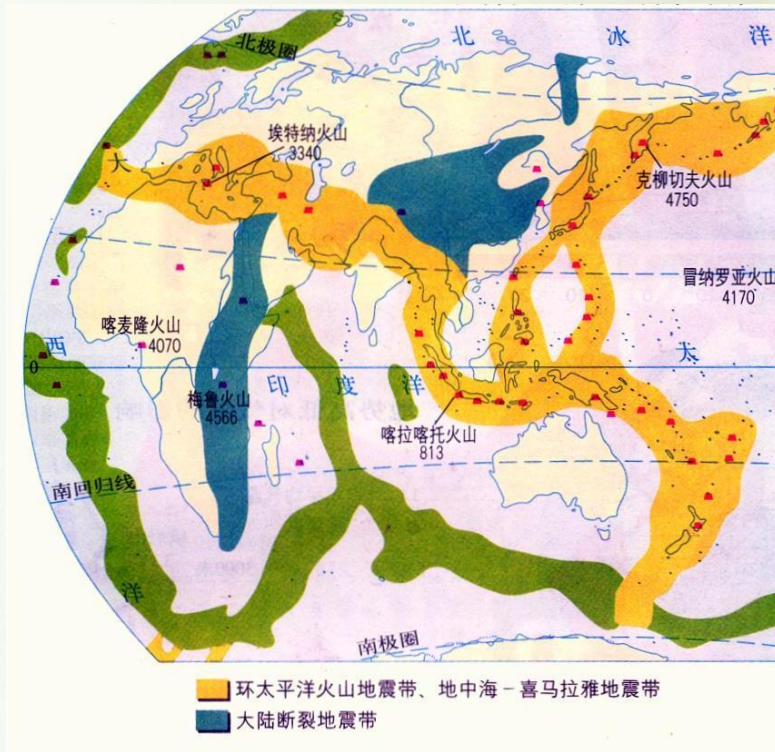
➤ 植物适应的特殊性

Specificity of plant adaptation



植物地理特征的交错性

Intersecting geographic characters of vegetation



Volcano Distribution

- The Pacific Rim volcano belt
- Mid ocean ridge volcano belt
- The East African Rift Zone volcano
- Alps - Himalaya volcano belt

Intra-continental Volcano

中国植被区划图 VEGETATION REGIONALIZATION MAP OF CHINA

比例尺 1:6 000 000



- Greater Khingan Mountains
- Lesser Khingan Mountains
- Songnen Plain.

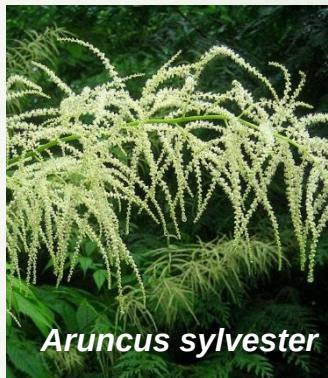


植物的丰富性和多样性

Diversity and abundance in Plant

五大连池位于大兴安岭寒温带落叶针叶林区系和小兴安岭温带针阔混交林植被区系交界处，是典型的生态交错区，增强了其多样性。

Wudalianchi is located within the ecotone between the Great Hinggan Mountains, the Less Hinggan Mountains and the forest steppes of the Songnen Plain. There are intersecting geographic characters of vegetation, extensive floral components and high relative species richness.





五大连池是独立的大陆火山地，跨越了一些生物地理区域，具有丰富的生境多样性（很多火山，不同年代的熔岩，古老的地表，其它火山地面，湿地和湖泊等），因此增强了其多样性。

The WDLC is an isolated continental volcanic field that happens to straddle several biogeographic zones. The extreme habitat diversity (many volcanoes, lava of many ages, other volcanic surfaces, presence of very ancient surfaces not by lava, wetlands, lakes, etc.) , leads to relatively high species richness.





植物适应的特殊性

Specificity of plant adaptation

矮曲林

Dwarf forests





植物适应的特殊性

Specificity of plant adaptation

石塘林

The stone pools

Larix gmelinii

Picea spp.



植被演替的原生性与完整性

The primary and the integrity of vegetation succession

As the primary succession caused by the volcanic eruption is a little bit complex, and it is required to have stages such as the lichen - moss - herb - shrub – tree in the lava bare ground, due to moisture and weathering in exposed lava, the succession to the climax community need hundreds of years' or even millions of years' evolutionary process.



Moss and Lichen



Herb community



Shrub community



Pioneer forest community



Transitional forest community



Stable forest community



□ 五大连池简介

Introduction for Wudalianchi

□ 生态研究价值

Study on the Ecological Value of Volcanoes

□ 目前开展的工作

Recetly work

□ 展望与未来

Future Prospects



目前开展的工作 Recetly work

- ❑ 五大连池植物种类及组成
Plant species and composition in WDLC
- ❑ 植物进化与环境协同作用
Plant evolutionary and environment synergies
- ❑ 土壤微生物多样性-稳定性关系
Microbial diversity-stability relationship in Soil
- ❑ 火山植物多样性和土壤驱动机构
Volcanic plant diversity and soil drive mechanish
- ❑ 火山植物功能性状与功能多样性
Volcanic plant functional traits and diversity





黑龙江省
科学院
Institute of Natural Resources And Ecology.HAS

自然与生态研究所
Institute of Natural Resources And Ecology.HAS



研究目的与意义

Purpose and significance

对五大连池不同历史年代火山植物演化和植被演替过程的研究，试图揭示200万年以来植物演化和生态演替过程、及其环境协同机制，为温带大陆环境火山植物和植被的演替提供重要的科学依据。

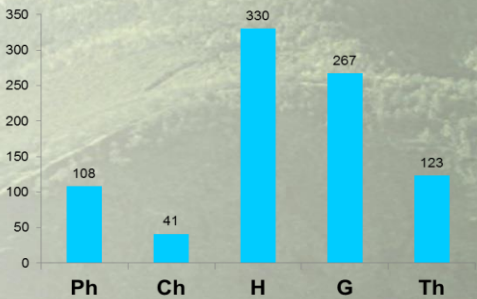
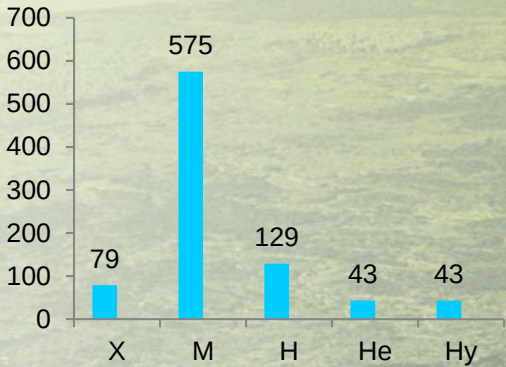
The research try to reveal the plants and vegetation evolutionary history in the 200 0000 years, which provid important scientific evidence for the evolution of plants and vegetation in temperate continental environment under primary succession by volcanic eruption.



研究结果 Results

五大连池植物种类及组成 Plant species and composition in WDLC

- 植物组成
Plant species composition
- 生活形特征
Plant life form characteristics
- 生态型特征
Plant ecotype characteristics
- 植物属的分布
Distribution types of genera



	family	% in family	genus	% in genus	specie	% in specie
Gymnosperm	2	2.02	5	1.36	7	0.81
Angiosperm	Dicotys	78	281	76.15	671	77.22
	Monocots	19	83	22.49	191	21.98
In all	69	100	369	100	869	100

研究结果 Results

火山植物多样性及环境协同性

volcanic vegetation diversity and environmental synergy

利用“空间代替时间”的研究方法，对不同历史年代火山植物及植被恢复进行研究，物种多样性的变化规律符合“中间干扰假说”。

By “space replacing time” method, volcanic plants and vegetation restoration in different time was studied, the change rule of species diversity is fit for “The intermediate disturbance hypothesis”.

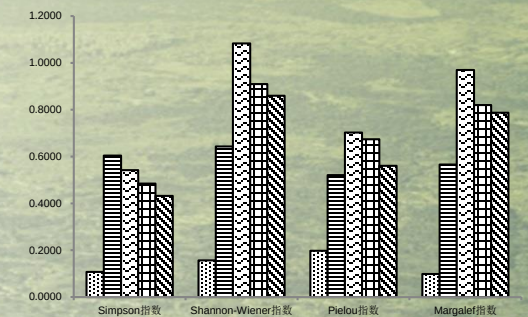


图1 不同历史年代火山植物群落α多样性指数

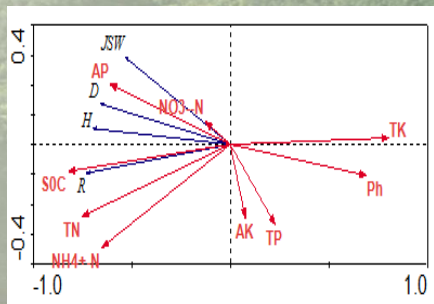


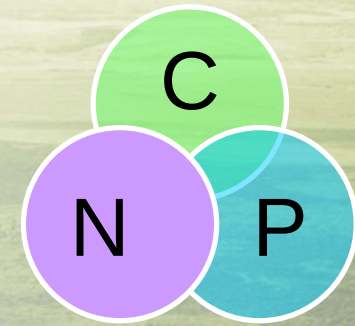
图2 物种多样性与土壤发育因子的RDA二维排序图





研究结果 Results

火山植物功能性状与功能多样性 Volcanic plant functional traits and diversity



随着火山喷发后恢复期的增加，不同历史年代火山植物叶片全碳含量先增加后减小。

With the increase of restoration phase after volcanic eruption, the carbon content of volcanic plant blade was increased first and decreased later in different times.

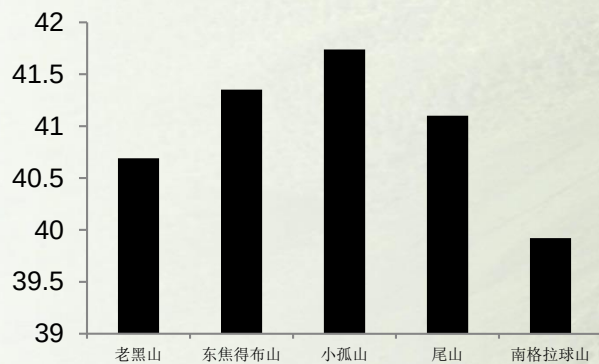


图3 不同历史年代火山植物叶片全碳含量变化

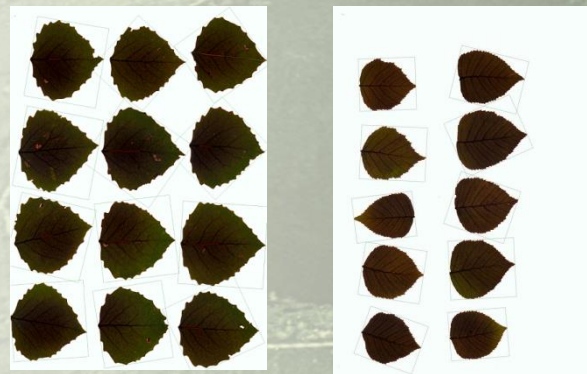


图4 白桦、山杨叶片扫描图片





研究结果 Results

火山土壤微生物及其环境驱动机制

Volcanic soil microbial and environment driving mechanism

MRT分析表明：土壤有机碳、全磷、全钾和铵态氮等显著影响火山生态系统土壤微生物群落结构。

MRT analysis shows volcanic soil that soil microbial community structure was affected by organic carbon, total phosphorus, total potassium and ammonium nitrogen.

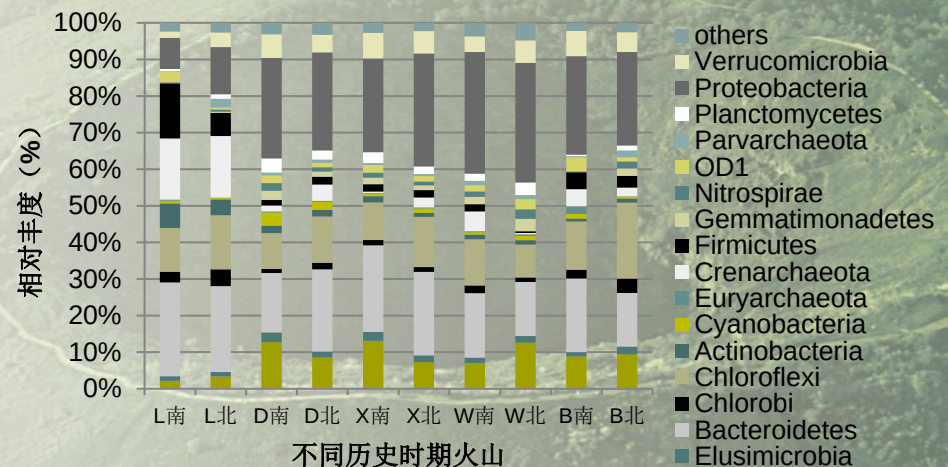
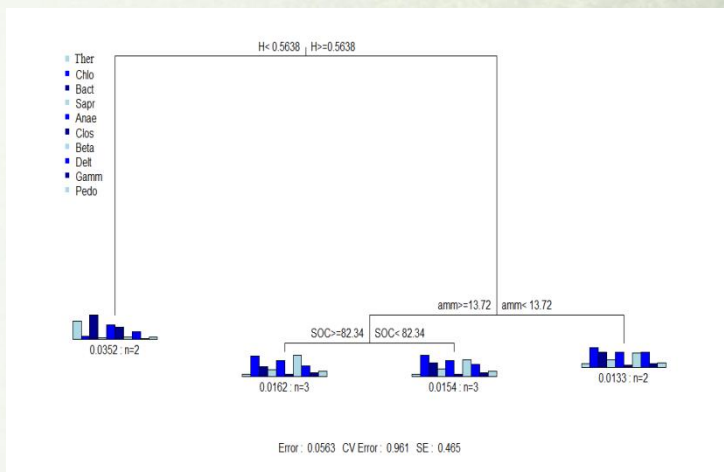


图5 植物 α 多样性与土壤理化性质对土壤微生物主要纲水平影响的MRT分析



□ 五大连池简介

Introduction for Wudalianchi

□ 生态研究价值

Study on the Ecological Value of Volcanoes

□ 目前开展的工作

Recetly work

□ 展望与未来

Future Prospects



展望与未来 Future Prospects

➤ 火山植被生态及其全球变化响应

Vegetation Ecology and its responses to global change in Wudalianchi

➤ 火山微生物多样性与稳定性关系

Microbial diversity-stability relationship in Wudalianchi

➤ 火山植物进化与环境协同性

Plant evolutionary and environment synergies





Thanks!





黑龙江省
科学院
Institute of Natural Resources And Ecology.HAS

自然与生态研究所
Institute of Natural Resources And Ecology.HAS



United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO



UNESCO HIST-HB

Welcome to wudalianchi

