中芬合作 Sino-Finnish Cooperation

CHINA EUROPE Water Platform

SYKE

PYHÄJÄRVI INSTITUUTTI

TBA

基于水资源综合管理的湖泊生态修复项目（第一阶段）成果介绍

Integrated Water Resources Management Based Lake Restoration (InteRest)〞

2019.11.21 Shanghai




汇报提纲 OUTLINE

I 项目背景
Background

II 项目组织及进展情况
Project Progress

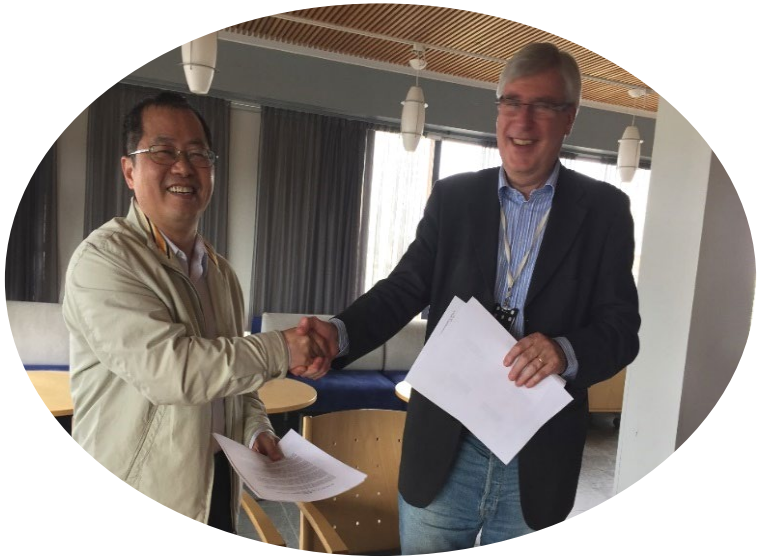
III 项目主要研究成果
Cooperation Research Results

IV 下阶段合作研究计划
Future plans

一、项目背景 Background

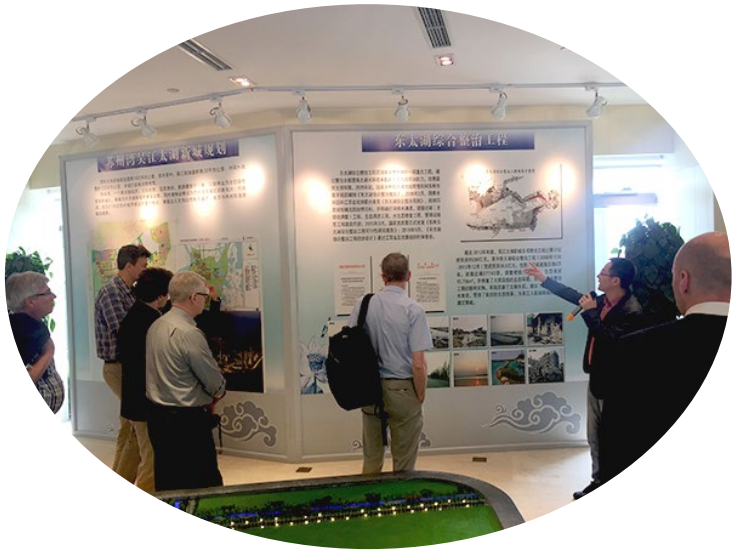
2014.2 水利部与芬兰农业与林业部签署水资源领域合作备忘录

MOU between the Ministry of Agriculture and Forestry of the Republic of Finland and the Ministry of Water Resources of People's Republic of China.



2015.5.5 中芬联委会第一次会议明确，太湖局作为中方牵头单位，就“基于水资源综合管理的湖泊生态修复”主题与芬兰开展技术交流与合作，在中国的太湖和芬兰的皮海湖开展对比研究

It was agreed TBA and SKYE as partners for the cooperation project “Integrated water resources management based lake restoration” according to the Minutes of the first meeting of JSC



2015.5.7 芬兰农业与林业部副司长凯·凯特拉一行考察太湖流域，与太湖局专家就项目合作方向进行初步探讨

Delegation of Finland visited Taihu Basin, and discussed general cooperative directions with TBA experts

二、项目组织及进展情况
Project Progress

2015.12-2016.5

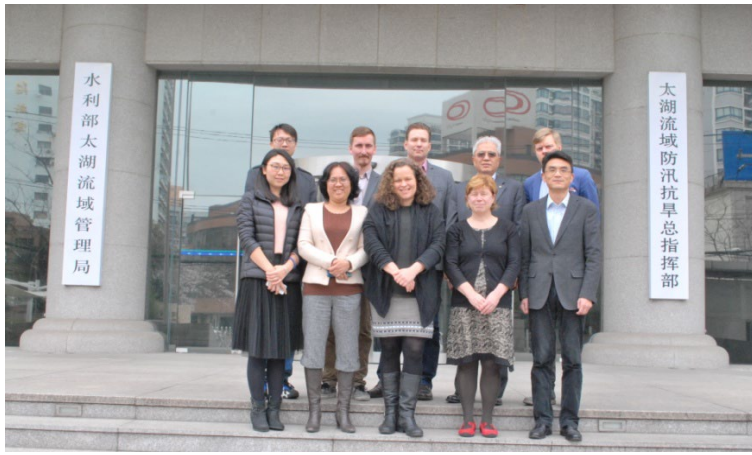
太湖局、芬兰环境研究院、皮海湖研究所等专家共同编制形成项目建议书，由中芬联委会第2次会议通过

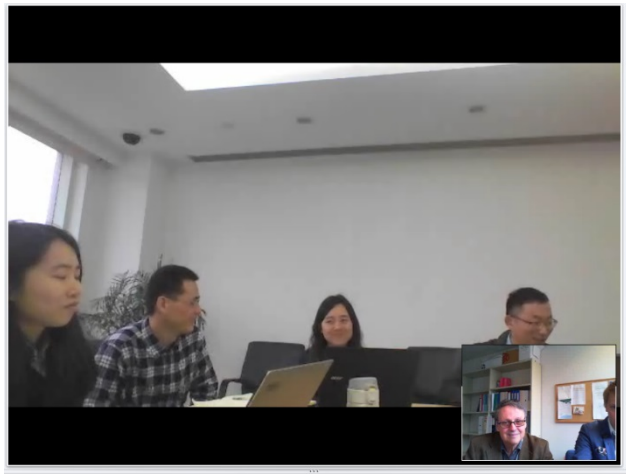
The two sides jointly established the proposal of "Integrated water resources management based lake restoration (InteRest)", which was adopted by The second Meeting of the JSC in Turku, Finland

2016-2019

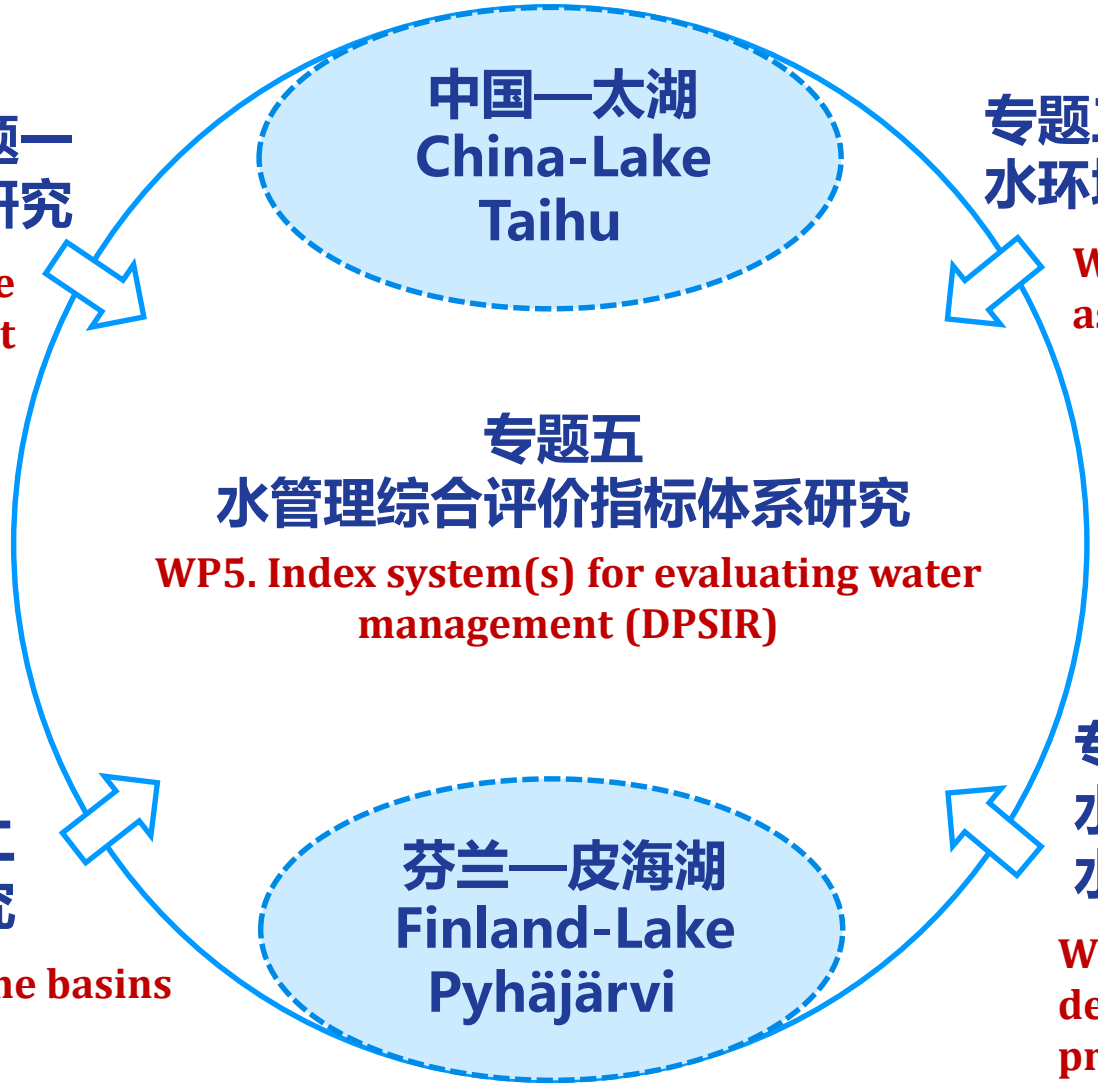
双方开展了十余次交流互访及项目讨论，并通过视频及邮件往来加强日常沟通，交流太湖流域和皮海湖流域水环境治理经验，加深双方对湖泊生态修复工作的理解，拓展工作视野与思路。

There were multiple mutual exchanges organized and planned, for discussion of the project progress and exchange of experience on water environment management in Lake Taihu and Lake Pyhäjärvi



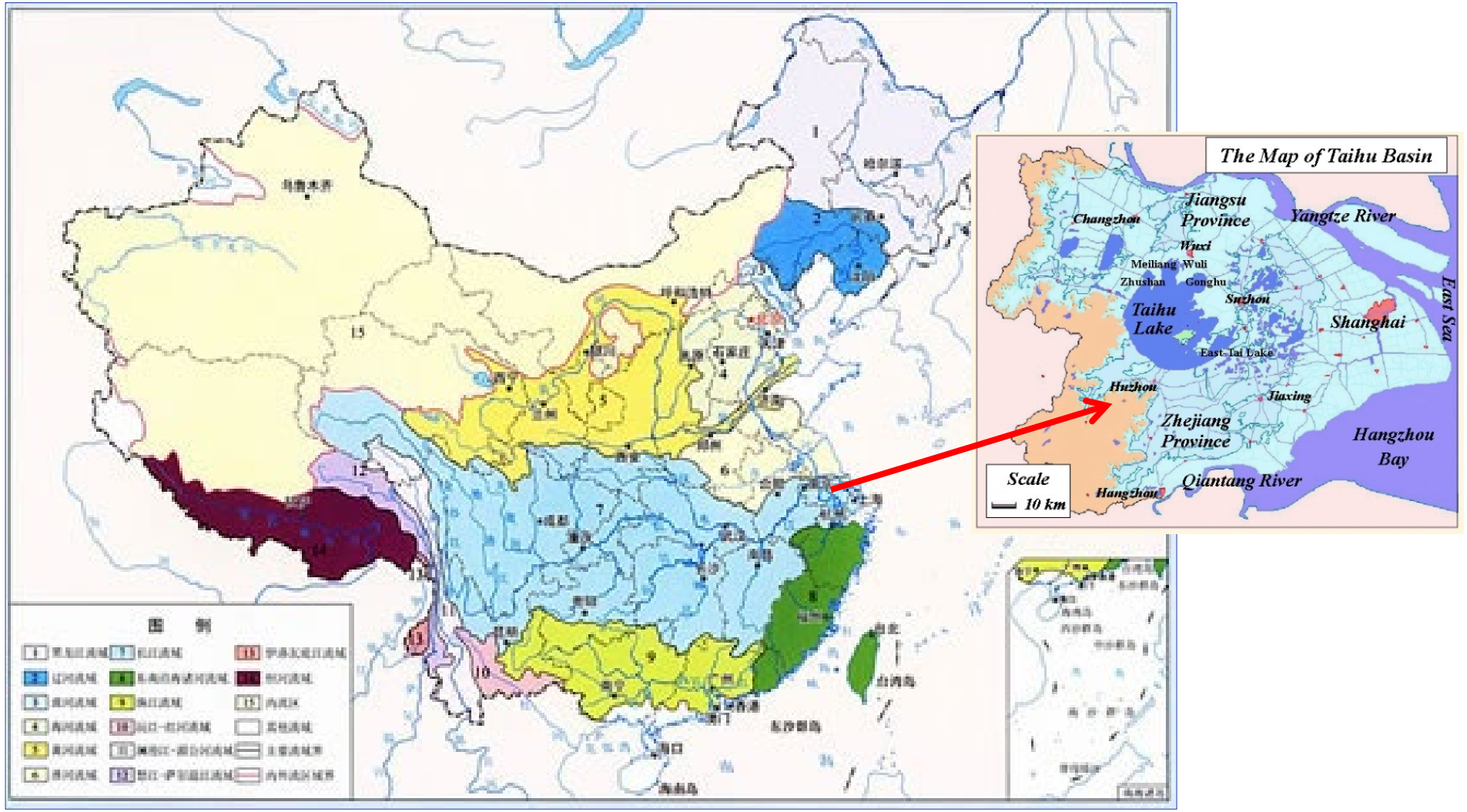


二、项目组织及进展情况 Project Progress



三、项目主要研究成果

太湖流域概况
Basic situation of Taihu basin



流域面积:
36,895 km²

太湖面积:
2338 km²

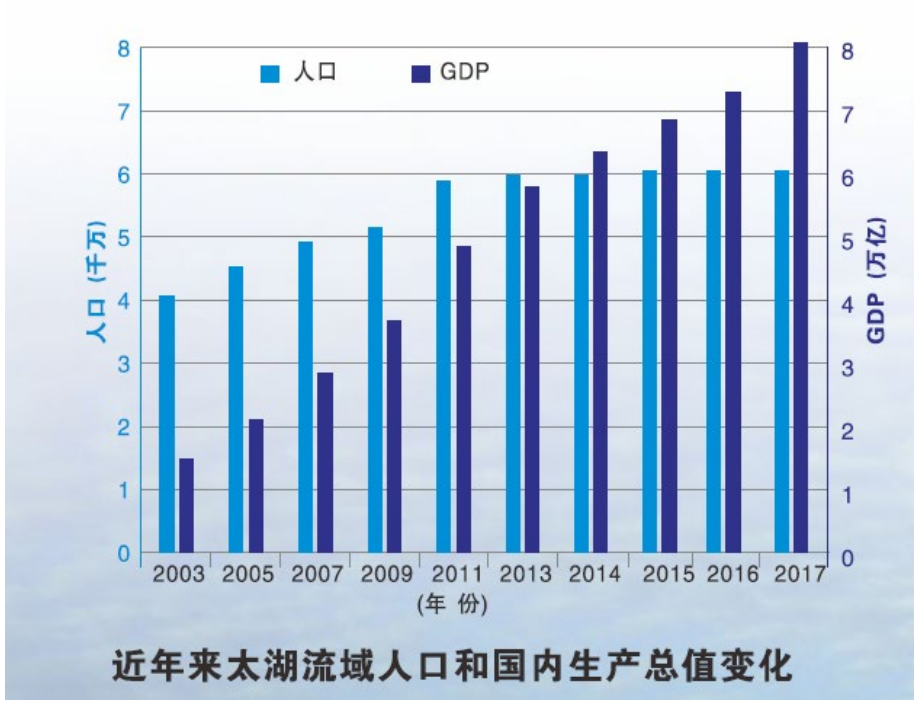
Catchment area:

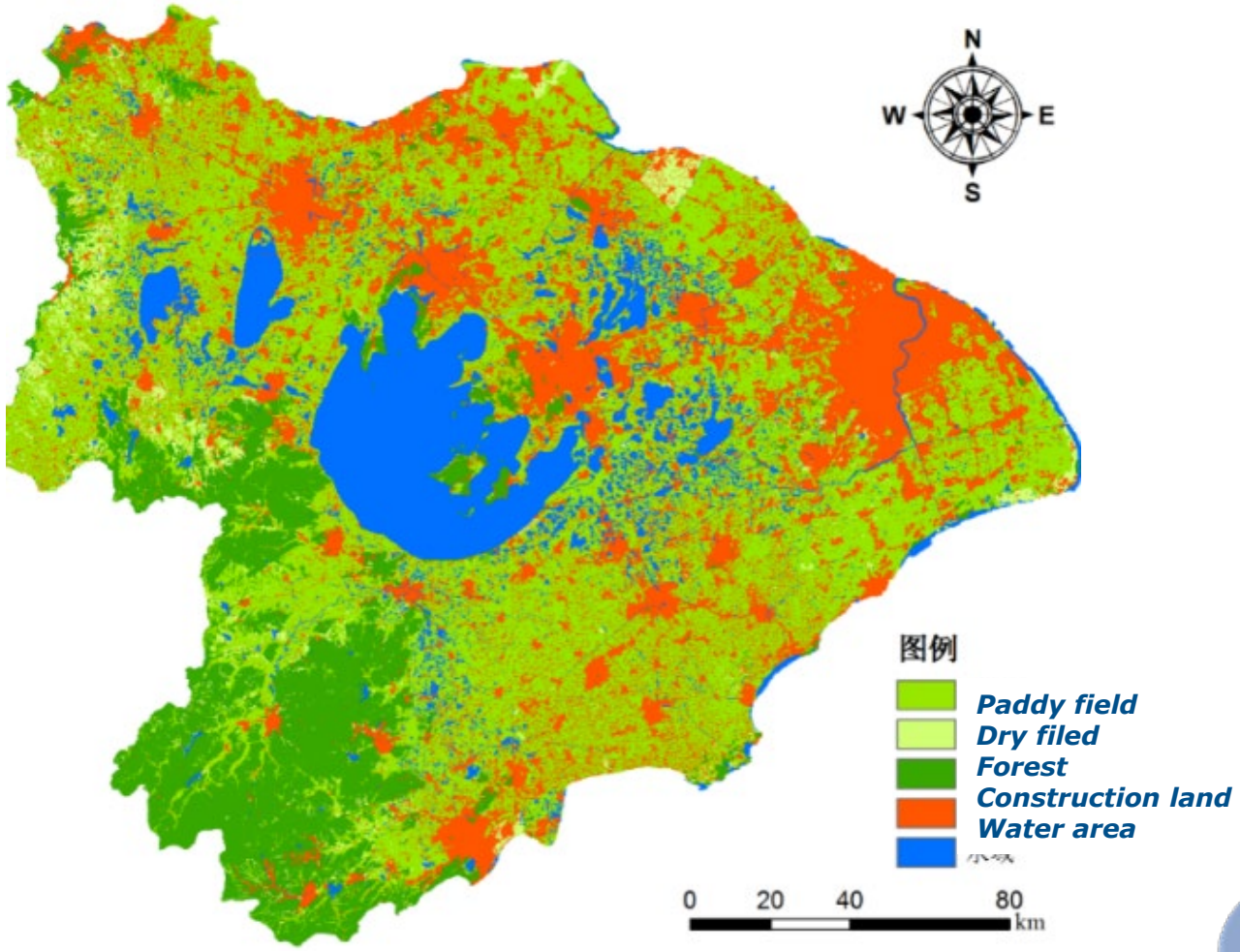
36,895 km²

Taihu Lake area:

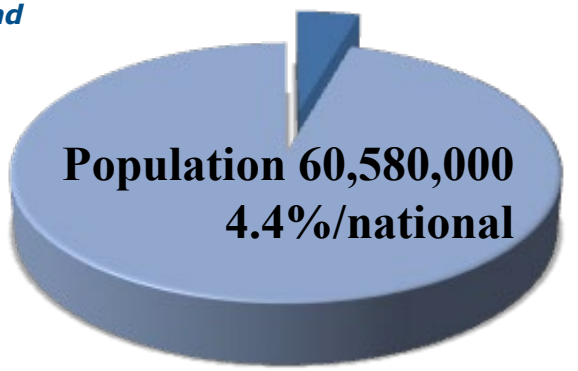
2,338 km²

Change of population and GDP(2003-2017)





Land use of Taihu basin in 2010



Year 2017

近年来，太湖流域一直受到富营养化问题的困扰，2007年太湖蓝藻曾大规模暴发引发无锡饮水危机，通过开展流域水环境综合治理河湖水质已有好转，但由于湖体藻型生境尚未得到有效改变，未来太湖仍有蓝藻大规模暴发的可能。

Pea soup. Hans Paerl samples cyanobacteria in ailing Taihu Lake.

ECOLOGY

Doing Battle With the Green Monster of Taihu Lake

In attempting to subdue a vicious algal bloom, scientists aim to restore the health of a major lake in China and hone strategies for heading off toxic soups elsewhere

TAIHU LAKE, CHINA—As the motorboat glides through a carpet of fetid algae, Hans Paerl leans over the side and scoops up some of the tea-green muck with a plastic sampling bottle. In early June, a bloom of cyanobacteria, also called blue-green algae, fanned out across Taihu, China's third-largest lake. The growth was unchecked when a team led by Paerl, a cyanobacteria expert at the University of North Carolina, Chapel Hill, arrived last month to help colleagues at the Nanjing Institute of Geography and Limnology combat the foul bloom.

Much is at stake. Taihu, fed by the Yangtze River, helps irrigate millions of hectares of grains and cotton in a lush agricultural region between Shanghai and Nanjing. When it's healthy, the lake also provides drinking water for more than 2 million people, and it sustains one of China's most important fisheries for crabs, carp, and eels. The bloom that has turned Taihu into a toxic nightmare shows no signs of abating and may last until winter, experts say.

The ecological drama has far-reaching consequences. "It's safe to say that it's a pretty serious problem, and not just in China," says Paerl. At one time a villain largely confined to small lakes, algal blooms have of late gotten serious footholds in larger water bodies. Paerl warns that lakes such as Victoria in Africa and Erie and Okeechobee in the United States could be on the brink of becoming perennial algal soups.

That could pose a grave health risk. Some cyanobacteria, such as *Microcystis aeruginosa*, make toxins that can damage the liver, intestines, and nervous system. "Toxic cyanobacteria in drinking-water supplies pose a direct threat to public health," says Brett Neilan of the University of New South Wales in Sydney, Australia. Microcystis causes symptoms including diarrhea and liver failure. Reining in the algae at Taihu, Neilan says, could help prevent disasters elsewhere.

It wasn't long ago that Taihu enjoyed a cleaner reputation. A popular 1980s song, "Taihu Beauty," boasted of "white sails above the water, green reeds along the water, fish and shrimp below the water." Back then, says Paerl, Taihu rarely suffered blooms. Now they arrive like clockwork every summer, forcing locals to resort to bottled drinking water.

The root cause of Taihu's ills is an accumulation of nutrient-rich sewage and agricultural runoff in the shallow lake. That resulted in severe eutrophication: a surfeit of minerals and organic nutrients that nourishes algal growth. Unusually hot, dry conditions in early summer appear to have been the spark that ignited this year's bloom.

After the bloom reached nightmarish proportions 2 months ago, cleanup crews skimmed more than 6000 tons of algae from the lake and laid a polyvinyl chloride barrier to prevent algae from getting swept into pipes that funnel water to a drinking-water plant. But some organisms still seep through, says Qin Boqiang of the institute in Nanjing, and currents cannot flush away algae in water enclosed by the barrier.

Simply "cleaning out the algae" will not solve the problem, says Qin. He emphasizes the need to reduce nutrients, especially phosphorus and nitrogen, in the agricultural runoff and sewage. Paerl and Qin are conducting experiments to determine how much nutrient concentrations must fall to arrest a bloom. They also hope to unravel the dynamics of bloom formation. "The reason we developed this collaborative effort is that we have similar problems in the United States," says Paerl. "We thought, 'Why not combine our expertise?' "

Other researchers are probing the molecular biology of cyanobacteria toxins. With global temperatures rising, warmer surface water leads to less mixing, which favors the growth of toxic cyanobacteria. Deciphering the toxins' biological role and how the environment influences their production may suggest strategies for making blooms less venomous, Neilan says.

Cyanobacteria have a long history of acquiring remarkable adaptations, such as nitrogen fixation and gas vesicles that keep them afloat and enable them to outcompete diatoms and green algae for light and nutrients. They can lie dormant in extreme conditions—surviving droughts and freezing—then roar to life when conditions improve. Cyanobacteria are "very tough," Paerl says. "They're the cockroaches of lakes."

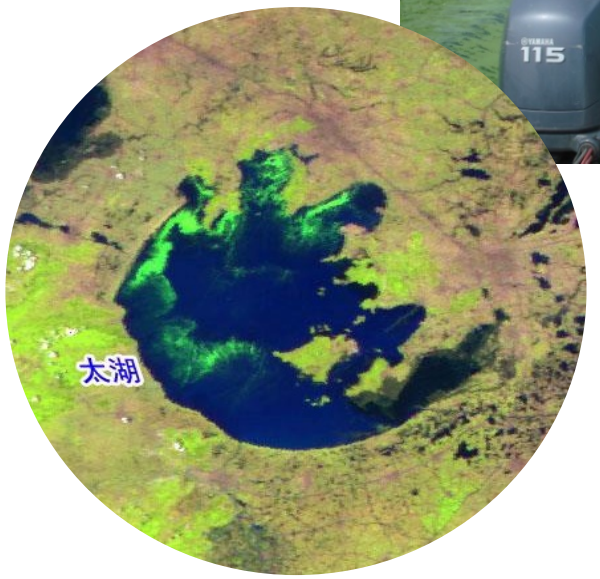
To control Taihu's little green pests, the government in the nearby city of Wuxi crafted an aggressive recovery strategy. The plan promulgates tough emissions standards for phosphorus and nitrogen for factories near Taihu and requires the installation of facilities that remove nutrients from sewage. Nutrient-rich agricultural runoff would be stemmed by banning chemical fertilizers, pesticides, and detergents that contain phosphorus or nitrogen. The amount of clean water pumped from Taihu is projected to reach 1 million tons per day by the end of 2008, and industries in Wuxi must meet a water-recycling rate of 78% by 2010.

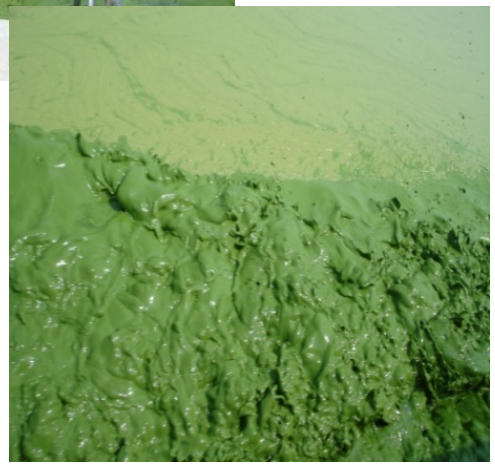
"There's no doubt that Taihu is going to be a challenge," says Paerl. Degradation of the lake's water quality was a slow-motion train wreck that played out over several decades. It may take many more years to banish the blooms and bring back the Taihu Beauty of yore.

–LUCIE GUO

Lucie Guo is a freelance writer based in Boston.

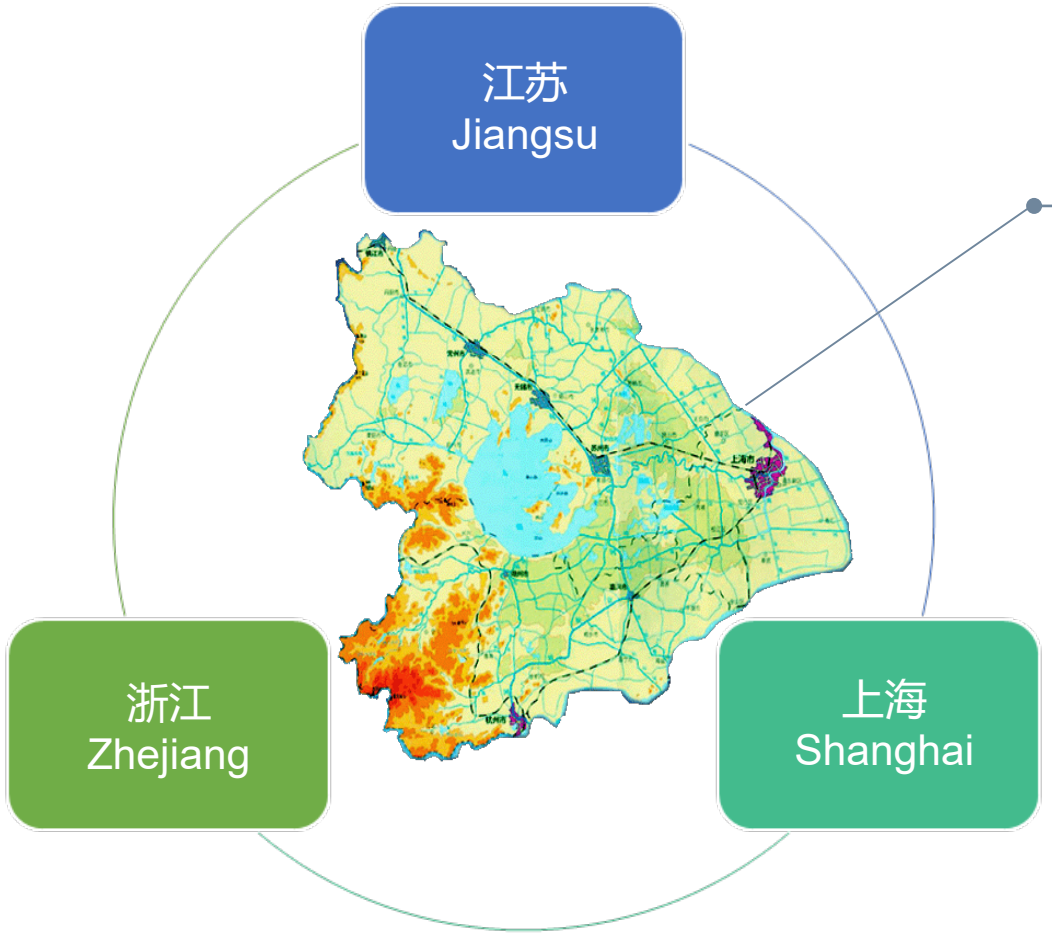
CREDIT: HANS PAERL





《太湖流域水环境综合治理总体方案》
Master Plan for comprehensive Management of Water Environment in Taihu Basin

还太湖一盆清水
Restore clear Taihu lake



The "Two Guarantees" goal

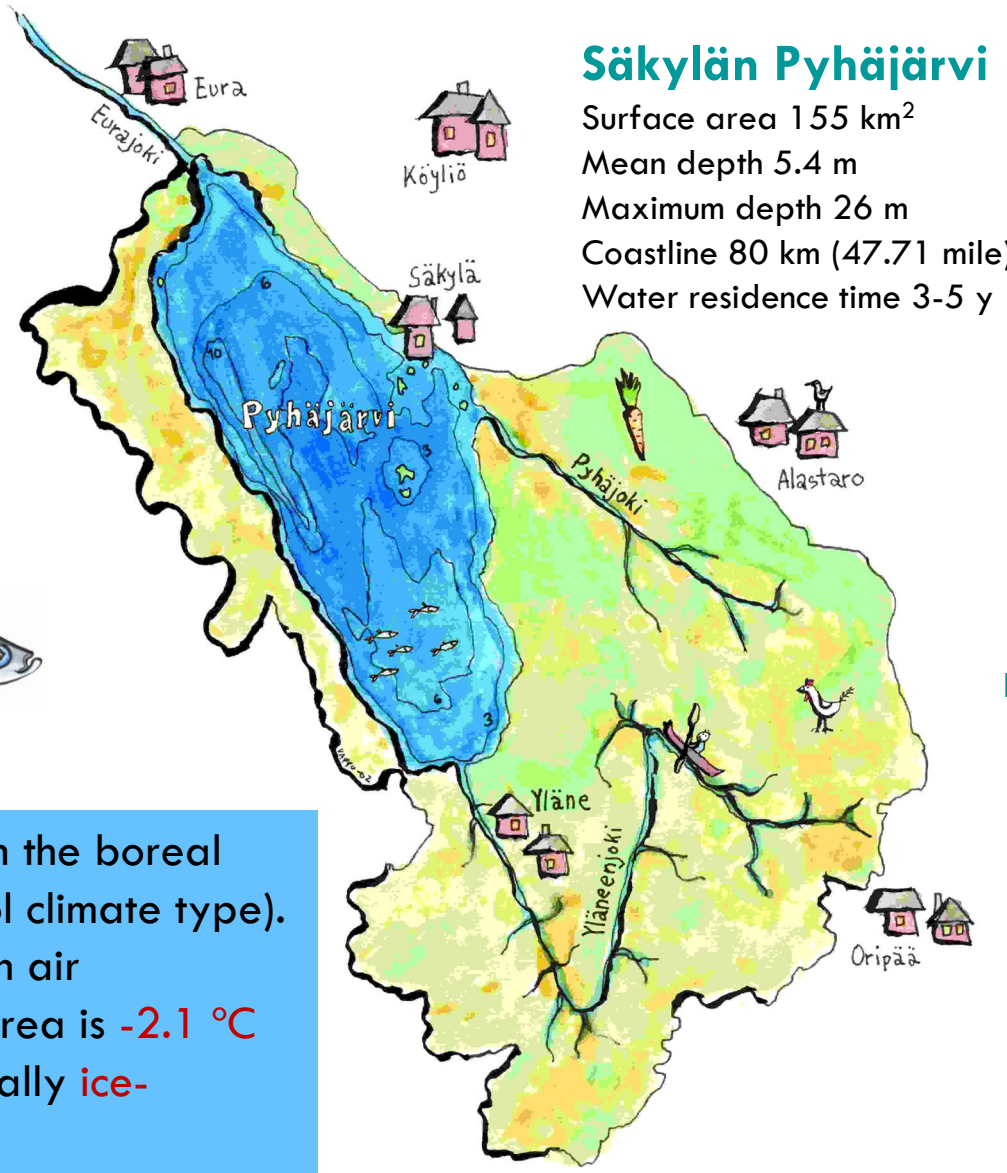
确保饮用水安全
Guarantee the drinking water safety
确保不发生大面积湖泛
Guarantee no large area of foul water caused by Cyanobacteria bloom

2008—2020

指导太湖流域水环境综合治理的行动纲领和基本依据

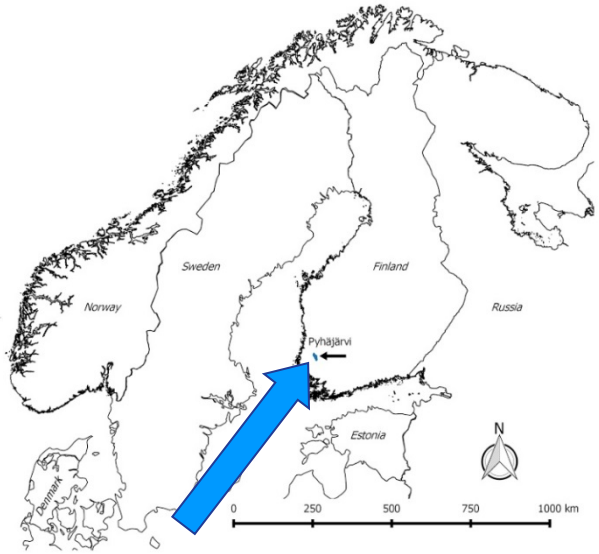
Guidline and fundamental basis for comprehensive management of water environment in Taihu Basin before 2020

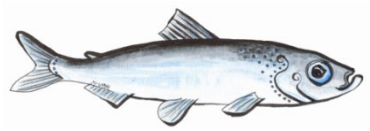
皮海湖概况 The basic situation of Lake Pyhäjärvi



Säkylän Pyhäjärvi

Surface area 155 km^2
Mean depth 5.4 m
Maximum depth 26 m
Coastline 80 km (47.71 mile)
Water residence time 3-5 y





The lake is located in the boreal temperate zone (cool climate type). The winter time mean air temperature in the area is -2.1 ℃ and the lake is normally ice-covered in winter.

Drainage basin area

Total 61,500 ha
River Yläneenjoki 23,400 ha
River Pyhäjoki 7,750 ha
Remaining area (small sub-basins) 14,950 ha

- **皮海湖主要的入湖河流**

南部的Yläneenjoki河（集水区234.0 km^2）

东部的Pyhäjoki河（集水区77.5 km^2）

- **主要的出湖河流**

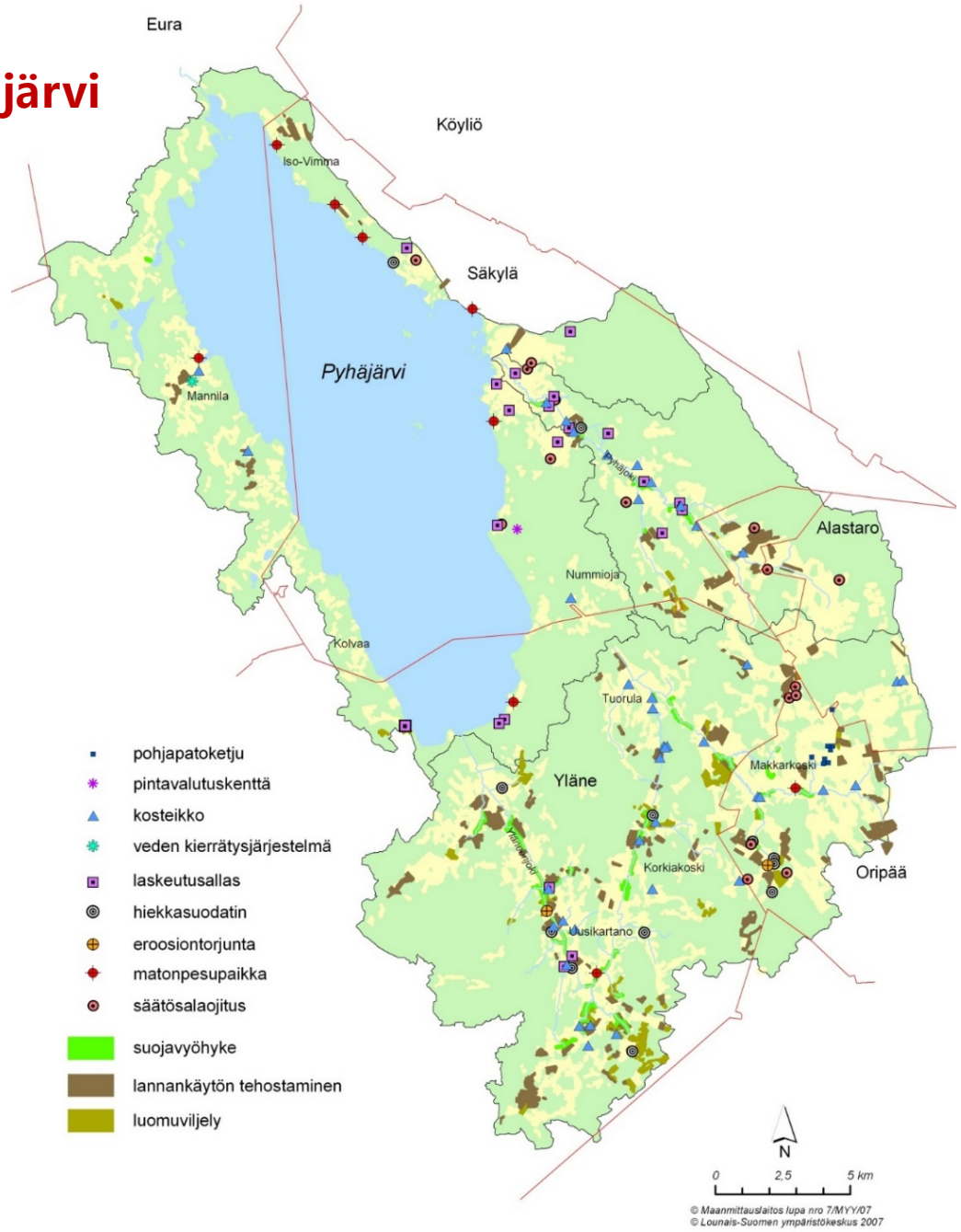
北部的埃乌拉约基（Eurajoki）河，流向Bothnian海

皮海湖概况 The basic situation of Lake Pyhäjärvi

The total population of Pyhäjärvi basin was 27389 in 2016. There were 6900 people in Säkylä, 12000 people in Eura and 8489 people in Pöytyä.
2016年，皮海湖流域总人口27389人，其中，Säkylä 6900人，Eura 12000人，Pöytyä 8489人。

Main industrial enterprises in Pyhäjärvi basin are paper making industry and food processing industry.
芬兰西南部是一个重要的粮食生产区，工业企业以造纸业和食品加工业为主。

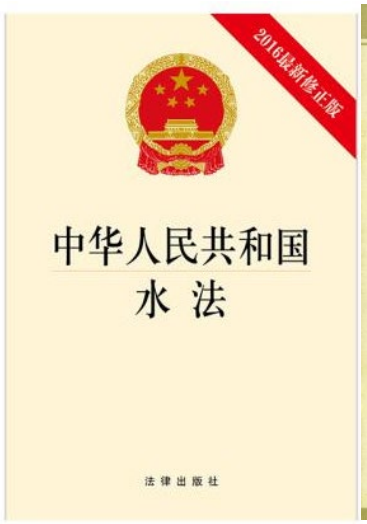
Utilization of water resources in Lake Pyhäjärvi include tourism, recreation activities and fishery.
皮海湖内相关涉水行业主要有旅游和养殖业等。

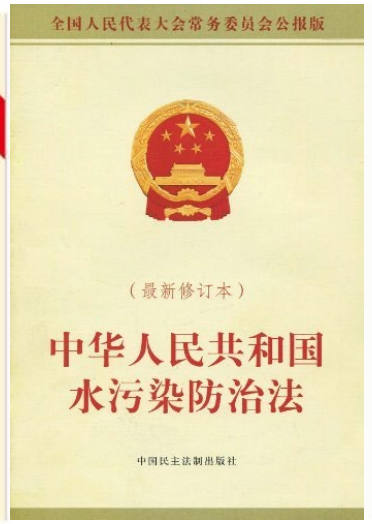


（一）水管理政策对比研究

WP1. Comparison of governance of the water management

- 收集相关的法律、法规、指导性文件、背景信息和水管理相关规划，并与涉水管理人员、利益相关方沟通
- Relevant laws, regulations, guidance documents, background information and water management related plans were collected, and communicate with water management personnel and stakeholders
- 制定了对比研究模板
- A comparative study template was developed.





法律法规 Legislation	许可制度 Permitting System	利益相关方 Key actors and stakeholders
政府与社会合作模式 Public-Private Partnership	水管理目标 Environmental objectives	水管理单元 management units

（一）水管理政策对比研究

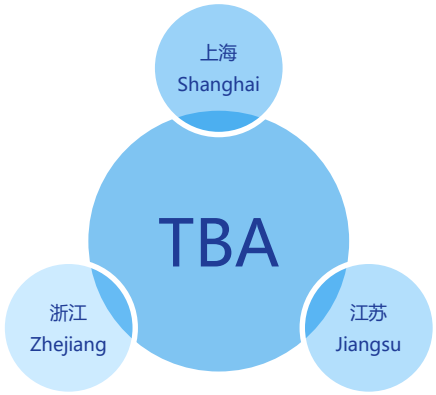
WP1. Comparison of governance of the water management

Both lakes have strong network of participation of actors.

- In Taihu basin, the watershed management coordination mechanism has different levels of participation from provincial and inter-ministerial level to municipal level.
- In Lake Pyhäjärvi, the stakeholder participation is strong both in regional cooperation group of South Western Finland, and in Local stakeholder group including local municipalities, companies and other interested parties.

太湖和皮海湖的管理都形成了较强的参与者网络结构。

- 在太湖流域，流域协调管理机制得到来自省级、部际到市级等不同程度的参与。
- 在皮海湖流域，芬兰西南部的区域合作组织以及当地利益相关组织包括当地市政府、企业和其他感兴趣的组织群体等利益相关方的参与性都很强。



Ympäristöministeriö
Miljöministeriet
Ministry of the Environment

SYKE

Luke
NATURAL RESOURCES INSTITUTE FINLAND

Ministry of Agriculture and Forestru of Finland

Centre for Economic Development, Transport and the Environment

CHINA

- **Key actors:** MWR（中国水利部），TBA(水利部太湖流域管理局), Provincial Water Administrative Departments(省级水行政管理部门)
- **Stakeholders:** Goverment, water user, the public, research department

FINLAND

- **Key actors:** Ministry of Environment and Ministry of Agriculture and Forestry, National Research Institutes
- **Stakeholders:** National river basin management work other ministries, VARELY, SYKE, Municipalities of Eura, Säkylä, Pöytyä, Oripää, Loimaa and Rauma

（一）水管理政策对比研究

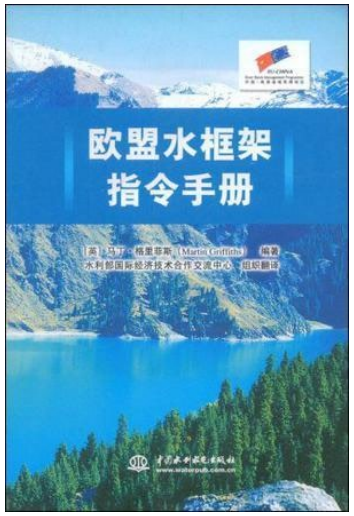
WP1. Comparison of governance of the water management

The regulative framework for water environment protection is strong in both countries.
两个国家都建立了较强的水环境保护监管框架。

In Lake Taihu:

- National Water law, Water pollution prevention and control law, and Environmental protection law
- Permit system
- River(Lake) Chief System

太湖流域——有水法、水污染防治法以及环保法，辅以流域管理的区域性法规。许可证制度在环境影响的监管中也得到了使用。此外，新近建立起来的“河长制”对于许可的监管具有巨大的影响并且提升了监管体系。



《供水法》（119/2001）

《健康保护法》（763/1994）

《环境保护法》（2014）

《流域管理和海洋战略组织法》（1299/2004）

《水法案》（587/2011）

In Finland

- EU legislation
- Strict permit procedures and regulative framework

芬兰——欧盟法律已被实施为国家层面法律，并且是为预防人类活动带来的环境影响来制定标准和基准的。此外，许可程序是及其严格的，一般来说对于较大项目其新许可将会被带到法庭上解决，这通常需要花费好几年的时间。

（一）水管理政策对比研究

WP1. Comparison of governance of the water management

Despite the strong regulative frameworks, some development would be still needed to the legislation.
除了强有力的监管框架，法律法规体系仍然需要一些提升。

- There may be need to tighten the water quality norms of municipal and industrial waste waters, and to have all facilities under the regulative system. The supervision of permit system needs more resources to make it more efficient.
- This is also the case in Finland, the supervision of permits is not effectively finding possible offences of permit conditions.
- The Finnish legislation should be re-evaluated in order to facilitate the review of existing environmental and water permits on the grounds of environmental objectives in river basin management (Belinskij et al. 2019).

需要提高市政和工业污水的水质标准，并且将所有的产污设备置于监管体系之下。许可证制度的监管也需要投入更多的资源以使其更为有效。在芬兰，上述情况同样存在，许可证监督并不能有效地发现可能违反许可证的情况。此外，人们已经意识到，为实现流域管理的环境目标，需重新审视现有的环境和水许可制度，并重新评估芬兰的法律法规体系(Belinskij et al. 2019)。

（一）水管理政策对比研究

WP1. Comparison of governance of the water management

PPP model

- In Finland the PPP model of Lake Pyhäjärvi is one of the first cases private companies have been voluntarily participating to lake restoration.
- The “intermediate organisations” are crucial in connecting the local people and actors with private companies and other stakeholders.
- The model is capable of running a continuous portfolio of restoration projects, and getting funding from external sources to support the local work on water environment conservation

However…

- The challenge of communication needs to be overcome. How to get the private companies involved, and understand the indirect benefits related to the “investment”. The private actors need to be more tightly engaged through direct meetings and stakeholder groups.

- 在芬兰，皮海湖的PPP模式是私营企业自发加入到湖泊生态修复的第一批案例中的一个。所谓的“中间组织”的作用，比如皮海湖研究所，它在连接当地人民、管理者和私营企业以及其他利益相关方方面，是很关键的。这个模式可以为一个修复项目运行连续投资组合，从外部来源获取投资来支撑地方水环境保护工作。
- 然而，为了在欧洲和中国成功推广皮海湖的PPP模式，必须克服交流方面的障碍。如何吸引私营企业入局，并使其理解投资产生的间接利益？这些私人参与者需要更紧密地参与到直接的面谈、会议和利益相关方组织中去。

（一）水管理政策对比研究

WP1. Comparison of governance of the water management

- The information sharing between actors. Sometimes it is difficult to get the sufficient information even inside the state administration, from different administrations.
- In Taihu the participation of NGOs and the public is not very strong.

- 另一个挑战是利益相关方之间的信息共享。有时，即使在国家行政管理体系内部，也很难从不同的管理部门得到足够的信息，比如农业，更不用说第三方，如私营企业、大学和研究机构，以及非政府组织。
- 在太湖流域，非政府组织和公众的参与并不强。

（一）水管理政策对比研究

WP1. Comparison of governance of the water management

Suggestions 建议

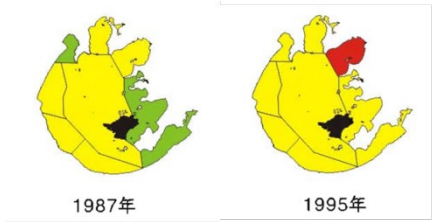
- Strengthening the implementation of the legislation, and more developed methods and resources for supervision.
- Improving engagement of actors and stakeholder and information sharing.
- Promotion of PPP model in lake restoration and bringing the indirect benefits visible.

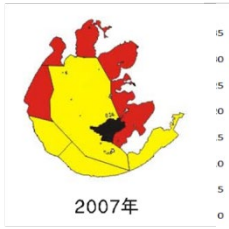
- 强化法律法规实施、完善监管方式和资源
- 提高管理者和利益相关方的参与和信息共享
- PPP模式在湖泊修复中的推广及间接效益的显现

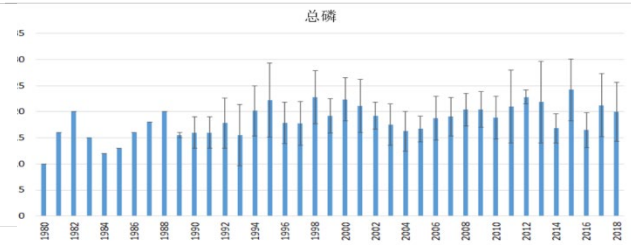
（二）：流域特征对比研究 WP2. Characteristics of the basins

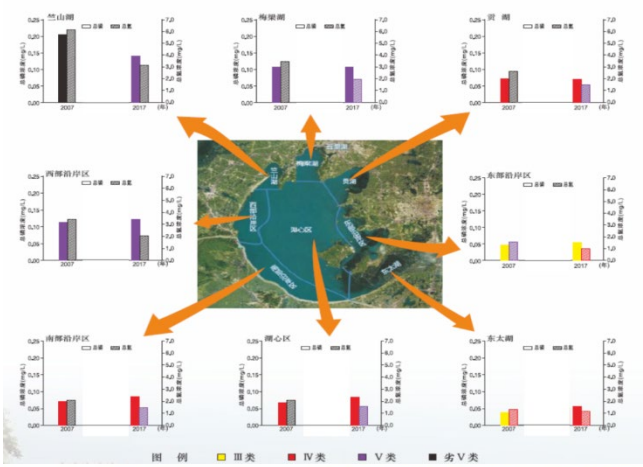
- 收集整理太湖流域和皮海湖流域相关资料
- Relevant data and reports about the characteristics of the two basins were collected and analyzed.
- 创建流域特征对比研究模板，开展对比研究。
- A comparative study template was developed covering most of the characteristics.

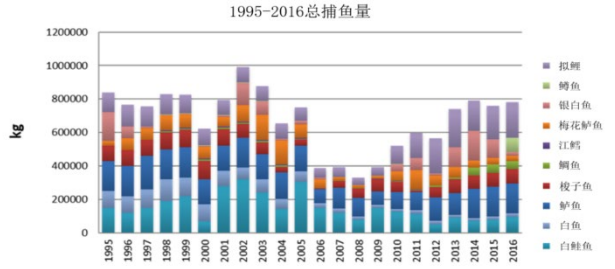
水文特征对比分析 Comparison of hydrological characteristics	水资源利用状况 Utilization of water resources
流域营养盐循环对比研究 Comparison of nutrient sources and fluxes (circulation) within the basins	湖泊生态系统对比分析 Comparative analysis of lake ecosystem

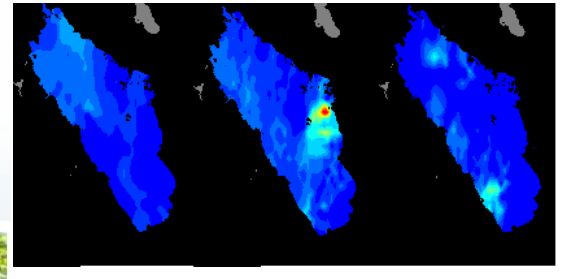






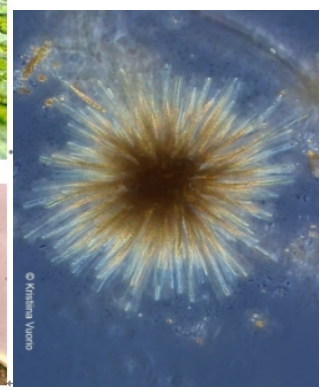






（a）微囊藻 （b）鱼腥藻

（c）小环藻 （d）直链藻

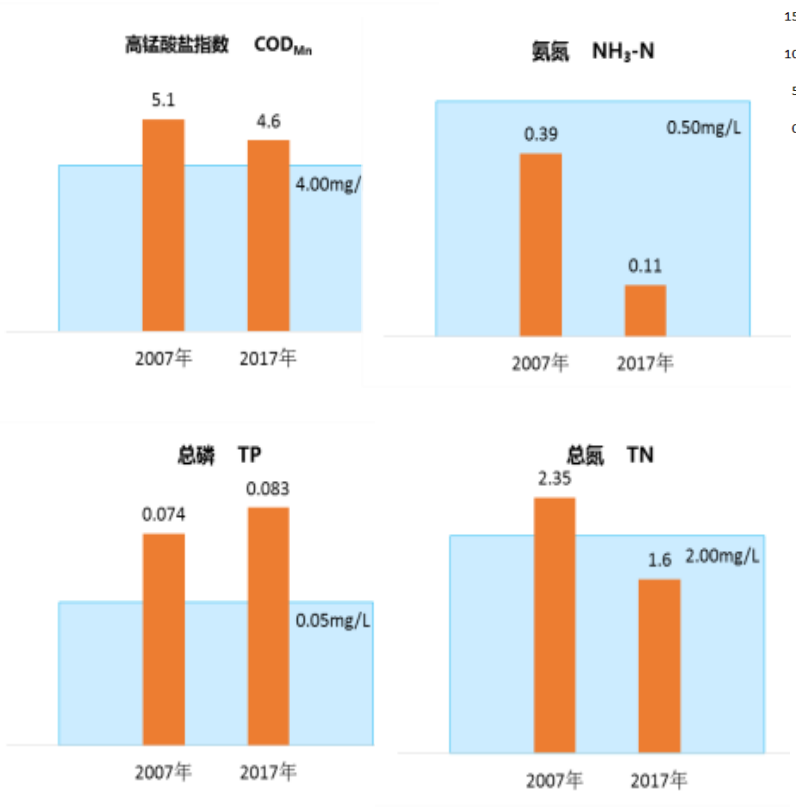


（二）：流域特征对比研究

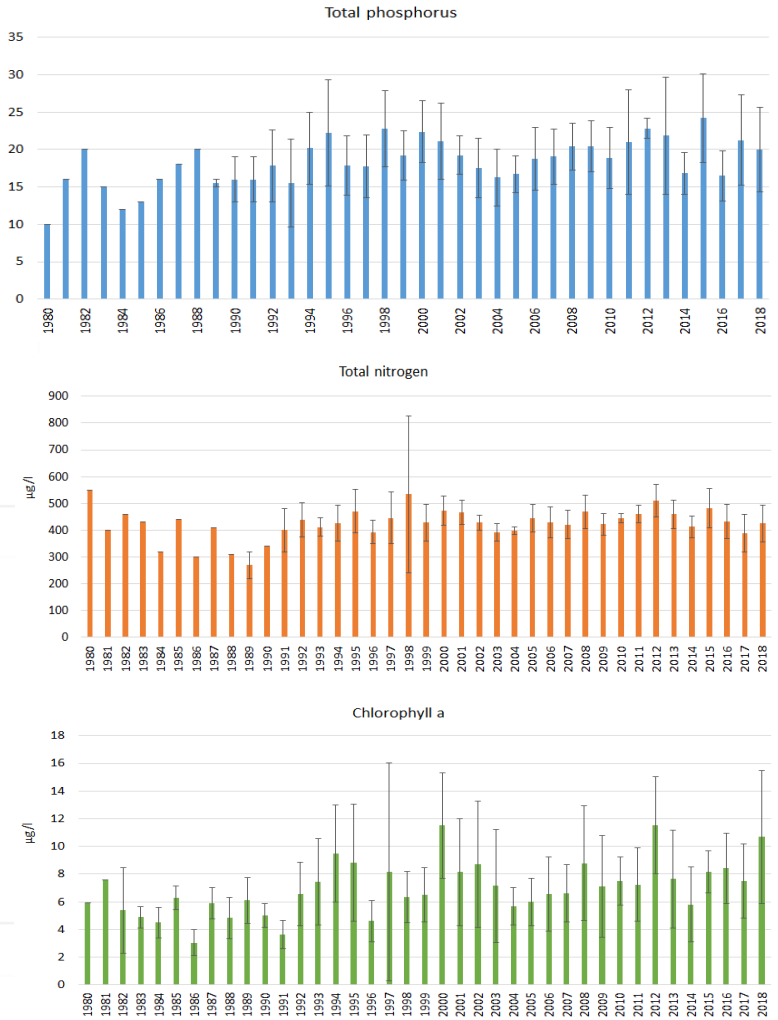
WP2. Characteristics of the basins

- The ecosystems of Taihu and Pyhäjärvi are well studied and there is a good knowledge base for the actions.
- In Taihu, many monitored variables indicate that the water quality has improved.
- In ecological status classification, Lake Pyhäjärvi is between good and moderate. The general usability of the lake is excellent and fish production high.

太湖和皮海湖的生态系统都较好的研究基础和认知基础。目前皮海湖水生态处于良好和中等的状态。太湖的许多监测显示太湖水质已有所改进。



Water quality variables of Taihu (2007, 2017)



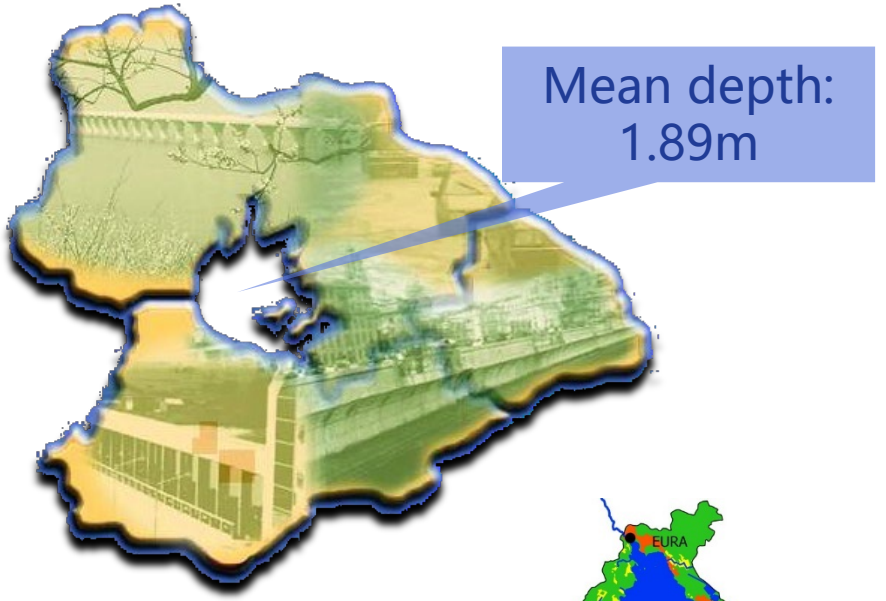
Water quality variables of Pyhäjärvi (1980-2018)

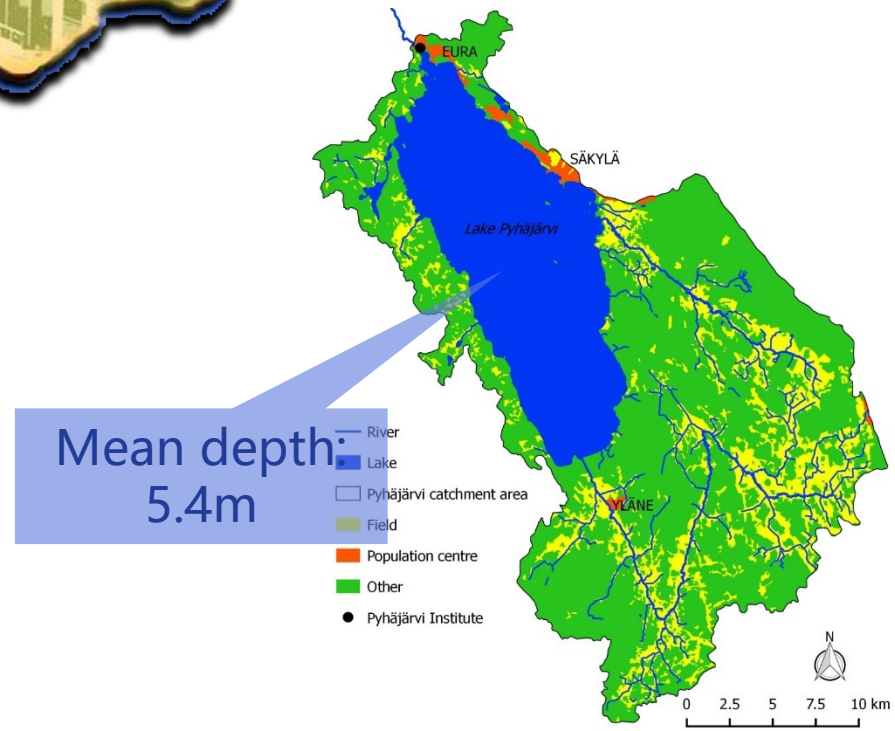
（二）：流域特征对比研究

WP2. Characteristics of the basins

- Both Taihu and Pyhäjärvi are and have been affected by human actions for centuries.
- They are very shallow and this makes them vulnerable for eutrophication. Shallowness magnifies the role of internal load and resuspension.

- 太湖和皮海湖都已经受到人类行为的影响，并已有数百年历史。
- 两个湖都很浅，这使它们容易富营养化。浅度会放大内部负载和重新悬浮的作用。



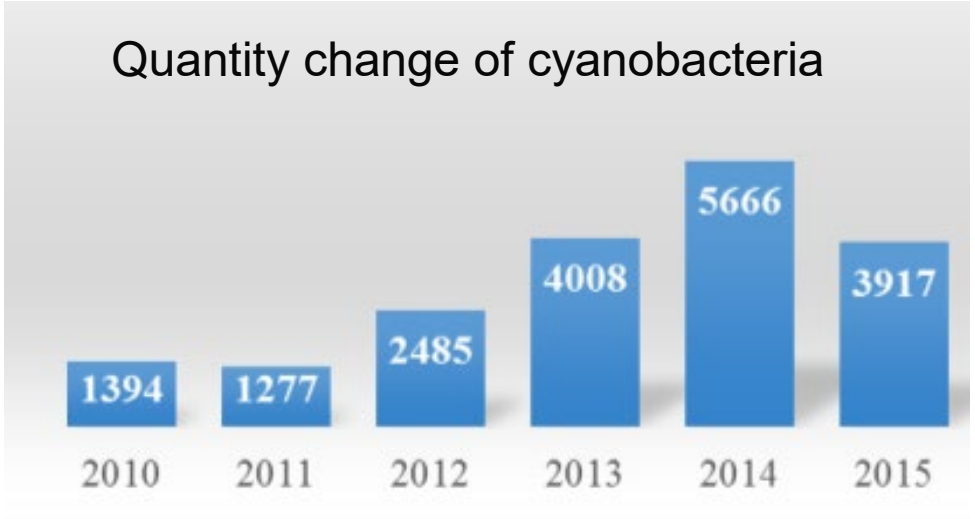


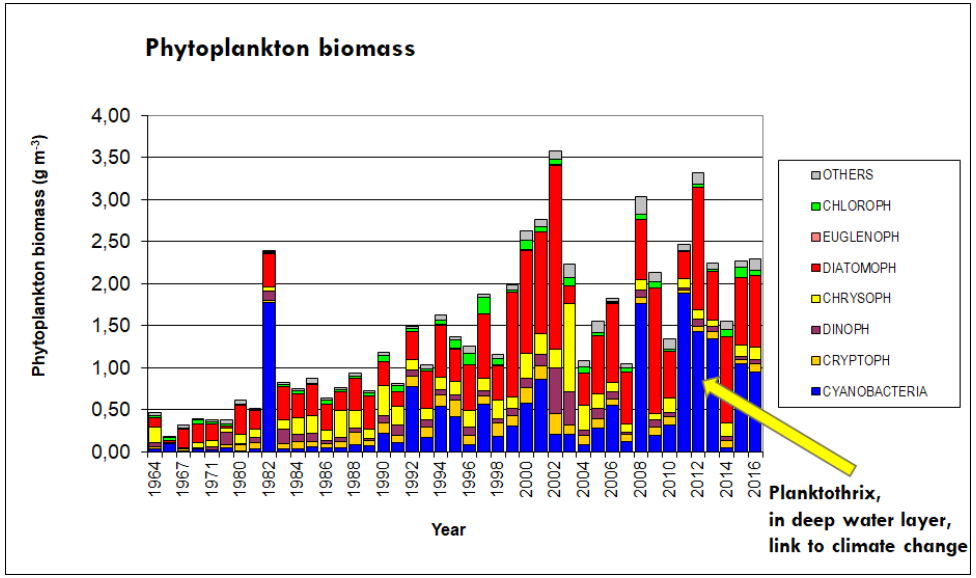
（二）：流域特征对比研究

WP2. Characteristics of the basins

- Phytoplankton is the most visible and significant indicator of eutrophication in both lakes.
- There are annually massive cyanobacterial blooms in Taihu and they are the topic of public concern.
- The share of cyanobacteria has also increased in Pyhäjärvi due to climatic changes since 1990's.
- Especially inedible species for zooplankton have increased and this is disturbing the classic zooplankton-phytoplankton top-down food chain control.

浮游植物是两个湖泊富营养化的最明显和最明显的指示。太湖每年都有大量的蓝藻繁殖，这是公众关注的话题。由于1990年代以来的气候变化，Pyhäjärvi中的蓝细菌份额也有所增加。特别是浮游动物不可食用的物种有所增加，这扰乱了经典的浮游植物-浮游植物自上而下的食物链控制。





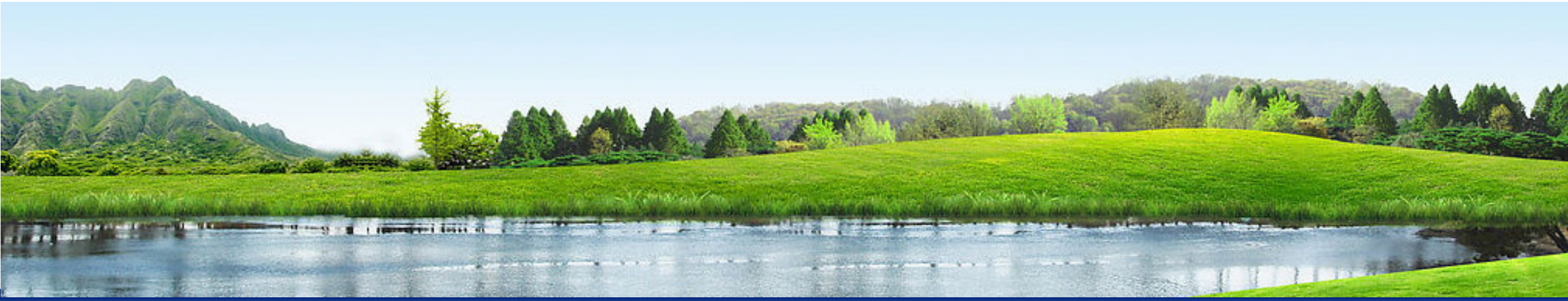
（二）：流域特征对比研究

WP2. Characteristics of the basins

Suggestions 建议

- To maintain the knowledge base of these ecosystems and share all the available information with all actors, including public.
- Understanding on ecosystem processes related to eutrophication should be further improved, especially those connected with internal loading, total phosphorus, phytoplankton and climate change impacts.
- Sufficient monitoring and research resources for this should be guaranteed.

维持现有的生态系统认知基础并与所有的相关方，包括大众共享所有的水质监测信息是十分重要的。进一步研究与富营养化相关的生态系统过程，特别是与内源、总磷、浮游植物及气候变化相关的。保障足够的监测及研究资源。



（三）水环境监测和评价方法对比研究

WP3. Monitoring and status assessment

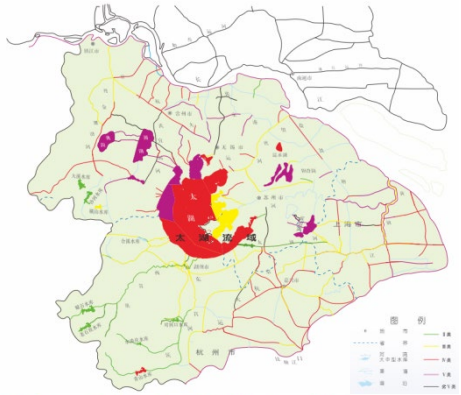
- 对比分析太湖流域、皮海湖流域水生态环境监测体系的现状情况及运行机制
- Current situation and mechanism of water ecological environment monitoring system in both basins were compared
- 研究中芬双方采取的湖泊水生态环境评价方法及评价指标，提出可能改进的方向和建议。
- The lake water ecological environment assessment methods and evaluation indicators adopted by China and Finland were studied, and possible suggestions for improvement are expected

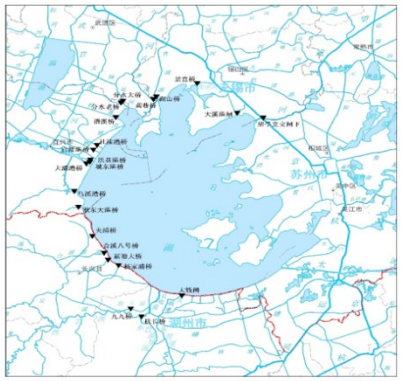
监测　Monitoring

监测站网　监测指标体系　监测频次
监测方法体系　监测体系运行机制

水质、水生态评价体系
Water quality and ecological evaluation system

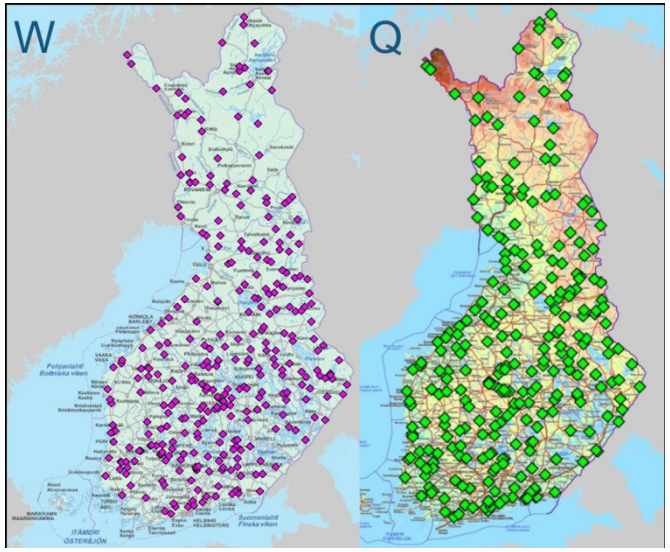
优化监测评价体系措施分析
Analysis of measures to optimize monitoring and evaluation system

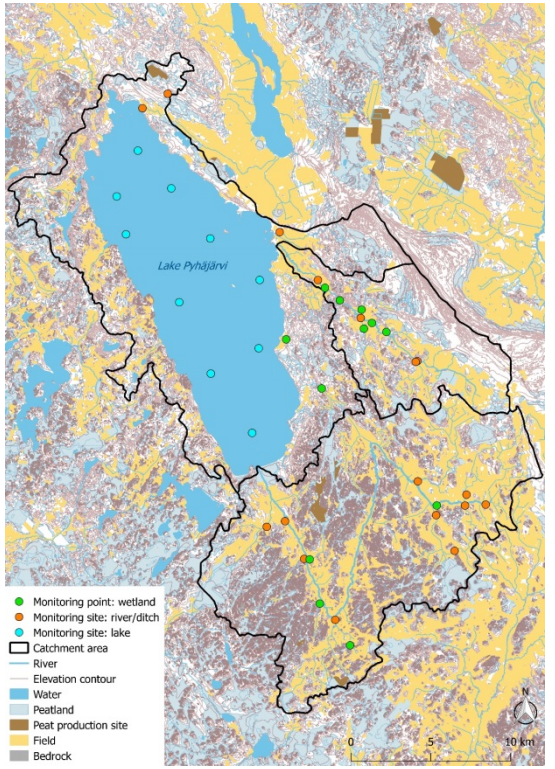




主要入太湖河道控制断面示意图

太湖湖区划分及监测站点分布示意图

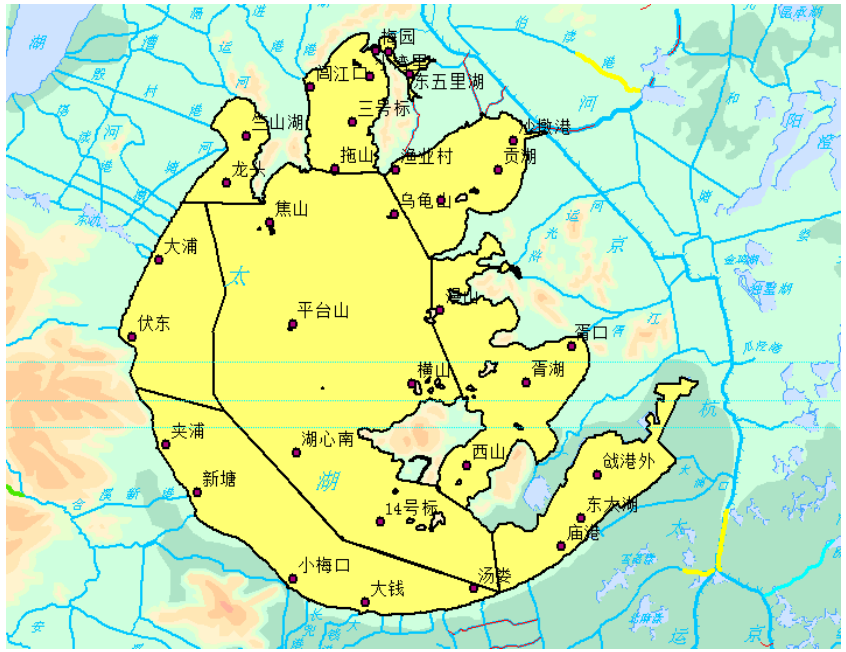




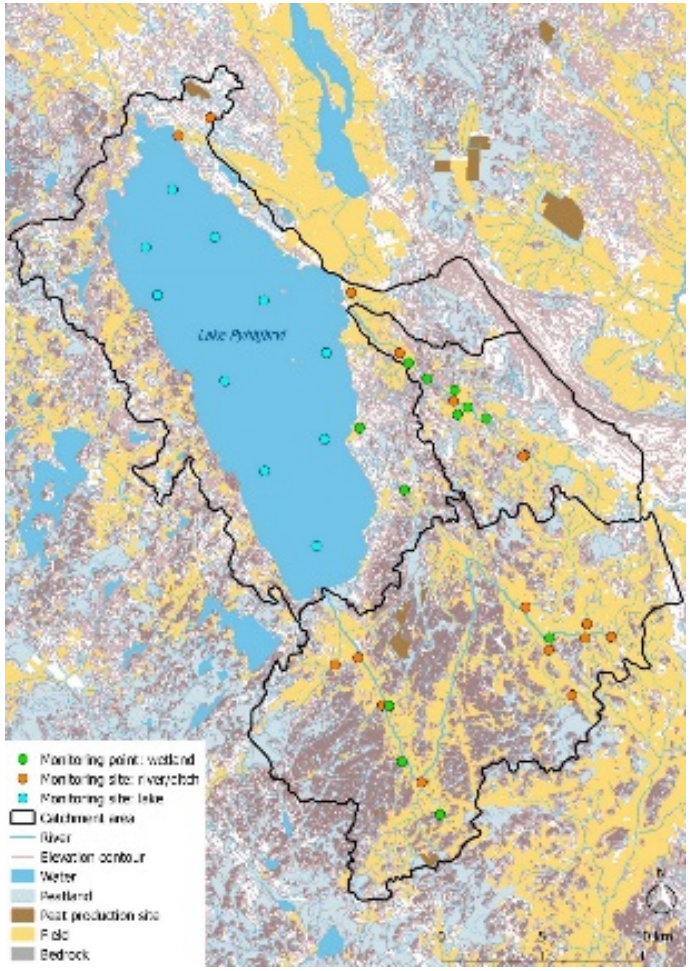
（三）水环境监测和评价方法对比研究

WP3. Monitoring and status assessment

- The monitoring for both Lake Pyhäjärvi and Taihu has been going on for decades and there are long time series, and good data from the past (many decades). Many parameters have been monitored and they have been used for the evaluation system for lake ecological status.
- There is currently possibility to use variety of monitoring methods like remote sensing, automatic measurements and water samples.
- 皮海湖和太湖的监测已经进行了数十年，而且时间序列很长，获取了几十年的良好数据。监测的众多参数在湖泊生态状况评估中得到很好的应用。当前应用的监测方法主要包括遥感，自动测量和水样监测等。



Monitoring sites in Lake Taihu



Monitoring sites in Lake Pyhäjärvi

（三）水环境监测和评价方法对比研究

WP3. Monitoring and status assessment

The evaluation system is well developed both in China and in EU.

湖泊生态评估体系在中国和欧盟均得到了很好的发展。

水体现状水质评价:
- 对照水质标准进行测站、水体水质状况评价；
- 在水质状况评价基础上，对照水质目标进行水功能区水质达标评价。

水生态评价：
- 生物多样性评价、生物完整性评价和河湖健康状况评价等。

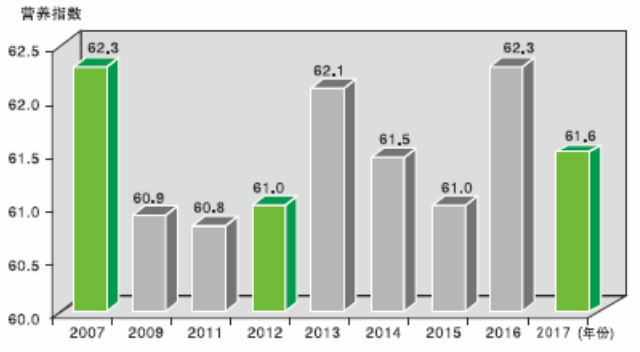
Status assessment for Lake Taihu

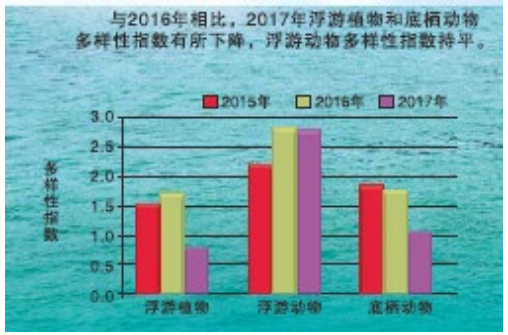
Water quality assessment :

- to evaluate the water quality of stations and water bodies according to water quality standards,
- to evaluate the water quality of water functional zones according to water quality objectives.

The evaluation of aquatic ecology:

biodiversity, biological integrity and health status of rivers and lakes.





（三）水环境监测和评价方法对比研究

WP3. Monitoring and status assessment

The evaluation system is well developed both in China and in EU.

湖泊生态评估体系在中国和欧盟均得到了很好的发展。

皮海湖状态评估：

- 根据种级监测数据计算出的指标可用于评估每个生物质量要素的状态，并根据所有指标确立了不同湖泊类型对应的国家参考条件（物种列表）、参考值和参考状态级别界限。
- 全国范围内的水体状态是根据国家指导方针和欧盟法律（水框架指令，WFD）的执行规定来分类的

Status assessment for Lake Pyhäjärvi

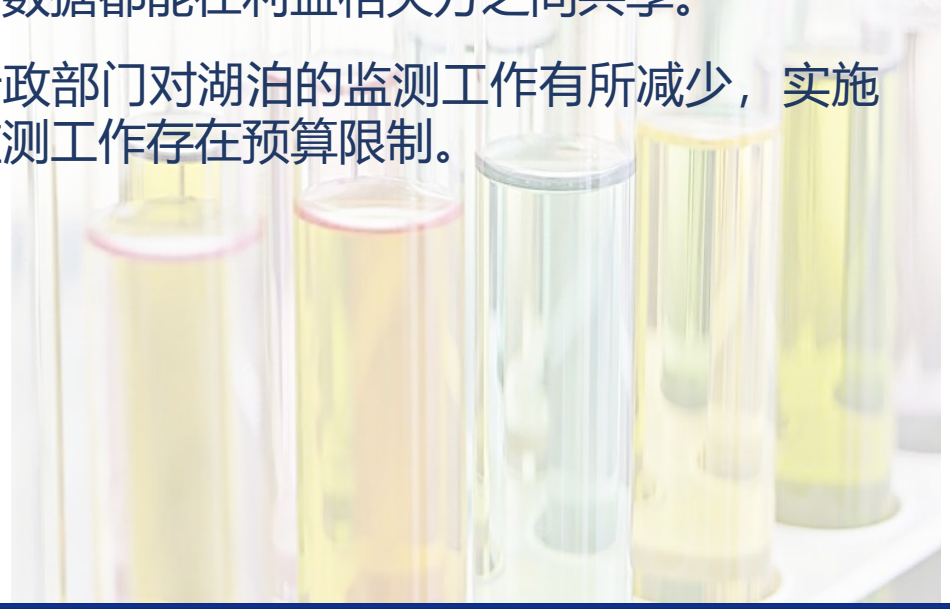
- The status of each of the **biological quality elements** is assessed by indices that are calculated from the species-level monitoring data. For all indices national reference conditions (species lists), reference values and status class boundaries have been established for different lake types.
- The **status classification** across the country is done based on national guidelines and legislation implementing the EU law (Water Framework Directive, WFD).

（三）水环境监测和评价方法对比研究

WP3. Monitoring and status assessment

- There are still many parts of lake ecosystems, which are very difficult to monitor. Generally, there is not enough resources for monitoring spatial and temporal variation.
- Algae bloom forecasting and warning system are big challenge especially in Taihu.
- There is not common database for Taihu results.In Finland, there is a common database where Pyhäjärvi data can be stored and shared. But not all collected data is shared between actors.
- In Finland, the lake monitoring made by administration has been under reductions and there has been budget limitations in implementing monitoring.

- 湖泊生态系统的许多部分仍然很难监测。通常，没有足够的资源来监视时空变化。
- 对于太湖来说，蓝藻预报和预警系统是一个巨大的挑战。
- 目前尚没有储存太湖监测数据的通用数据库。在芬兰，有一个公共数据库，可以存储和共享皮海湖的监测数据。当前，并非所有收集的数据都能在利益相关方之间共享。
- 行政部门对湖泊的监测工作有所减少，实施监测工作存在预算限制。



（三）水环境监测和评价方法对比研究

WP3. Monitoring and status assessment

Suggestions 建议

- It is very important to continue and further improve the long-term monitoring in both lakes. Resources for funding should be guaranteed.
- Establishment of ”environmental observatories” with intensive monitoring both in lakes and in surrounding catchments, for both spatial and temporal variation.
- More parameters (e.g. SS, DTP) should be included for river network monitoring.
- New cost-effective monitoring and data analysis methods should be taken into use. Continuous measurements with digital sensors should be made around the year, in Pyhäjärvi also under ice, which is still a technical challenge.

- 继续并进一步改善两个湖泊的长期监测非常重要，并应该保证资金来源。
- 需要建立“环境观测站”，并在湖泊和周围流域进行密集监测，以了解时空变化
- 应包括更多参数（例如SS，DTP）以进行河网监控。
- 应采用新的高效监测和数据分析方法，改善对内部污染负荷和蓝藻水华的监控。同时，建议对皮海湖使用数字传感器进行全年连续测量（包括结冰期）。

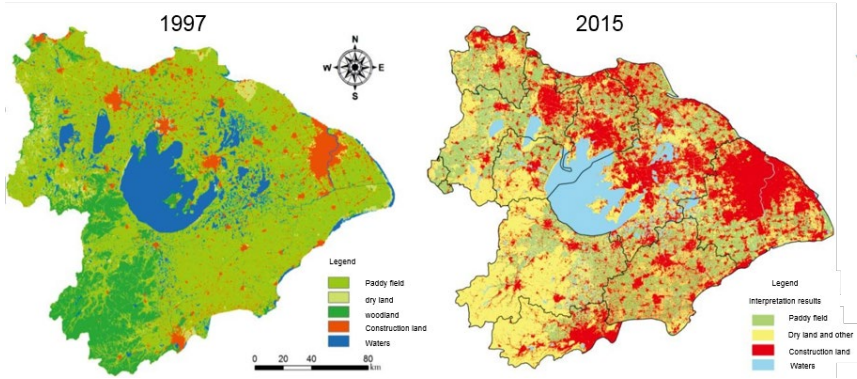
（四）水污染压力因子识别及水环境治理措施示范研究

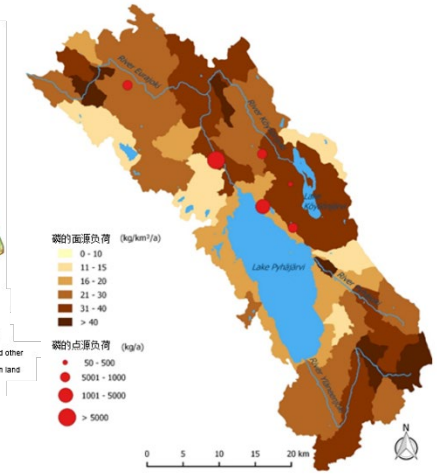
WP4. Comparison of pressures and demonstration of practical water protection measures

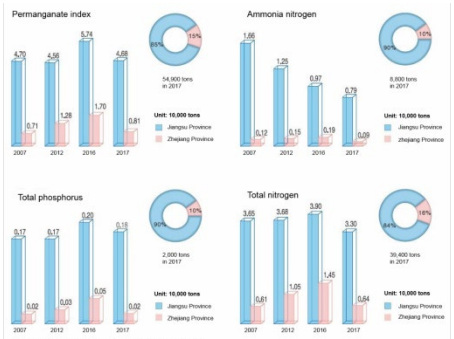
- 识别和分析影响太湖和皮海湖水环境的主要驱动力、压力和影响因素
- The main driving forces, pressures and impacting factors affecting the water environment were analyzed

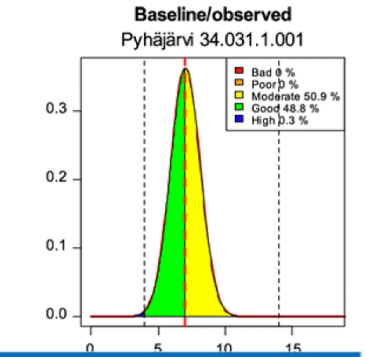
- 分析梳理已采取的水环境综合治理措施、规划治理目标及任务
- Existing comprehensive water management measures, planning management objectives and tasks of the basins were summarized

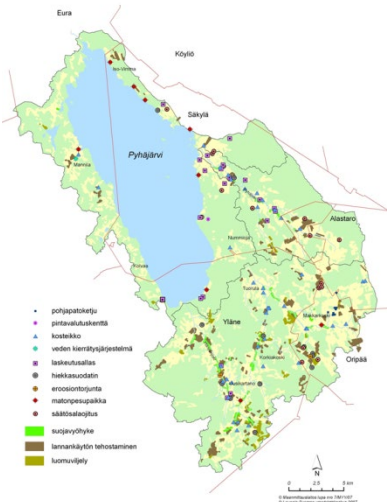
- 对已开展的水生态修复措施进行了案例分析
- Case study of water ecological restoration measures carried out

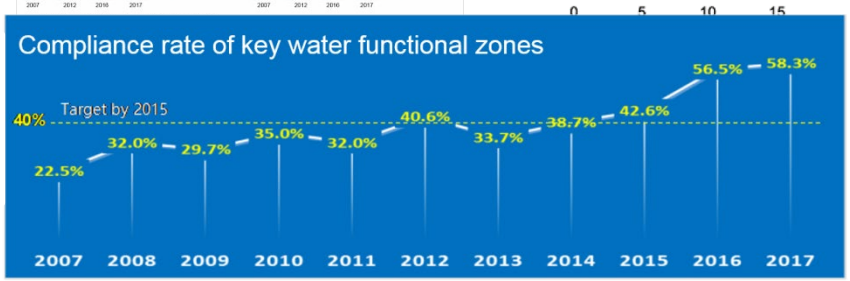












驱动力 Drivers	压力 Pressures	影响 Impacts	措施 Measures (responses)

（四）水污染压力因子识别及水环境治理措施示范研究

WP4. Comparison of pressures and demonstration of practical water protection measures

Drivers	Pressures	Impact	Response
• Population and urban development • Economic Development • Industry structure • Agricultural cultivation • Land use • Fisheries and aquaculture • Climate Change • …….	• Industrial point source loading • Agricultural diffuse source loading • Hydro-morphological alterations • ……	• Eutrophication • Water supply • Human and animal heath • Recreation and tourism • Industry	• Water management measures • Water protection measures • Climate change adaptation

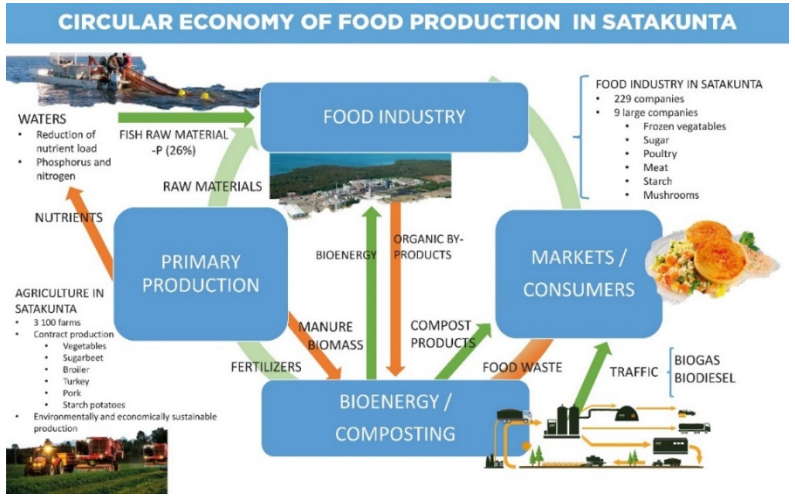
（四）水污染压力因子识别及水环境治理措施示范研究

WP4. Comparison of pressures and demonstration of practical water protection measures

- A lot of actions have been taken in both basins to implement the required measures, and improve the status of water environment. There is good understanding of the pressures related to external loading.
- In Lake Pyhäjärvi catchment, the circular economy system is set up, and is working.
- Due to the actions taken, the external loading has been decreasing in both basins.

两个流域都采取了许多措施，改善水环境状况。对与外部荷载有关的压力有很好的了解。在皮海湖流域，建立了循环经济体系，并正在发挥作用。由于所采取的措施，两个盆地的外部荷载都在减少。

规划十大类综合治理措施
（重点治理区771个项目，一般治理区462个项目）
Ten kinds of comprehensive treatment measures were planned
771 projects in key management area and 462 projects for other areas

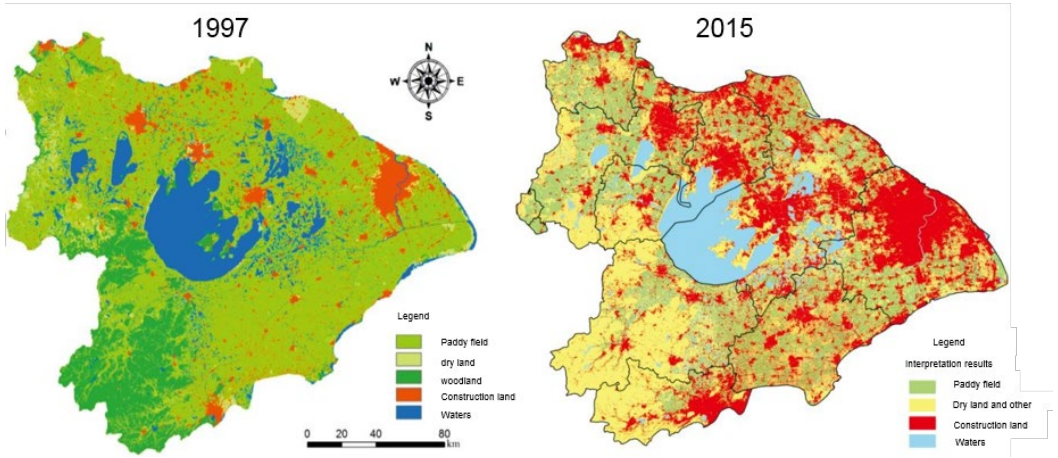


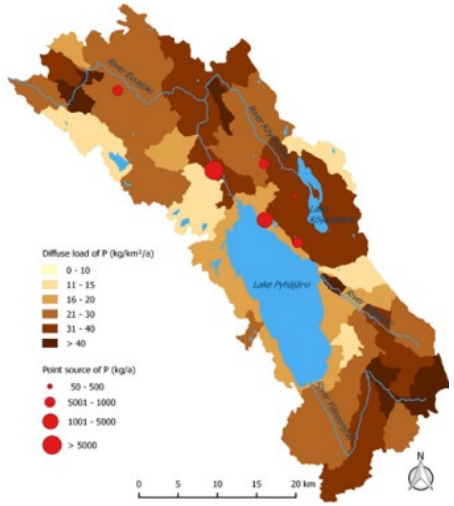
（四）水污染压力因子识别及水环境治理措施示范研究

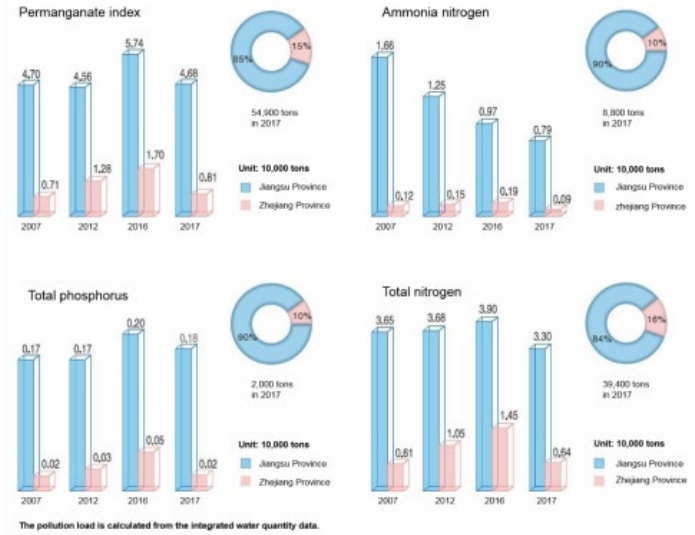
WP4. Comparison of pressures and demonstration of practical water protection measures

- The challenges include **quick land use** and **population changes**, especially in Taihu Basin,
- High **external loading** in both basins,
- Quantification of **internal loading** and **resuspension** is currently not well known in both of the lakes.

面临挑战包括快速的土地利用和人口变化，以及两个流域较高的外部负荷。以及目前，人们对于这两个湖泊内部负荷和再悬浮的量化研究还不够清晰。







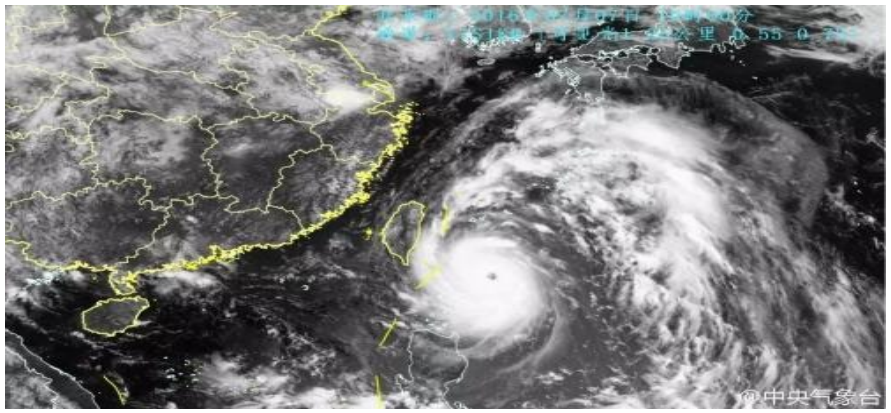
construction land ↑

（四）水污染压力因子识别及水环境治理措施示范研究

WP4. Comparison of pressures and demonstration of practical water protection measures

- The knowledge gaps on the **effectiveness of the measures**, and the monitoring data does not enable analysis of the effectiveness.
- The financial resources for the implementation of the measures are too few.
- There seems to be need for new techniques and innovations, as the environmental objectives are too far to be reached with current measures.
- Climate change brings its own challenges and adaptation needs.

- 关于措施有效性的认知差距，以及监测数据无法进行有效性分析。
- 实施这些措施的财政资源太少。
- 需要新的技术和创新，因为目前的措施远远不能实现环境目标。
- 需对气候变化开展进一研究



（四）水污染压力因子识别及水环境治理措施示范研究

Suggestions 建议

- Improving the understanding of land use impacts by modeling
- Promotion of circular economy in Taihu Basin and Finland
- Improving the knowledge base of effectiveness of the measures
- New techniques and innovations in quantification and reduction of both external and internal loading
- New techniques and innovations for algae bloom prevention
- To identify the significant pressures for the waters, targeting the measures into biggest pressures
- Secure financial resources for implementing and maintenance of the measures

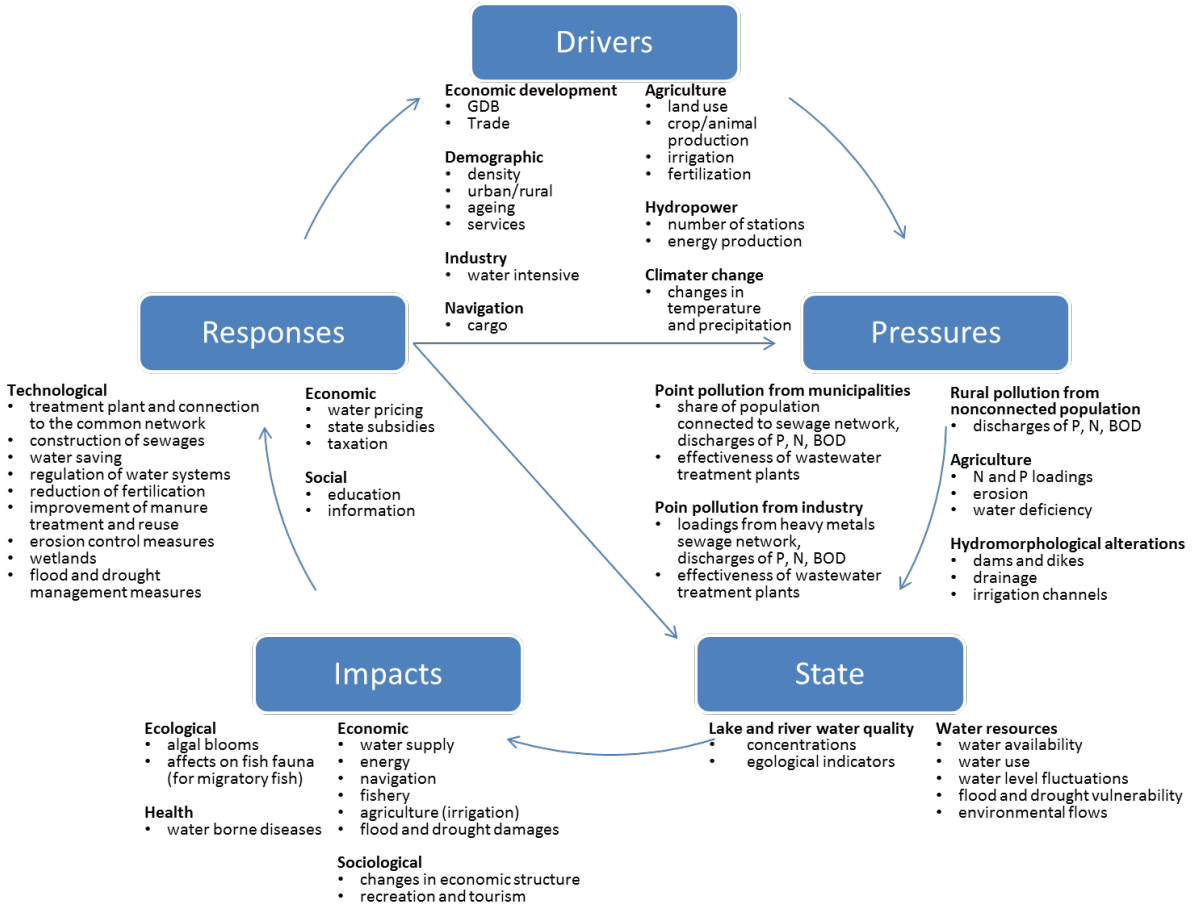
- 通过建模提高对土地利用影响的理解。
- 推动太湖流域和芬兰循环经济发展。
- 进一步完善措施成效的知识库。
- 开发降低外源负荷和内源负荷的一些新的技术和创新措施。
- 开发阻止蓝藻水华爆发的新技术和创新措施。
- 确定对水域的重大压力，将措施目标定为最大压力。
- 确保执行和维持措施的财政资源。

（五）水管理综合评价指标体系研究（DPSIR）

WP5. Index system(s) for evaluating water management (DPSIR)

- Based on the drives, pressures, states, impacts, and reponses factors proposed from WP1-4 research, applying DPSIR framework, a comprehensive evaluation framework for water resources management were initially constructed and preliminary tested in both basins.

- 基于专题一至专题四研究提出的重要评价因子，基于DPSIR框架模型，初步构建适用于太湖和皮海湖的水管理综合评价指标体系，并分别在皮海湖流域和太湖流域开展试算

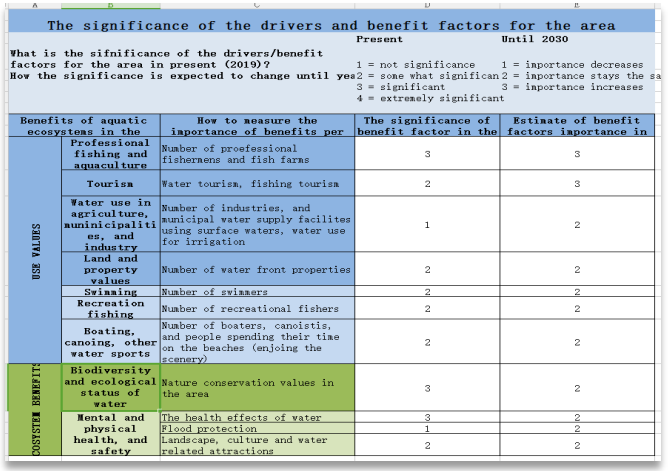


（五）水管理综合评价指标体系研究（DPSIR）

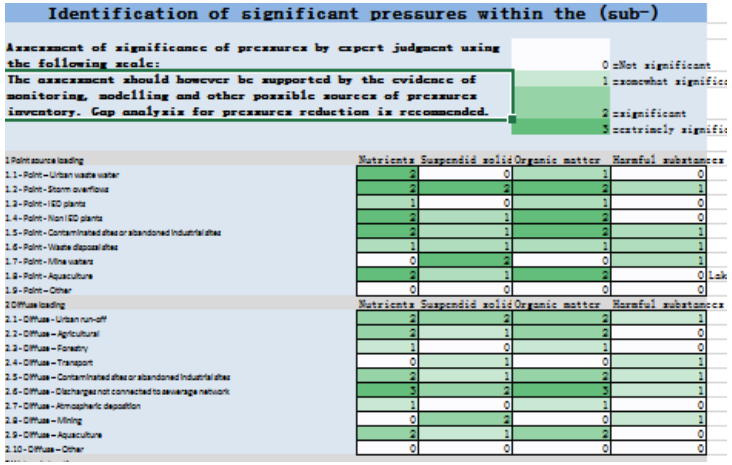
WP5. Index system(s) for evaluating water management (DPSIR)

- Evaluation of the significance of the drivers for the area
- Identification of significant pressures within the (sub-) catchment
- Assesment of the effectiveness of the measures in reducing the identified pressures

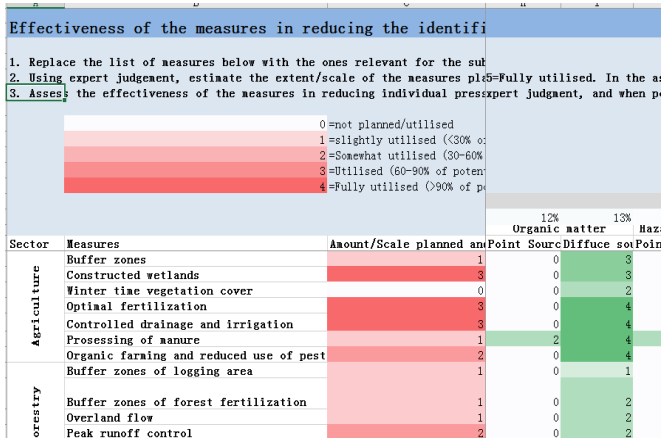
- 评价驱动因子的重要性
- 识别重要压力因子
- 评估降低压力的措施的有效性



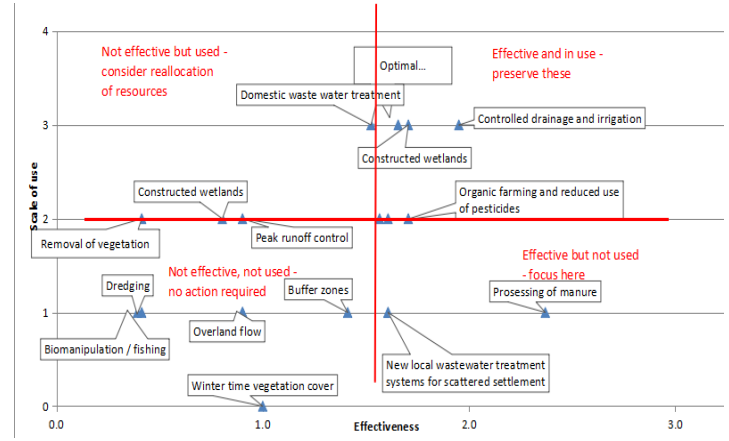
Importance of Drivers



Significant Pressures



Effectiveness of the measures



Impact of the measures

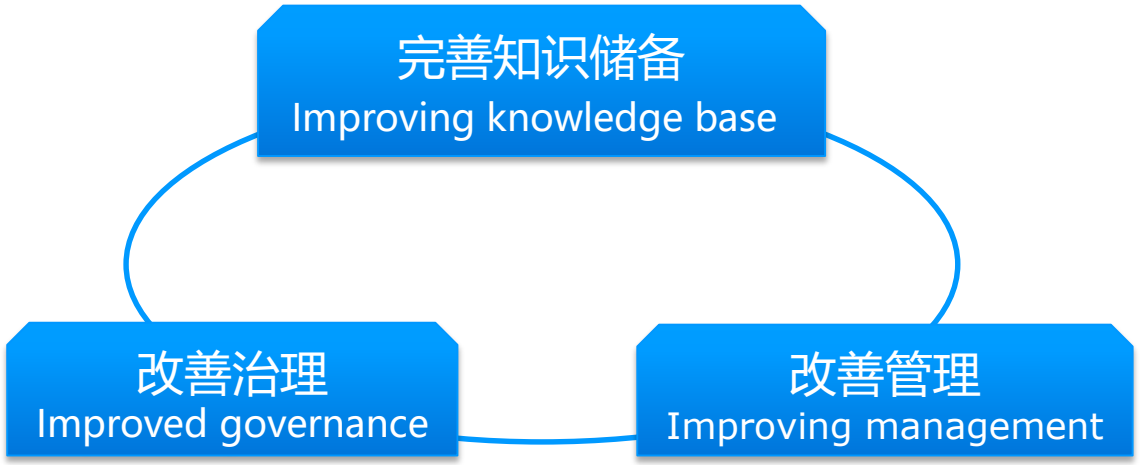
四、下阶段合作计划 Next Plans

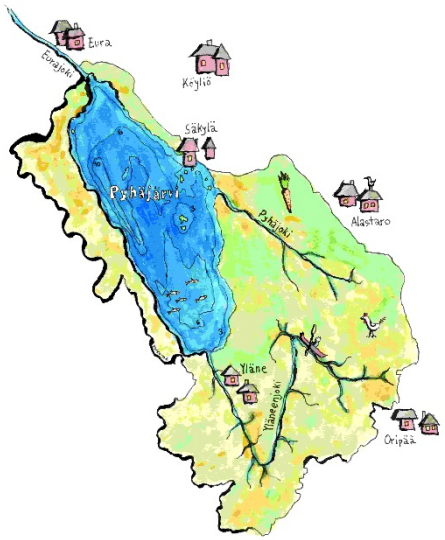
项目预期成果（2019年底）

- 完善合作项目研究报告，
- 修改完善DPSIR评价体系
  1）建立水环境压力与治理措施之间的联系
  2）分析评估水环境治理的效益
  3）识别存在的主要问题及短板
- 提出改善太湖和皮海湖水环境治理管理相关建议

Expected outcomes in the end of year 2019 are:

- Improve the final report
- Revise and Improve the DPSIR based matrix system for
  i) linking the proposed measures to the identified pressures
  ii) assessing the benefits of improving the water conservation
  iii) identification of implementation gaps
- Suppose the suggestions for improving the water resources management and lake water quality in Lake Taihu and Pyhäjärvi





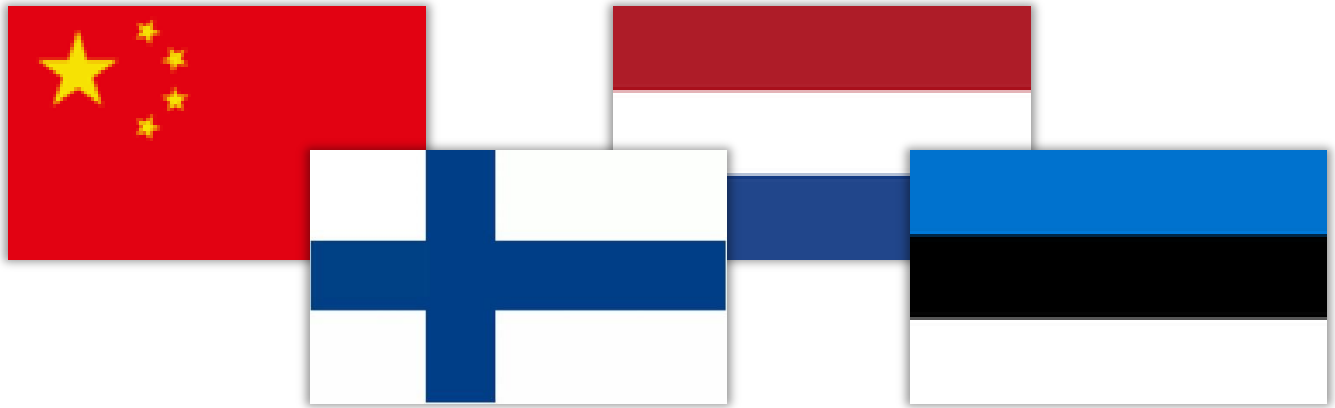
经沟通，我局与芬兰合作单位拟延续已有项目，并以政策建议作为第二阶段合作的主要研究内容，项目期为2019 年~2021年

结合流域治理与管理现状的不足与困境，从不同层面（如国家、流域，宏观、微观），在技术、行政管理、法律法规、体制机制等方面提出预见性的政策建议，以期为今后中远期高层制定新政策或改进已有政策作决策支持

Based on the results of the first phase cooperation, the next phase research will start with the shortcomings and dilemmas of lake and basin governance and management, and policy recommendations will be proposed from different levels (such as countries, river basins, macro, micro) and different aspects (sunch as in technology, administrative management, laws and regulations, mechanisms, etc.) , providing support for new policy formulation and improvement

拟联合建立小型的湖泊研究网络，将中芬双边研究经验与荷兰、爱沙尼亚相关湖泊研究经验相结合，进一步提升政策建议研究成果

Plan to jointly establish a shallow lake research network, combining the Sino-Finnish bilateral research experience with the Dutch and Estonian lake research experience, and further enhance the research results of policy recommendations



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THANK YOU FOR YOUR ATTENTION