# 湖泊科学动态

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## 热点文章

## Greenland supraglacial lake drainages triggered by hydrologically induced basal slip

Laura A. Stevens; Mark D. Behn; Jeffrey J. McGuire; et al.

Water-driven fracture propagation beneath supraglacial lakes rapidly transports large volumes of surface meltwater to the base of the Greenland Ice Sheet1. These drainage events drive transient ice-sheet acceleration and establish conduits for additional surface-to-bed meltwater transport for the remainder of the melt season. Although it is well established that cracks must remain water-filled to propagate to the bed, the precise mechanisms that initiate hydro-fracture events beneath lakes are unknown. Here we show that, for a lake on the western Greenland Ice Sheet, drainage events are preceded by a 6–12 hour period of ice-sheet uplift and/or enhanced basal slip. Our observations from a dense Global Positioning System (GPS) network allow us to determine the distribution of meltwater at the ice-sheet bed before, during, and after three rapid drainages in 2011–2013, each of which generates tensile stresses that promote hydro-fracture beneath the lake. We hypothesize that these precursors are associated with the introduction of meltwater to the bed through neighbouring moulin systems (vertical conduits connecting the surface and base of the ice sheet). Our results imply that as lakes form in less crevassed, interior regions of the ice sheet, where water at the bed is currently less pervasive, the creation of new surface-to-bed conduits caused by lake-draining hydro-fractures may be limited.

中文点评: 在冰面湖底部，水流驱动的裂隙延伸会将大量地表融水迅速带到格陵兰冰盖底部。这种排水活动会导致冰盖出现暂时性的加速移动，并为形成小水沟，成为更多的顶底融水传输通道，在整个融冰季节发挥作用。尽管现已确定，裂缝必须全部注满水才能抵达河床，但其在湖底引起水压裂活动的精确作用机制还尚为人知。本文发现，在格陵兰冰盖西部的一个湖泊中，排水之前会出现 6~12 小时的冰盖抬升和/或增强的基面滑移作用。通过密集的全球定位系统（Global Positioning System, GPS）网络进行观察，本文确定了 2011-2013 年间三次快速排水活动之前、之中和之后的冰盖基底融水分布状况，每一次排水都会产生张应力，导致湖底的水压致裂活动增强。本文假设，这些破裂与融雪水通过附近的冰川锅穴系统（moulin system， 连通冰盖表面与底部的垂直通道）流入基底有关。此结果说明，如果湖泊在较少裂缝、水渗透性较差的冰盖中心地带形成，由湖泊排水压裂导致的成冰盖顶底通道的活动就会受到限制。

（来源：http://www.huanqiukexue.com）

## Early land use and centennial scale changes in lake-water organic carbon prior to contemporary monitoring

Carsten Meyer-Jacoba; Julie Tolua; Christian Bigler; et al.

Organic carbon concentrations have increased in surface waters across parts of Europe and North America during the past decades, but the main drivers causing this phenomenon are still debated. A lack of observations beyond the last few decades inhibits a better mechanistic understanding of this process and thus a reliable prediction of future changes. Here we present past lake-water organic carbon trends inferred from sediment records across central Sweden that allow us to assess the observed increase on a centennial to millennial time scale. Our data show the recent increase in lake-water carbon but also that this increase was preceded by a landscape-wide, long-term decrease beginning already A.D. 1450–1600. Geochemical and biological proxies reveal that these dynamics coincided with an intensification of human catchment disturbance that decreased over the past century. Catchment disturbance was driven by the expansion and later cessation of widespread summer forest grazing and farming across central Scandinavia. Our findings demonstrate that early land use strongly affected past organic carbon dynamics and suggest that the influence of historical landscape utilization on contemporary changes in lake-water carbon levels has thus far been underestimated. We propose that past changes in land use are also a strong contributing factor in ongoing organic carbon trends in other regions that underwent similar comprehensive changes due to early cultivation and grazing over centuries to millennia.

（来源：PNAS, 2015, 112(21): 6579–6584）

**中文点评**: 土地使用与地表水有机碳相关研究发现，近来瑞典中部湖泊有机碳水平的上升之前很可能存在一场长期的有机碳下降事件，该事件最早始于公元 1450 年，而且可能与该区域夏季森林放牧和农业的加剧有关联。

（来源：http://zh.eurekalert.org）

## Cahokia's emergence and decline coincided with shifts of flood frequency on the Mississippi River

Samuel E. Munoza; Kristine E. Gruleya; Ashtin Massie; et al.

Here we establish the timing of major flood events of the central Mississippi River over the last 1,800 y, using floodwater sediments deposited in two floodplain lakes. Shifts in the frequency of high-magnitude floods are mediated by moisture availability over midcontinental North America and correspond to the emergence and decline of Cahokia—a major late prehistoric settlement in the Mississippi River floodplain. The absence of large floods from A.D. 600 to A.D. 1200 facilitated agricultural intensification, population growth, and settlement expansion across the floodplain that are associated with the emergence of Cahokia as a regional center around A.D. 1050. The return of large floods after A.D. 1200, driven by waning midcontinental aridity, marks the onset of sociopolitical reorganization and depopulation that culminate in the abandonment of Cahokia and the surrounding region by A.D. 1350. Shifts in the frequency and magnitude of flooding may be an underappreciated but critical factor in the formation and dissolution of social complexity in early agricultural societies.

（来源：PNAS, 2015, 112(20): 6319–6324）

**中文点评**：洪水与卡霍基亚的兴衰研究表明，对来自密西西比河附近的泛滥平原湖泊的沉积物岩芯的一项研究发现，位于今天的密苏里州圣路易斯附近的卡霍基亚史前定居点在大约公元 1050 年的没有大洪水的时期是作为一个区域中心出现的，到公元 1350 年这个定居点被抛

弃可能是由于洪水的原因，这一发现凸显了洪水频率在早期农业社会的崛起和衰落中的作用。

## 摘要精选

### Contrasting taxonomic stratification of microbial communities in two hypersaline meromictic lakes

Adrian-Ştefan Andrei; Michael S Robeson; Andreea Baricz; et al.

Hypersaline meromictic lakes are extreme environments in which water stratification is associated with powerful physicochemical gradients and high salt concentrations. Furthermore, their physical stability coupled with vertical water column partitioning makes them important research model systems in microbial niche differentiation and biogeochemical cycling. Here, we compare the prokaryotic assemblages from Ursu and Fara Fund hypersaline meromictic lakes (Transylvanian Basin, Romania) in relation to their limnological factors and infer their role in elemental cycling by matching taxa to known taxon-specific biogeochemical functions. To assess the composition and structure of prokaryotic communities and the environmental factors that structure them, deep-coverage small subunit (SSU) ribosomal RNA (rDNA) amplicon sequencing, community domain-specific quantitative PCR and physicochemical analyses were performed on samples collected along depth profiles. The analyses showed that the lakes harbored multiple and diverse prokaryotic communities whose distribution mirrored the water stratification patterns. Ursu Lake was found to be dominated by Bacteria and to have a greater prokaryotic diversity than Fara Fund Lake that harbored an increased cell density and was populated mostly by Archaea within oxic strata. In spite of their contrasting diversity, the microbial populations indigenous to each lake pointed to similar physiological functions within carbon degradation and sulfate reduction. Furthermore, the taxonomy results coupled with methane detection and its stable C isotope composition indicated the presence of a yet-undescribed methanogenic group in the lakes' hypersaline monimolimnion. In addition, ultrasmall uncultivated archaeal lineages were detected in the chemocline of Fara Fund Lake, where the recently proposed Nanohaloarchaeota phylum was found to thrive.

### Relative importance of phosphorus, invasive mussels and climate for patterns in chlorophyll a and primary production in Lakes Michigan and Huron

Warner, David M.; Lesht, Barry M.

Lakes Michigan and Huron, which are undergoing oligotrophication after reduction of phosphorus loading, invasion by dreissenid mussels and variation in climate, provide an opportunity to conduct large-scale evaluation of the relative importance of these changes for lake productivity. We used remote sensing, field data and an information-theoretic approach to identify factors that showed statistical relationships with observed changes in chlorophyll a (chla) and primary production (PP).

Spring phosphorus (TP), annual mean chla and PP have all declined significantly in both lakes since the late 1990s. Additionally, monthly mean values of chla have decreased in many but not all months, indicating altered seasonal patterns. The most striking change has been the decrease in chla concentration during the spring bloom.

Mean chlorophyll a concentration was 17% higher in Lake Michigan than in Lake Huron, and total production for 2008 in Lake Michigan (9.5tgyear(-1)) was 10% greater than in Lake Huron (7.8tgyear(-1)), even though Lake Michigan is slightly smaller (by 3%) than Lake Huron. Differences between the lakes in the early 1970s evidently persisted to 2008.

Invasive mussels influenced temporal trends in spring chla and annual primary production. However, TP had a greater effect on chla and primary production than did the mussels, and TP varied independently from them. Two climatic variables (precipitation and air temperature in the basins) influenced annual chla and annual PP, while the extent of ice cover influenced TP but not chla or primary production. Our results demonstrate that observed temporal patterns in chla and PP are the result of complex interactions of P, climate and invasive mussels.

（来源：FRESHWATER BIOLOGY, 2015, 60(5): 1029-1043）

# Challenges and prospects for interpreting long-term phytoplankton diversity changes in LakeZurich (Switzerland)

Pomati, Francesco; Tellenbach, Christoph; Matthews, Blake; et al.

Analysing and interpreting long-term phytoplankton time series present a number of challenges, arising from potential historical inconsistencies in data collection and taxonomic identification of organisms. In a previous paper, Pomati etal. (2012) found a remarkable increase in phytoplankton diversity that coincided with oligotrophication and warming of Lake Zurich over a 32-year period. These findings were recently challenged on the basis of potential biases in detection limits and taxonomic classification over the time series (Straile, Jochimsen & Kummerlin, 2013). We agree that being cautious with long-term phytoplankton data series is extremely important, but argue that the increase in richness detected in Lake Zurich cannot be due only to methodological bias.

Following additional analysis of the Lake Zurich phytoplankton dataset, we found that the shift in taxon detection limits reported by Straile etal. (2013) is not supported by the data and stems from a rounding error in the calculation of density in the dataset available to those authors. We found a decline in the proportional abundance for common taxa, an increase in the annual prevalence of taxa and reduced community turnover over the time series. Taken together, the data clearly indicate a trend of decreasing dominance, while more taxa coexist simultaneously. We also argue that the taxonomic classification has been robust (at least at the family level) and propose a diagnostic plot that can help detect an unbiased signal of change in plankton richness through time.

Straile etal. (2013) observed perfect synchrony in species occurrence between Lake Zurich and nearby Lake Walen. While we agree that such perfect synchrony in community composition can reflect a bias in the database compilation, it can also be an important ecological signal of changes in regional species pools that deserves further analysis.

We conclude that the results of Pomati etal. (2012) are robust and not substantially undermined by the

criticisms of Straile etal. (2013). More generally, it is indeed possible to extract meaningful signals of biodiversity change from long-term phytoplankton monitoring datasets, provided there is a clear understanding of how the data have been sampled, recorded and analysed over the history of the time series.

<div align="right">（来源：FRESHWATER BIOLOGY, 2015, 60(5): 1052-1059）</div>

# Homogenization of fish assemblages in different lake depth strata at local and regional scales

Menezes, Rosemberg F.; Borchsenius, Finn; Svenning, Jens-Christian; et al.

Eutrophication alters the trophic dynamics in lakes and may result in homogenisation of biotic communities. How nutrient enrichment drives patterns of homogenisation of fish species composition at within-lake (local) and among-lake (regional) scales is, however, not well studied.

To test for homogenisation in fish communities, we analysed number, biomass and individual mean body mass of the different fish species present in 53 Danish lakes with contrasting depths, surface area and eutrophication.

A combination of uni- and multivariate techniques revealed that eutrophication homogenises fish community composition in the littoral zone of both shallow and deep lakes at within- and among-lake scales, a notable contrast being that community composition was not homogenised in the offshore in deep lakes.

In addition, fish species richness and diversity converged with progressive eutrophication and mean lake depth in all lake zones. For deep lakes, surface area was positively related to increasing differences in fish species richness and diversity.

Increased homogeneity of this key assemblage may have profound implications for ecosystems and their stability (such as decreased resilience to disturbance, reduced biological complexity and increased vulnerability to large-scale and stochastic environmental events).

Thus, to fully understand the impacts of eutrophication on aquatic communities at both local and regional scales, the effects of nutrient enrichment on compositional heterogeneity should be considered.

<div align="right">（来源：FRESHWATER BIOLOGY, 2015, 60(4): 745-757）</div>

# Factors influencing nitrogen processing in lakes: an experimental approach

Olsen, Saara; Jeppesen, Erik; Moss, Brian; et al.

To help improve our understanding of the nitrogen cycle in lakes, particularly in the context of climate change, we analysed total nitrogen (TN) and nitrate ($NO_3$--N) data from six mesocosm experiments (in Denmark, U.K., China and Turkey) covering different climatic regions. We assessed the effects of nitrogen (N) and phosphorus (P) loading, temperature, salinity and water level on N processing. Water column N loss (defined as the nitrogen processed in and lost from the water column in units of net amount processed per unit area and per unit of time, or in relative terms as the percentage loss of the

total pool in 2weeks) was particularly sensitive to external nutrient loading to the mesocosms. Mean water column TN loss at high N loading varied from 111 to 250mgm(-2)day(-1) and increased with N loading. High P loading resulted in increased water column N loss, possibly because of increased uptake into plants and attached algae and sedimentation of the increased algal crop. High salinity generally decreased water column TN loss; on average, 10% more TN was in the water column at 12 salinity than at 2 parts per thousand salinity, while no significant effect of water level was found. Only weak relationships were observed between N processing and temperature, and mesocosms limited by P accumulated more nitrogen in their water columns than those with high P loadings. Our results suggest that N processing in lakes appears to be more sensitive to features of the catchment, such as hydrology and loading, than to climatic effects related to temperature, salinity and water level.

（来源：FRESHWATER BIOLOGY, 2015, 60(4): 646-662）

## Profundal benthic invertebrate communities in boreal lakes vary with climate fluctuation

Jyvasjarvi, Jussi; Hamalainen, Heikki.

Despite increasing evidence that climate change affects aquatic ecosystems, influences on lake benthic communities are still poorly known. We studied the effects of short-term climatic fluctuation on profundal benthic invertebrates using at least six annual samples (over 6-17 years) from 38 Finnish lake basins. Faunal abundance, species diversity and species composition were related to annual winter and summer North Atlantic Oscillation (NAO) indices as measures of climatic fluctuation. Algal productivity, hypolimnetic oxygen concentration and water temperature weakly increased during the positive NAO periods. Profundal macroinvertebrate abundance and species diversity declined with increasing NAO in summer, but not winter. The main gradient of species compositional overturn (DCA axis 1) was negatively associated with lake productivity and varied independent of NAO, whereas the secondary gradient (DCA axis 2) correlated positively with hypolimnetic temperature and winter NAO. The responses of species diversity and abundance to climatic fluctuation were not related to any measured lake-specific environmental characteristics, but the response of species composition (DCA axis 1) to NAO showed a consistent negative association with lake depth and trophic status, so that size and even direction of compositional response to NAO was related to these two lake characteristics. Our study suggests that local profundal benthic macroinvertebrate communities can respond rapidly to short-term, large-scale climate fluctuation and hence that future global warming can be expected to modify these sensitive communities considerably.

（来源：AQUATIC SCIENCES, 2015, 77(2): 261-269）

## Phytoplankton response to the environmental and climatic variability in a temperate lake over the last 14,500 years in eastern Latvia

Stivrins, N.; Kolaczek, P.; Reitalu, T.; et al.

Phytoplankton species are the primary producers in lakes and play important roles in food-web structures. Any shift in their diversity and productivity has an impact on other aquatic life forms. We use a range of environmental variables to explore the possible drivers influencing phytoplankton composition over the last 14,500 years in a temperate lake Lielais SvA"tiA dagger u, eastern Latvia. Using pollen, non-pollen

palynomorphs, temperature reconstructions and lithological information as proxies of environmental factors, we statistically test their associations with the fossil phytoplankton community composition. Our results reveal that during the Late Glacial, the climate warming, the decrease in landscape openness, and increase in organic matter were significant environmental variables affecting dynamics of phytoplankton communities , especially in the prevalence of Botryococcus, Tetraedron, Scenedesmus and Pediastrum. According to the Redundancy Analysis and Generalized Least Squares models, Pediastrum, Scenedesmus and Tetraedron were positively associated with waterlogging tolerance that indicates moist soils in surroundings of the lake, during the Early Holocene. The 8.2 ka cold event with a 2-3 A degrees C cooling led to a strong environmental disturbance for nearly 700 years, indicated by an increased chlorophyta accumulation rates and a decrease in the organic matter. Our results indicate that Coelastrum reticulatum and C. polychordum are characteristic for the 8.2 ka cold event. Positive association between cyanobacteria and mean air summer temperature suggests that a warming favoured cyanobacteria over other phytoplankton taxa between 8000 and 4000 cal yr BP. High nutrient loads and water turbidity were more important for the dynamics of cyanobacteria from 4000 to 2000 cal yr BP. Human-driven trophic level change was recorded in the last 2000 years by abundances of fungi Sporormiella and Sordaria, and by the peaks of Gloeotrichia pisum, C. reticulatum and C. polychordum indicating eutrophication.

（来源：JOURNAL OF PALEOLIMNOLOGY, 2015, 54(1): 103-119）

## Diversity and spatial distribution of autotrophic communities within and between ice-covered Antarctic lakes (McMurdo Dry Valleys)

Dolhi, Jenna M.; Teufel, Amber G.; Kong, Weidong; et al.

We compared the spatial distribution and diversity of autotrophic microbial communities among four permanently ice-covered, chemically stratified lakes located in the Taylor (Lakes Bonney-east and west lobes, Fryxell), and Wright (Lake Vanda) Valleys of the McMurdo Dry Valleys (Victoria Land, Antarctica). Clone libraries were constructed for major carbon fixation genes (rbcL isoforms IA/B and ID; cbbM; nifJ). Real time quantitative polymerase chain reaction assays were also developed for each of these markers of autotrophy to assess the influence of lake physicochemical factors on spatial trends in major photosynthetic and chemolithoautotrophic groups. Both lobes of Lake Bonney were dominated by Ribulose-1, 5-bisphosphate carboxylase oxygenase (RubisCO) form ID rbcL (haptophytes and stramenopiles), while Lake Fryxell was dominated by rbcL form ID-harboring cryptophytes. Lake Vanda was the least productive lake and was dominated by form IA/B rbcL (cyanobacteria and chlorophytes) and form ID rbcL (stramenopiles). Autotrophic carbon fixation genes from photosynthetic organisms were generally positively correlated with light availability. Chemolithoautotrophic organisms harboring form II RubisCO were detected in only two of the four lakes (west lobe Lake Bonney and Fryxell) and were associated with the presence of either sulfide (Fryxell) or dimethylated sulfur compounds (west lobe Lake Bonney).

（来源：LIMNOLOGY AND OCEANOGRAPHY, 2015, 60(3): 977-991）

## 共和盆地更尕海湖泊现代水环境与碳酸盐碳氧同位素组成变化

金彦香, 强明瑞, 刘英英, 等

通过分析更尕海轮藻碳酸盐结壳、软体动物壳体等碳氧同位素的季节变化，δ结合湖水溶解无机碳(DIC)碳同位素( δ13C$_{DIC}$)和湖水氧同位素( δ$^{18}$O$_{Lake}$)，δ探讨其与现代湖泊水体环境的关系。结果表明，δ5~8月，δ轮藻植物生长速率约为5~6 cm/月； 期间，δ沉水植物强烈的光合作用和碳酸盐的析出导致湖水pH升高，δ同时湖水DIC和Ca2+含量显著下降。结合流域水体氧同位素、气温和降水量等观测资料，δ指出更尕海湖泊水位季节变化是区域降水量与蒸发作用平衡的结果；湖水氧同位素组成主要受入湖水氧同位素组成、湖泊内蒸发过程和降水量等的影响。 软体动物壳体氧、碳同位素组成可分别代表 δ$^{18}$O$_{Lake}$与 δ13C$_{DIC}$的年际变化。 然而，δ轮藻结壳氧同位素与 δ$^{18}$O$_{Lake}$之间非平衡分馏效应显著，δ有待于进一步开展工作。

（来源：科学通报, 2015, 60(9): 847-856）

## The stable carbon isotopic composition of Daphnia ephippia in small, temperate lakes reflects in-lake methane availability

Schilder, Jos; Bastviken, David; van Hardenbroek, Maarten; et al.

Daphnia can ingest methane-oxidizing bacteria and incorporate methanogenic carbon into their biomass, leading to low stable carbon isotope ratios (expressed as delta C-13 values) of their tissue. Therefore, delta C-13 analysis of Daphnia resting eggs (ephippia) in lake sediment records can potentially be used to reconstruct past in-lake availability of methane (CH4). However, detailed multilake studies demonstrating that delta C-13 values of recently deposited Daphnia ephippia (delta C-13(ephippia)) are systematically related to in-lake CH4 concentrations ([CH4](aq)) are still missing. We measured delta C-13(ephippia) from surface sediments of 15 small lakes in Europe, and compared these values with late-summer [CH4](aq). delta C-13(ephippia) ranged from -51.6 parts per thousand to -25.9 parts per thousand, and was strongly correlated with [CH4](aq) in the surface water and above the sediment (r -0.73 and -0.77, respectively), whereas a negative rather than the expected positive correlation was found with delta C-13 values of carbon dioxide (CO2) (r -0.54), and no correlation was observed with [CO2](aq). At eight sites, offsets between delta(13) C-CO2 and delta C-13(ephippia) exceeded offsets between delta C-13(CO2) and delta C-13(algae) reported in literature. delta C-13(ephippia) was positively correlated with delta C-13 values of sedimentary organic matter (r 0.54), but up to 20.7 parts per thousand lower in all except one of the lakes (average -6.1 parts per thousand). We conclude that incorporation of methanogenic carbon prior to ephippia formation must have been widespread by Daphnia in our study lakes, especially those with high [CH4](aq). Our results suggest a systematic relationship between delta C-13(ephippia) values and [CH4](aq) in small temperate lakes, and that delta C-13(ephippia) analysis on sediment records may provide insights into past changes in in-lake [CH4](aq).

（来源：LIMNOLOGY AND OCEANOGRAPHY, 2015, 60(3): 1064-1075）

## Multielement stoichiometry of submerged macrophytes across Yunnan plateau lakes (China)

Wei Xing; Haoping Wu; Qiao Shi; et al.

Stoichiometric homeostasis of element composition is one of the central concepts of ecological stoichiometry. We analyzed concentrations of macroelements (C, N, P, Ca, K, Mg, S), microelements (Cu, Fe, Mn, Mo, Ni, Zn) and beneficial elements (Na, Se, Si) in submerged macrophytes, water and sediments across 20 Yunnan plateau lakes. We predicted that tissue element composition in submerged macrophytes is affected by lake trophic level and taxonomy, and submerged macrophytes have weak stoichiometric homeostasis for all above 16 elements. Canonical discriminant analyses successfully discriminated among trophic level groups and taxa groups. Of all the elements, C, N, P and S most effectively discriminated among trophic level groups across 20 lakes, revealing lake trophic level mostly affect tissue macroelement composition in submerged macrophytes; while Ca, K and Se most effectively discriminated among submerged macrophytes taxa groups, suggesting taxonomy mostly affect compositions of macroelements and beneficial elements in submerged macrophytes. In addition, the stoichiometric homeostatic coefficient of 1/HCa:C for all five taxa of submerged macrophytes were less than zero, suggesting submerged macrophytes in Yunnan plateau lakes have strong Ca stoichiometric homeostasis. Our findings, not only broaden the knowledge of multielement stoichiometric homeostasis, but also help to choose most appropriate lake management strategy.

（来源：Scientific Reports, 2015, 5:10186 doi:10.1038/srep10186）

## Macrophytes and periphyton carbon subsidies to bacterioplankton and zooplankton in a shallow eutrophic lake in tropical China

de Kluijver, A.; Ning, J.; Liu, Z.; et al.

The subsidy of carbon derived from macrophytes and associated periphyton to bacterioplankton and zooplankton in subtropical shallow eutrophic Huizhou West Lake in China was analyzed using carbon stable isotope signatures. A restored part of the lake dominated by macrophytes was compared with an unrestored phytoplankton-dominated part. Macrophytes, periphyton, seston, and zooplankton were sampled every two months to determine natural-abundance carbon isotope ratios (C-13). The C-13 of phytoplankton and bacterioplankton was determined from C-13 of fatty acid biomarkers. Macrophytes and associated periphyton had similar C-13 values and were the most enriched in C-13 of all measured organic carbon pools. A macrophyte-periphyton carbon isotopic signal was detected in particulate organic carbon, bacterioplankton, and zooplankton in the macrophyte-dominated lake part, which was demonstrated by a significant enrichment in C-13 compared with the unrestored part, while phytoplankton and dissolved organic carbon had similar C-13 values in both lake parts. A two-source (macrophytes-periphyton and phytoplankton) mixing model showed that macrophytes-periphyton potentially contributed 14-85% (average 55%) to bacterioplankton in the macrophyte-dominated lake part, depending on season. The macrophytes-periphyton contribution to zooplankton seasonally varied between 26% and 86%, with an average of 47%. The contribution of macrophytes-periphyton to bacterioplankton increased with increasing macrophyte biomass relative to phytoplankton biomass (indicated by chlorophyll a). Carbon from macrophytes with associated periphyton subsidizes bacterioplankton and zooplankton, likely enhancing the cascading effects of planktonic food webs, providing an additional explanation for the stability of a clear-water state in shallow lakes dominated by macrophytes.

（来源：LIMNOLOGY AND OCEANOGRAPHY, 2015, 60(2): 375-385）

# Effects of seasonal seston and temperature changes on lake zooplankton fatty acids

McMeans, Bailey C.; Koussoroplis, Apostolos-Manuel; Kainz, Martin J.

We investigated how seston fatty acids (FA) and water temperature explained seasonal variation in cladoceran and copepod FA over three years in pre-alpine, oligotrophic Lake Lunz, Austria. Using the mostly algal-derived polyunsaturated FA (PUFA: arachidonic, ARA; eicosapentaenoic, EPA; docosahexaenoic acid, DHA), terrestrial FA (TFA, 22 : 0, 24 : 0), and bacterial FA (BAFA, 15 : 0, 17 : 0 and their branched homologues) as source-specific biomarkers, we show that cladocerans consistently contained more ARA and EPA and copepods more DHA than the available food (seston). None of these physiologically important PUFA were significantly related between zooplankton and seston across the entire study period but copepod DHA increased with seston DHA during the coldest months (< 8 degrees C, based on a significant seston FA*temperature interaction). EPA, conversely, increased with decreasing water temperature in both zooplankton groups. For the nonessential FA, TFA were lower in zooplankton than in seston and not related to dietary supply or water temperature. However, cladoceran and copepod BAFA increased significantly with increasing seston BAFA and decreasing water temperature. These findings suggest that physiological regulation in response to changing water temperature had a significant impact on cladoceran and copepod EPA and the extent of dietary tracking for copepod DHA. TFA available in the seston may not have been consumed or were poorly incorporated by zooplankton, but BAFA were good indicators of available resources throughout multiple seasonal cycles. Based on our study, both FA type and water temperature impact the extent that dietary vs. nondietary processes govern cladoceran and copepod FA in oligotrophic lakes.

（来源：LIMNOLOGY AND OCEANOGRAPHY, 2015, 60(2): 573-583）

# Invasive mussels modify the cycling, storage and distribution of nutrients and carbon in a large lake

Ozersky, Ted; Evans, David O.; Ginn, Brian K.

This study examined the effect of invasive dreissenid mussels on nutrient and carbon dynamics in a large lake (Lake Simcoe, Ontario). We measured rates of nutrient (phosphorus and nitrogen) and carbon excretion and biodeposition by zebra and quagga mussels and the P, N and C content of their soft tissues and shells at different depths throughout the open-water season. Measurements were combined with detailed information about dreissenid biomass and lakewide distribution to examine the impacts of dreissenids on whole-lake dynamics of P, N and C. Mussel tissue P, N and C content and rates of excretion and biodepositon varied among species, seasons and depths, apparently driven by metabolic and stoichiometric factors. Dreissenid mussels excreted, deposited and stored large quantities of P, N and C when compared to lake standing stocks and loadings, and represent an important driver of nutrient cycling in the lake. Living and discarded mussel shell material is shown to represent a potentially important, and hitherto largely overlooked, long-term sink for P, N and C. The concentration of dreissenid biomass in the well-mixed and illuminated littoral portion of L. Simcoe results in redirection of nutrients and carbon from offshore areas to the nearshore zone of the lake. Changes in nutrient and carbon distribution and cycling patterns caused by dreissenid establishment in L. Simcoe and other ecosystems can have implications for the distribution of primary and secondary production and should be considered in the context of water quality and nutrient input management.

# Local dispersion of nonmotile invasive bivalve species by wind-driven lake currents

Hoyer, Andrea B.; Schladow, S. Geoffrey; Rueda, Francisco J.

Asian clam (Corbicula fluminea) is among the most aggressive freshwater invaders worldwide causing major ecological and economic damage. However, the mechanisms leading to the water-borne dispersion of the species within aquatic ecosystems, particularly lakes, is an area where research is at a relatively early stage. A numerical model has been developed to analyze and describe the dispersion that is produced by the actions of waves and currents. The model represents the basic particle processes of release (R), water-borne transport (T), and survival (S). The model has been applied to a large, deep lakeLake Tahoe. The dispersion model results reveal that (1) under episodic, extreme wind forcing, larvae are carried away from the original areas, along a discrete number of preferred pathways, (2) bays can act as retention zones, with low current velocities and recirculating eddies, and (3) the majority of the larvae released in the infested areas stay within these areas or disperse on a small spatial scale.

# Deep groundwater and potential subsurface habitats beneath an Antarctic dry valley

J. A. Mikucki; E. Auken; S. Tulaczyk; et al.

The occurrence of groundwater in Antarctica, particularly in the ice-free regions and along the coastal margins is poorly understood. Here we use an airborne transient electromagnetic (AEM) sensor to produce extensive imagery of resistivity beneath Taylor Valley. Regional-scale zones of low subsurface resistivity were detected that are inconsistent with the high resistivity of glacier ice or dry permafrost in this region. We interpret these results as an indication that liquid, with sufficiently high solute content, exists at temperatures well below freezing and considered within the range suitable for microbial life. These inferred brines are widespread within permafrost and extend below glaciers and lakes. One system emanates from below Taylor Glacier into Lake Bonney and a second system connects the ocean with the eastern 18 km of the valley. A connection between these two basins was not detected to the depth limitation of the AEM survey (~350 m).

# Bioassay-directed identification of organic toxicants in water and sediment of Tai Lake, China

Hu, Xinxin; Shi, Wei; Yu, Nanyang; et al.

The government of China has invested large amounts of money and manpower into revision of water quality standards (WQS). Priority organic pollutants have been screened for WQS establishment using the potential hazard index method, however, some unsuspected chemicals that could cause adverse effects might have been ignored. A large number of chemicals exist in environment and there might be interactions between or among chemicals especially those with the same mode of action. Therefore, a

toxicity-directed analysis, based on acute toxicity to Daphnia magna, was conducted for organic extracts of water and sediment from Tai Lake (Ch: Taihu) to determine toxicants responsible for adverse effects. Extracts of five of twelve samples of water and all extracts of sediment were acutely toxic. Based on toxic units, water from location L1 in July and sediments from locations L1 and L4 during several months would be expected to result in some toxicity. Twenty one (21) organophosphorus pesticides, 25 organophosphorus pesticides and 10 pyrethroids were detected in samples, extracts of which caused toxicity to D. magna. Chlorpyrifos and cyfluthrin were identified as predominant pollutants in organic extracts of sediments, accounting for up to 71% and 57% of bioassay-derived toxicity equivalents (BEQs), respectively. Chlorpyrifos was identified as the major contributor to toxicity of organic extracts of surface water, accounting for 71% to 83 % of BEQs. The putative causative agents were confirmed by use of three lines of evidence, including statistical correlation, addition of key pollutants or synergists. Greater attention should be paid to chlorpyrifos and cyfluthrin, neither of which is currently on the list of priority pollutants in China. Bioassay-directed analysis should be added for screening for the presence of priority organic pollutants in environmental media.

（来源：WATER RESEARCH, 2015, 73: 231-241）

# The "nutrient pump:" Iron-poor sediments fuel low nitrogen-to-phosphorus ratios and cyanobacterial blooms in polymictic lakes

Orihel, Diane M.; Schindler, David W.; Ballard, Nathaniel C.; et al.

Several lines of evidence from a eutrophic lake show how polymixis enables phosphorus (P) released from anoxic, iron (Fe)-poor sediments to lower nitrogen-to-phosphorus (N : P) ratios and stimulate cyanobacterial blooms. Detailed sediment analyses revealed extensive formation of Fe sulfides, which suppressed porewater Fe levels and prevented sequestration of P in Fe minerals. Experimental additions of Fe significantly decreased the flux of dissolved P from warm, anoxic sediments, increasing N : P ratios in porewater and overlying water. The net midsummer effect of polymixis and P release from Fe-poor sediments quickly doubled the total P in the euphotic zone during a period of very low external P loading. This internal nutrient pump decreased N : P in surface waters and led to a cyanobacterial bloom comprised primarily of diazotrophic Anabaena and Aphanizomenon spp. along with nonheterocystous and potentially toxic Microcystis icthyoblabe and Woronichinia naegelianum. Concentrations of the cyanotoxin, microcystin, in this lake were typically elevated during, or shortly after, episodes of internal P loading. Our study demonstrates an important mechanism underlying the increasing cyanobacterial dominance of weakly stratified eutrophic north temperate lakes, and warns of further increases under a warming climate.

（来源：LIMNOLOGY AND OCEANOGRAPHY, 2015, 60(3): 856-871）

# Diel cycles in the fluorescence of dissolved organic matter in dystrophic Wisconsin seepage lakes: Implications for carbon turnover

Watras, C. J.; Morrison, K. A.; Crawford, J. T.; et al.

We monitored the dynamics of chromophoric dissolved organic matter (CDOM) fluorescence in two Wisconsin bog lakes over timescales ranging from hours to months. Peatland-derived dissolved organic

matter (DOM) was the major solute in both bog lakes, and diel cycles were dominant features of the CDOM fluorescence time series. Two distinct diel cycles that differed in amplitude and timing were observed: one in oxic epilimnia and a second in anoxic, hypolimnetic waters. These cycles were not attributable to instrumental artifacts (i.e., daily oscillations of temperature, ambient light, or battery voltage), hydrologic forcing, or the effects of inner filtering, pH, or redox conditions. High light extinction coefficients, especially in the ultraviolet region (approximate to 10 m(-1) to 30 m(-1)), suggest that DOM photolysis was negligible at the depths of the CDOM fluorescence probes in these dark-water lakes (dissolved carbon concentration: 10 mg C L-1 to 20 mg C L-1). The diel cycles were apparently governed primarily by biological activities that mediate DOM production (release) and destruction (uptake). Rates of carbon turnover derived from properties of the epilimnetic CDOM fluorescence cycle (0.28 mg C L-1 d(-1)) were similar to rates of net ecosystem production based on daily CO2 dynamics (0.32 mg C L-1 d(-1)). It appears that a small, secondary pool of labile organic carbon turns over at relatively high rates in these bog lakes, consistent with the two-compartment view of DOM stability.

（来源：LIMNOLOGY AND OCEANOGRAPHY, 2015, 60(2): 482-496）

## Short-term and seasonal variability of oxygen fluxes at the sediment-water interface in a riverine lake

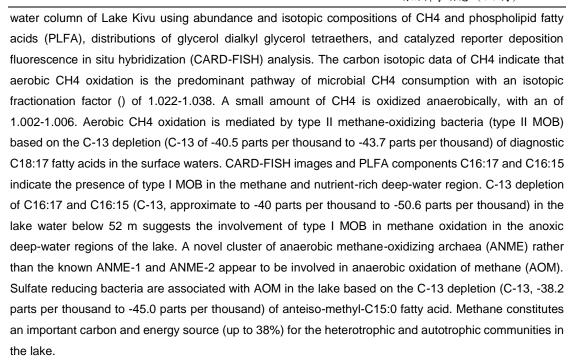Murniati, Erni; Geissler, Sebastian; Lorke, Andreas.

In situ measurements of sediment-water oxygen fluxes conducted in a riverine lake during different seasons were analyzed with the aim of quantifying the combined effects of hydrodynamic forcing and seasonal changes in temperature on sediment oxygen uptake rate. Oxygen fluxes measured using the eddy correlation (EC) technique varied widely between -6.4 and -84 mmol m(-2) day(-1), while variations observed on hourly time scales were of comparable magnitude to seasonal variations. Oxygen fluxes were most strongly correlated to current speed in the benthic boundary layer and water depth, which both co-varied with discharge, temperature, and oxygen concentration. A direct correlation of measured fluxes with temperature and corresponding seasonal flux variations could not be observed. To explore the potential effect of temperature on oxygen fluxes, we applied a simplified analytical model, which couples the effect of hydrodynamic forcing with a temperature-dependent oxygen consumption rate within the sediment. The results suggest that the flux is a non-linear function of both variables and both can have comparable effects on the magnitude of the oxygen fluxes. The model confirms our observation that short-term variations of oxygen fluxes in response to hydrodynamic forcing can mask longer-term seasonal variations driven by temperature. The model further indicates that the magnitude and form of the temperature dependence of oxygen uptake and mineralization rates in freshwater sediments obtained from laboratory incubations can be strongly affected by flow conditions during incubations. We conclude that predictions of oxygen uptake and mineralization rates under changing climatic conditions should also take potential changes of flow conditions into account.

（来源：AQUATIC SCIENCES, 2015, 77(2): 183-196）

## Methane oxidation pathways and associated methanotrophic communities in the water column of a tropical lake

Zigah, Prosper K.; Oswald, Kirsten; Brand, Andreas; et al.

We examined methane (CH4) oxidation pathways and associated methanotrophic communities in the

water column of Lake Kivu using abundance and isotopic compositions of CH4 and phospholipid fatty acids (PLFA), distributions of glycerol dialkyl glycerol tetraethers, and catalyzed reporter deposition fluorescence in situ hybridization (CARD-FISH) analysis. The carbon isotopic data of CH4 indicate that aerobic CH4 oxidation is the predominant pathway of microbial CH4 consumption with an isotopic fractionation factor () of 1.022-1.038. A small amount of CH4 is oxidized anaerobically, with an of 1.002-1.006. Aerobic CH4 oxidation is mediated by type II methane-oxidizing bacteria (type II MOB) based on the C-13 depletion (C-13 of -40.5 parts per thousand to -43.7 parts per thousand) of diagnostic C18:17 fatty acids in the surface waters. CARD-FISH images and PLFA components C16:17 and C16:15 indicate the presence of type I MOB in the methane and nutrient-rich deep-water region. C-13 depletion of C16:17 and C16:15 (C-13, approximate to -40 parts per thousand to -50.6 parts per thousand) in the lake water below 52 m suggests the involvement of type I MOB in methane oxidation in the anoxic deep-water regions of the lake. A novel cluster of anaerobic methane-oxidizing archaea (ANME) rather than the known ANME-1 and ANME-2 appear to be involved in anaerobic oxidation of methane (AOM). Sulfate reducing bacteria are associated with AOM in the lake based on the C-13 depletion (C-13, -38.2 parts per thousand to -45.0 parts per thousand) of anteiso-methyl-C15:0 fatty acid. Methane constitutes an important carbon and energy source (up to 38%) for the heterotrophic and autotrophic communities in the lake.

（来源：LIMNOLOGY AND OCEANOGRAPHY, 2015, 60(2): 553-572）

## Isomeric specific partitioning behaviors of perfluoroalkyl substances in water dissolved phase, suspended particulate matters and sediments in Liao River Basin and Taihu Lake, China

Chen, Xinwei; Zhu, Lingyan; Pan, Xiaoyu; et al.

The occurrence and distribution of eleven perfluoroalkyl substances (PFASs) and the isomers of perfluorooctanoate (PFOA), perfluorooctanesulfonate (PFOS) and perfluorooctane sulfonamide (PFOSA) were investigated in water dissolved phase, sediment and suspended particulate matter (SPM) in two typical watersheds in China: Liao River Basin and Taihu Lake. The total concentrations of the PFASs in the dissolved phase were 44.4-781ng/L in Liao River with high contribution of perfluorobutane sulfonate (PFBS) (75.7%) and PFOA (9.86%). The PFASs in the dissolved phase in Taihu Lake was 17.2-94.4ng/L with PFOA (39.8%), perfluorohexanoate (PFHxA) (30.1%) and PFOS (16.8%) as the dominant PFASs. The log Koc values of the PFASs in both SPM and sediment increased with increasing the perfluorinated carbon chain length. In Liao River Basin, the long chain perfluorocarboxylates (C10-12) bound with SPM contributed >30% to the total amount in water, suggesting that SPM could not be ignored when the environmental load of long chain PFASs in water was assessed. For the isomers of PFOA, PFOS and PFOSA, the linear isomers always displayed higher partition coefficients on particulate phases than the branched ones. An established isomer-profiling technique was applied to assess the relative contributions of various industrial origins for PFOA. In Liao River, when SPM was included in the water samples, there were contributions of PFOA from electrochemical fluorination (ECF) (55%), linear telomer (41%) and isopropyl telomer (4%) sources. While, the results based on the dissolved phase alone indicated more contribution of ECF (70%) source and lower contribution from linear telomer (26%) source. The discrepancy suggests that omitting SPM from water samples might lead to misunderstanding on the industrial origins of PFOA. In Taihu Lake, the isomer profile of PFOA was influenced mainly by ECF (88%) and partially by linear-telomer (12%) sources.

# A pilot study on the assessment of trace organic contaminants including pharmaceuticals and personal care products from on-site wastewater treatment systems along Skaneateles Lake in New York State, USA

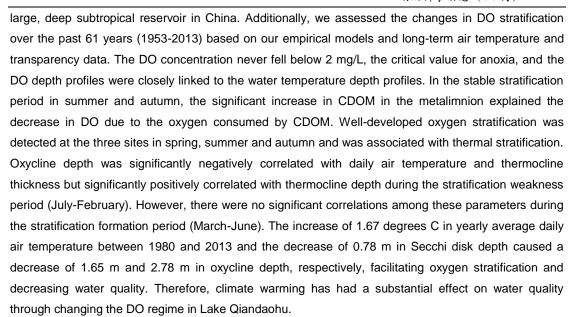Subedi, Bikram; Codru, Neculai; Dziewulski, David M.; et al.

On-site wastewater treatment systems (OWTSs or septic systems) are designed to treat and dispose effluents on the same property that produces the wastewater. Approximately 25% of the U.S. population is served by such facilities. Nevertheless, studies on the treatment efficiency and discharge of organic contaminants through septic effluents are lacking. This pilot study showed the occurrence of organic contaminants including pharmaceuticals and personal care products (PPCPs), perfluoroalkyl surfactants (PFASs), polybrominated diphenyl ethers (PBDEs), and polychlorinated biphenyls (PCBs) in septic effluents, adjacent lake water samples, household drinking water in homes that use lake water or a well adjacent to the lake as a source of drinking water, and offshore lake water samples. Septic effluent as well as lake and tap water samples were collected from several households with OWTSs around Skaneateles Lake located in central New York. The advanced on-site systems were installed in some households for the purpose of limiting nutrient levels in the effluent to protect the local surface water. Additionally, because many of these systems serve homes with limited land, advanced treatment systems were needed. The median concentrations of ten PPCPs (ranged from 0.45 to 388 ng/L) and eleven PFASs (ranged from 0.20 to 14.6 ng/L) in septic water were significantly higher ($p \le 0.01$) than in lake water samples. The Median concentrations of PPCPs and PFASs in lake and tap water samples were not significantly different ($p \ge 0.65$). The median concentrations of Sigma PBDEs in septic, lake, and tap water samples were 7.47, 3.49, and 2.22 ng/L, respectively, and those for Sigma PCBs were 33.1, 29.2, and 28.6 ng/L, respectively. The mass flux of PPCPs (i.e. the mass flow of PPCPs per unit area per unit time) through the disposal of treated septic effluent from textile biofilter and aerobic treatments to the dispersal unit ranged from 12 (carbamazepine) to 66900 mu g/m(2)/day (caffeine) whereas that for PFASs ranged from 7.0 (perfluorobutanesulfonate) to 833 mu g/m(2)/day (perfluorooctanoic acid). Based on the ratio of measured concentrations and method detection limit, triclocarban, perfluorooctanoic acid, and perfluorooctanesulfonate have the potential to be used as chemical tracers of septic water contamination in Skaneateles Lake. The median concentrations of atenolol, a beta-blocker drug, in septic water were significantly ($rho = 0.86$, $p = 0.01$) correlated with enterococci counts.

# Dissolved oxygen stratification and response to thermal structure and long-term climate change in a large and deep subtropical reservoir (Lake Qiandaohu, China)

Zhang, Yunlin; Wu, Zhixu; Liu, Mingliang; et al.

From January 2010 to March 2014, detailed depth profiles of water temperature, dissolved oxygen (DO), and chromophoric dissolved organic matter (CDOM) were collected at three sites in Lake Qiandaohu, a

large, deep subtropical reservoir in China. Additionally, we assessed the changes in DO stratification over the past 61 years (1953-2013) based on our empirical models and long-term air temperature and transparency data. The DO concentration never fell below 2 mg/L, the critical value for anoxia, and the DO depth profiles were closely linked to the water temperature depth profiles. In the stable stratification period in summer and autumn, the significant increase in CDOM in the metalimnion explained the decrease in DO due to the oxygen consumed by CDOM. Well-developed oxygen stratification was detected at the three sites in spring, summer and autumn and was associated with thermal stratification. Oxycline depth was significantly negatively correlated with daily air temperature and thermocline thickness but significantly positively correlated with thermocline depth during the stratification weakness period (July-February). However, there were no significant correlations among these parameters during the stratification formation period (March-June). The increase of 1.67 degrees C in yearly average daily air temperature between 1980 and 2013 and the decrease of 0.78 m in Secchi disk depth caused a decrease of 1.65 m and 2.78 m in oxycline depth, respectively, facilitating oxygen stratification and decreasing water quality. Therefore, climate warming has had a substantial effect on water quality through changing the DO regime in Lake Qiandaohu.

（来源：WATER RESEARCH, 2015, 75: 249-258）

## In situ, high-resolution imaging of labile phosphorus in sediments of a large eutrophic lake

Ding, Shiming; Han, Chao; Wang, Yanping; et al.

Understanding the labile status of phosphorus (P) in sediments is crucial for managing a eutrophic lake, but it is hindered by lacking in situ data particularly on a catchment scale. In this study, we for the first time characterized in situ labile P in sediments with the Zr-oxide diffusive gradients in thin films (Zr-oxide DGT) technique at a two-dimensional (2D), submillimeter resolution in a large eutrophic lake (Lake Taihu, China, with an area of 2338 km(2)). The concentration of DGT-labile P in the sediment profiles showed strong variation mostly ranging from 0.01 to 0.35 mg L-1 with a considerable number of hotspots. The horizontal heterogeneity index of labile P varied from 0.04 to 4.5. High values appeared at the depths of 0-30 mm, likely reflecting an active layer of labile P under the sediment -water interface (SWI). Concentration gradients of labile P were observed from the high-resolution 1D DGT profiles in both the sediment and overlying water layers close to the SWI. The apparent diffusion flux of P across the SWI was calculated between -21 and 65 ng cm(-2) d(-1), which showed that the sediments tended to be a source and sink of overlying water P in the algal- and macrophyte-dominated regions, respectively. The DGT-labile P in the 0-30 mm active layer showed a better correlation with overlying water P than the labile P measured by ex situ chemical extraction methods. It implies that in situ, high-resolution profiling of labile P with DGT is a more reliable approach and will significantly extend our ability in in situ monitoring of the labile status of P in sediments in the field.

（来源：WATER RESEARCH, 2015, 74: 100-109）

## Long-term trends of nutrients and trophic response variables for the Great Lakes

Dove, Alice; Chapra, Steven C.

Based primarily on data collected over the past four decades by Environment Canada, long-term trends

of eutrophication-related variables are developed for the offshore waters of the Laurentian Great Lakes. Trends of spring concentration are reported for the major nutrient species: phosphorus [total phosphorus (TP), and soluble reactive phosphorus (SRP)]; nitrogen [total oxidized nitrogen (NO3 + NO2), and ammonia nitrogen (NH3)]; and silica [soluble reactive silica (SiO2)]. Summer trends of surface chlorophyll a and Secchi depth are developed as indicators of lake trophic response. The results show that phosphorus has declined significantly in all the lakes, whereas nitrogen and silica have both increased. Along with documenting the impacts of the 1978 Great Lakes Water Quality Agreement phosphorus controls and the introduction of dreissenids, the results demonstrate conclusively that the offshore waters are now overwhelmingly phosphorus limited, which supports the conclusion that controlling phosphorus remains the only viable option for managing the trophic status of the Great Lakes offshore waters.

（来源：LIMNOLOGY AND OCEANOGRAPHY, 2015, 60(2): 696-721）

## Ecological changes in two contrasting lakes associated with human activity and dust transport in western Wyoming

Brahney, J.; Ballantyne, A. P.; Kociolek, P.; et al.

The atmospheric transport and deposition of aerosols has the potential to influence the chemistry and biology of oligotrophic alpine lakes. In recent decades, dust and nitrogen emissions to alpine ecosystems have increased across large areas of the western U.S., including Wyoming. Here, we use sediment geochemistry and Sr-87/Sr-86 and Nd-143/Nd-144 isotopes to examine historical dust deposition rates to alpine lakes in the southwestern region of the Wind River Range, Wyoming. We evaluate the biological response using diatom fossil assemblages and sediment pigment concentrations. Sediment core analyses indicated that prior to a recent rise in dust flux, phosphorus concentrations and species composition were similar to those found in other alpine lakes in the region. Concomitant with a similar to 50 fold increase in dust flux to the sediments circa 1940, sediment proxies revealed a two- to threefold increase in normalized sediment phosphorus content, an increase in the diatom-inferred total dissolved phosphorus concentration from similar to 4 to 9-12 mu g L-1, a tenfold increase in diatom production, and a relative increase in cyanobacteria abundance. The increase in dust influx during the 20(th) century appears to be due in part to human factors and demonstrates the potential for dust and other atmospheric pollutants to significantly alter remote aquatic ecosystems.

（来源：LIMNOLOGY AND OCEANOGRAPHY, 2015, 60(2): 678-695）

## 青藏高原及其邻区晚更新世高湖面事件的年代学问题——以柴达木盆地和腾格里沙漠为例

隆浩, 沈吉

青藏高原及周边地区第四纪古湖泊演化时空序列已有诸多研究，然而对于晚更新世高湖面出现的时间框架还存在争议。可靠的测年技术是厘清这一科学问题的关键所在。基于 14C 和光释光(OSL)两种测年手段，以取自柴达木盆地和腾格里沙漠的两套湖相沉积序列为研究对象，开展了系统的沉积物定年工作。其研究结果如下：(1) 柴达木盆地的湖相沉积岩芯的 14C 年代数据显示，老于 30 ka 的 14C 年代可能存

在低估；(2) 腾格里沙漠地区的全新世湖相沉积物样品的 OSL 和 14C 测年结果在误差范围内一致，但对于较老(>30 ka)的地层，两种测年技术产生了较大偏差，即 OSL 年龄远老于 14C 年龄；(3) 两个地区的测年结果揭示了同一个现象：对于老于 30 ka 的湖相沉积物(尤其是来自干旱-半干旱区)，14C 测年技术很可能会低估其沉积年龄；(4) 以往基于 14C 数据建立的氧同位素三阶段晚期的高湖面事件年代框架可能存在低估，最新的 OSL 测年结果表明，该高湖面事件的真实年代很可能老于 80 ka。因此，对接近或老于 30 ka 的 14C 年代，我们需要谨慎对待，而对现有的较老的 14C 年代数据的可靠性进行科学系统的评估，将有助于我们重新认识和厘清诸多科学问题和争议。

（来源：中国科学 D 辑, 2015, 45(1): 52-65）

## 1969−2010 年青藏高原北麓河盆地热喀斯特湖塘演化过程

罗京，牛富俊，林战举，等

基于青藏高原北麓河盆地 1969 年航片资料以及 2003 和 2010 年 SPOT-5 遥感资料的解译，对该地区过去 40 年面积大于 0.1 ha (1 ha = 10,000 m$^2$)的热喀斯特湖面积和数量变化进行了研究。结果表明，该区域热喀斯特湖在过去 40 年中(1969～2010)年呈现显著的扩张趋势，湖塘的总数量增加了 534 个，总面积增加了 410 ha。此外，通过对 1969 年所有湖塘的追踪统计，自 1969 年至 2010 年大部分(84%)湖塘的面积呈增大的趋势，只有 8%的湖塘面积减小和 6%的湖塘彻底消失。这种湖塘数量和面积的增大趋势可能与持续升高的气温和逐渐增大的 P-E 值(降水与潜蒸散的差值)有关，但是一些非气候因素(比如工程活动、湖底的透水性等)对湖塘的演化过程也具有重要的影响。

（来源：科学通报, 2015, 60(9): 871-871）

## Under-ice thermal stratification dynamics of a large, deep lake revealed by high-frequency data

Bruesewitz, Denise A.; Carey, Cayelan C.; Richardson, David C.; et al.

We measured under-ice thermal stratification from before ice-on through after ice-off in Lake Sunapee, New Hampshire, a large, deep, north temperate lake, using a high-frequency monitoring buoy in the winter season of 2007-2008 to quantify how lake thermal stratification varies throughout the under-ice season. We examined potential drivers of variation in under-ice stability, identified diel-scale patterns in under-ice stratification, and used this dataset to test the hypothesis that there are two distinct under-ice phases driven by heat flux from the sediment followed by increased solar radiation as winter progresses. High-frequency measurements demonstrated that only a small fraction of the under-ice period exhibited the traditional inverse stratification previously thought to prevail, based on temporally discrete under-ice temperature profiles. Local short-term weather conditions altered under-ice conditions throughout the ice season with brief periods of snow melt, resulting in several days of disrupted thermal stratification. Our

data indicate that thermal structure under the ice in Lake Sunapee is dynamic, and in contrast to smaller, shallower lakes, may be categorized in three, not two, distinct phases. As the under-ice season continues to become shorter due to climate change, under-ice thermal stratification in lakes will likely decrease further.

## Is the island biogeography model a poor predictor of biodiversity patterns in shallow lakes?

Nolby, Luke E.; Zimmer, Kyle D.; Hanson, Mark A.; et al.

The classic island biogeography model (IBM) predicts highest species richness in large, connected habitats due to colonisation and reduced risk of extinction. Promoting large, connected habitats has subsequently become a common theme in conservation biology. However, the IBM does not account for direct and indirect interactions among species. For example, planktivorous and benthivorous fish may reduce biodiversity in shallow lakes by inducing shifts to a turbid-water lake state with low habitat complexity. We assessed relationships between species richness, landscape features, fish biomass and lake state in 104 shallow lakes in Minnesota, U.S.A. First, we tested whether lake size and connectivity influenced species richness of fish and biomass of planktivores and benthivores (fish biomass). We subsequently tested whether fish biomass affected the probability that lakes were in turbid versus clear-water states. Finally, we tested whether species richness of macrophytes and taxon richness of aquatic invertebrates showed stronger relationships with lake size and connectivity or with fish biomass and lake state. Fish richness and biomass both increased with lake size and were higher in connected basins. Fish biomass, in turn, increased the probability that lakes would be turbid. In contrast, macrophyte and invertebrate richness were unrelated to lake size or connectivity. Instead, macrophyte richness was best predicted by lake state, while invertebrate richness was predicted by lake state and fish biomass. Richness of both macrophytes and invertebrates was higher in clear lakes, and invertebrate richness was inversely related to fish biomass. Our results indicate the IBM poorly explains the diversity of macrophytes and invertebrates in shallow lakes, with diversity more strongly driven by biotic interactions and influences associated with fish. We suggest that ecological implications of increased connectivity and lake size should be considered in future conservation strategies for shallow lakes.

## Validity and slopes of the linear equation of state for natural brines in salt lake systems

Kohfahl, C.; Post, V. E. A.; Hamann, E.; et al.

Many density-dependent groundwater flow simulations rely on a linear equation of state that relates the fluid density to the total dissolved solute content (TDS). This approach ignores non-linear volume of mixing effects, as well as the impact of any chemical reactions. These effects can be considered by using geochemical codes that implement algorithms that calculate the density of a fluid based on the concentration of individual solute species. While in principle such algorithms could be used in-lieu of a linear equation of state in a groundwater model, the computational overhead is such that the use of a more simplified equation of state is preferred. This requires that the assumption of linearity as well as the

appropriate value of the linear slope have to be determined. Here, published density measurements of 7 chemically-distinct salt lake brines are compared with densities calculated by PHREEQC-3, confirming the applicability of PHREEQC's algorithm to salt lake brines, as well as to seawater brines and artificial brines from laboratory experiments. Further, calculations with PHREEQC-3 are used to assess the impact of mineral precipitation reactions during evaporative concentration. Results show that the density-TDS relationship is essentially linear over a wide concentration range, and that slopes range between 0.64 and 0.75, with the upper end of the range applying to Na-CO3-Cl brines and the lower end to Na-Cl brines. Mineral precipitation of highly-soluble evaporate minerals such as halite and trona limit TDS, and may lead to considerable errors in coupled flow simulations based on a linear equation of state at high concentrations. Misrepresentation of the slope may lead to an error of up to 20% in the calculated length of the brine nose bordering a salt lake, or of the Rayleigh number, which indicates if a density stratification is stable or not.

（来源：JOURNAL OF HYDROLOGY, 2015, 523: 190-195）

## Capturing variations in inundation with satellite remote sensing in a morphologically complex, large lake

Wu, Guiping; Liu, Yuanbo.

Poyang Lake is the largest freshwater lake in China, with high morphological complexity from south to north. In recent years, the lake has experienced expansion and shrinkage processes over both short- and long-term scales, resulting in significant hydrological, ecological and economic problems. Exactly how and how rapidly the processes of spatial change have occurred in the lake during the expansion and shrinkage periods is unknown. Such knowledge is of great importance for policymakers as it may help with flood/drought prevention, land use planning and lake ecological conservation. In this study, we investigated the spatial-temporal distribution and changing processes of inundation in Poyang Lake based on Moderate Resolution Imaging Spectroradiometer (MODIS) Level-1B data from 2000 to 2011. A defined water variation rate (WVR) and inundation frequency (IF) indicator revealed the water surface submersion and exposure processes of lake expansion and shrinkage in different zones which were divided according to the lake's hydrological and topographic features. Regional differences and significant seasonality variability were found in the annual and monthly mean IF. The monthly mean IF increased slowly from north to south during January-August but decreased quickly from south to north during September-December. During the lake expansion period, the lake-type water body zone (Zone II) had the fastest expansion rate, with a mean monthly WVR value of 34.47% in February-March, and was followed by the channel-type water body zone (Zone I) in March-May (22.47%). However, during the lake shrinkage period, rapid shrinkage first appeared around the alluvial delta zones in August-October. The sequence of lake surface shrinkage from August to December is exactly opposite to that of lake expansion from February to July. These complex inundation characteristics and changing process were driven by the high temporal variability of the river flows, the morphological diversity of the benthic landforms and the patterns of water movement. These results provide a foundation for basic hydrological and ecological studies and are valuable for the conservation and management of water resources in Poyang Lake.

（来源：JOURNAL OF HYDROLOGY, 2015, 523: 14-23）

# Box model and 1D longitudinal model of flow and transport in Bosten Lake, China

Li, Ning; Kinzelbach, Wolfgang; Li, WenPeng; et al.

Bosten Lake in the southeast of Yanqi Catchment, China, supports the downstream agricultural and natural environments. Over the last few decades the intensive agricultural activities in Yanqi Catchment resulted in decreased lake levels and deteriorated lake water quality. A two-box model is constructed to understand the evolution of lake level and salinity between 1958 and 2008. The two-box model of the lake indicates that the evaporation does have the same trend as the observed lake area and the annual average evaporation agrees with the value obtained from the Penman-Monteith approach. To achieve a correct salt balance, the ratio of outflow concentration and average lake concentration has to be around 0.7. This is due to the incomplete mixing of the lake caused by short-circuiting between tributary inflow and the main outflow via the pump stations abstracting water from the lake. This short-circuiting is investigated in more detail by a ID numerical flow and transport model of the lake calibrated with observations of lake level and lake concentrations. The distributed model reproduces the correct time-varying outflow concentration. It is used for the assessment of two basic management options: increasing river discharge (by water saving irrigation, reduction of phreatic evaporation or reduction of agricultural area) and diverting saline drainage water to the desert.
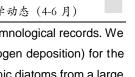
Increasing river discharge to the lake by 20% reduces the east basin salt concentration by 0.55 kg/m(3), while capturing all the drainage water and discharging it to depressions instead of the lake reduces the east basin salt concentration by 0.63 kg/m(3). A combination of increasing river inflow and decreasing drainage salt flux is sufficient to bring future lake TDS below the required 1 kg/m(3), to keep a lake level that sustains the lake ecosystem, and to supply more water for downstream development and ecosystem rehabilitation..

（来源：JOURNAL OF HYDROLOGY, 2015, 524: 62-71）

# Lake diatom responses to warming: reviewing the evidence

Ruehland, Kathleen M.; Paterson, Andrew M.; Smol, John P.

Algae, the dominant primary producers in many aquatic ecosystems, are critical to global biogeochemical cycling, and changes in their abundance and composition can cascade throughout aquatic food webs. Diatoms often dominate the algal communities in many freshwater systems. Their population dynamics are affected by a variety of environmental variables, many of which are linked to changes in water column properties and habitat availability, which themselves can be linked to shifts in ice cover, length of the growing season, thermal stability and stratification, vertical mixing patterns, habitat alterations, and the availability of resources such as light and nutrients. Climate has strong moderating controls on all of these fundamental aquatic processes, which can directly and indirectly alter species composition, abundance and seasonal dynamics of both periphytic and planktonic diatoms. In this review, we examine the role that climate-mediated alterations in inter-related lake processes have played on diatom community composition, dynamics and size structure, with particular attention to the recent success of planktonic diatom species relative to heavier tychoplanktonic and small benthic diatoms. We focus primarily on paleolimnological records, but also reference a wide spectrum of limnological and physiological studies to review and discuss how climate-driven shifts in lake properties may affect diatom assemblage reorganization. Understanding the limnological and historical context of these often complex

diatom changes is key to making scientifically defensible interpretations of paleolimnological records. We further evaluate the plausibility of alternative explanations (e.g. atmospheric nitrogen deposition) for the recent success of small cyclotelloid species by examining trends in these planktonic diatoms from a large number of sites. Using a weight-of-evidence approach, we conclude that recent climate change is the main driver that has led to ecological tipping points resulting in the recent success of small planktonic diatoms that have been reported in many aquatic systems.

（来源：JOURNAL OF PALEOLIMNOLOGY, 2015, 54(1): 1-35）

# Diatom community response to extreme water-level fluctuations in two Alpine lakes: a core case study

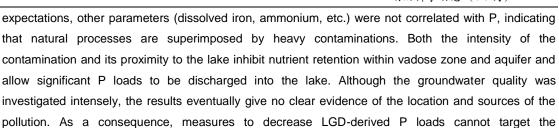Leira, M.; Filippi, M. L.; Cantonati, M.

Water-level fluctuations (WLF) often represent one of the greatest impacts on the development of lake ecosystems. In the year 1931, the Trentino Hydroelectric Company (SIT) requested the hydroelectric use of water bodies in the Upper and Middle Sarca basin. The largest and deepest lakes were dammed to increase lake volume and exploited since mid 1950s. This research uses the sediment record of two small lakes in close proximity to each other (GarzonS and Serodoli) in northern Italy, used for hydroelectric power generation to determine the dependence of diatom-assemblage dynamics on WLF that have taken place over the last 60 years. Historical WLF are clearly reflected in the lithological composition and grain-size variations of the sediment cores. During the regression and transgression phases, the boundaries between the erosion, transport and accumulation zones fluctuated, causing redistribution of previously accumulated sediments, and their return into the lake's cycling of biogeochemical matter. The water-level changes not only caused distinct taxonomic shifts in the diatom communities, which were dominated by different species in the core sections of each lake, but also significant shifts in the composition of the diatoms' ecological, morphofunctional and life-form groups. Diatoms with a low- and high-profile attachment type were the dominant morphological forms in the upper core levels, where the most extreme fluctuations in water level had occurred. Increased turbulent mixing caused by WLF favours the presence of large, heavily silicified centric diatoms, while more stable levels would select for smaller centric diatoms through thermal stratification.

（来源：JOURNAL OF PALEOLIMNOLOGY, 2015, 53(3): 289-307）

# Phosphorus in groundwater discharge - A potential source for lake eutrophication

Meinikmann, Karin; Hupfer, Michael; Lewandowski, Joerg.

Lake eutrophication has long been mainly associated with phosphorus (P) inputs from overland flow. The present study gives evidence that also groundwater can carry significant loads of dissolved P. We quantified P loads from groundwater to Lake Arendsee using near-shore measurements of P concentrations at a high spatial resolution and volume fluxes of lacustrine groundwater discharge (LGD) derived from a previous study. Results show that LGD accounts for more than 50% of the overall external P load, thus fuelling the eutrophication of the lake. Several different approaches of groundwater sampling (groundwater observation wells, temporary piezometers, and domestic wells) reveal a broad spatial heterogeneity of P concentrations in the subsurface catchment of the lake. The highest P concentrations (above 4 mg l(-1)) were found below a settled area along the southern lake shore. Contrary to

expectations, other parameters (dissolved iron, ammonium, etc.) were not correlated with P, indicating that natural processes are superimposed by heavy contaminations. Both the intensity of the contamination and its proximity to the lake inhibit nutrient retention within vadose zone and aquifer and allow significant P loads to be discharged into the lake. Although the groundwater quality was investigated intensely, the results eventually give no clear evidence of the location and sources of the pollution. As a consequence, measures to decrease LGD-derived P loads cannot target the contamination at its source in the catchment. They need to be implemented in the riparian area to eliminate groundwater P directly before it enters the lake.

（来源：JOURNAL OF HYDROLOGY, 2015, 524: 214-226）

## Change in event-scale hydrologic response in two urbanizing watersheds of the Great Lakes St Lawrence Basin 1969-2010

Trudeau, M. P.; Richardson, Murray.

The cumulative impacts of urban land use change on natural stream flow regimes and lotic ecosystems are poorly understood, and generally under-studied within the hydrologic sciences literature. Moreover, flow assessments using daily or monthly flows cannot adequately characterize long-term trends in event-scale flow dynamics in urbanizing watersheds. Accordingly, we analyzed high temporal resolution (15-min flows) growing season discharge records for two urbanizing watersheds in Canada's Great Lakes Basin, the Don and Humber, over a 42-year period. Results show that total discharge between May 26th and November 15th in the mainstem rivers has increased by about 45%, independent of total rainfall depth, over four decades. Peak rain event flow rates have increased by about 1 m(3) s(-1) yr(-1) in both watersheds and event flow variability has increased two-fold in the Don and five-fold in the Humber. In the Don, the ratio of rising limb event flows to median flow (for the period May 26 to November 15) increased from 13 in the 1970s to 21 in the 2000s. A similar comparison of ratios in the Humber showed higher variation in flow response but also an overall increase relative to the ratio of 14 in the 1970s. In the Don, rising limb event flow acceleration increased 2.4-fold over 4 decades. This study provides a new understanding of the changes in event-scale flow regime dynamics associated with over four decades of intensive urbanization, including increased magnitude of rising limb flows and flow acceleration, and systematic increases in the variability of peak discharges. Overall, our analysis demonstrates marked alteration in total and event flow regimes resulting in chronic perturbation of stream flows. The results also demonstrate an important application of long-term, high temporal resolution hydrological records. Furthermore, we quantify the degree to which hydrologic stationarity within the Don and Humber watersheds has been compromised over four decades, during a period prior to detectable climate-induced changes in rainfall patterns.

（来源：JOURNAL OF HYDROLOGY, 2015, 523: 650-662）

## Water balance of a lake with floodplain buffering: Lake Tana, Blue Nile Basin, Ethiopia

Dessie, Mekete; Verhoest, Niko E. C.; Pauwels, Valentijn R. N.; et al.

Lakes are very important components of the earth's hydrological cycle, providing a variety of services for humans and ecosystem functioning. For a sustainable use of lakes, a substantial body of knowledge on their water balance is vital. We present here a detailed daily water balance analysis for Lake Tana, the

largest lake in Ethiopia and the source of the Blue Nile. Rainfall on the lake is determined by Thiessen polygon procedure, open water evaporation is estimated by the Penman-combination equation and observed inflows for the gauged catchments as well as outflow data at the two lake outlets are directly used. Runoff from ungauged catchments is estimated using a simple rainfall runoff model and runoff coefficients. Hillslope catchments and floodplains are treated separately, which makes this study unique compared to previous water balance studies. Impact of the floodplain on the lake water balance is analyzed by conducting scenario-based studies.

We found an average yearly abstraction of 420 x 10(6) m(3) or 6% of river inflows to the lake by the floodplain in 2012 and 2013. Nearly 60% of the inflow to the lake is from the Gilgel Abay River. Simulated lake levels compare well with the observed lake levels (R-2 = 0.95) and the water balance can be closed with a closure error of 82 mm/year (3.5% of the total lake inflow). This study demonstrates the importance of floodplains and their influence on the water balance of the lake and the need of incorporating the effects of floodplains and water abstraction for irrigation to improve predictions.

（来源：JOURNAL OF HYDROLOGY, 2015, 522: 174-186）

## Examining the influence of river-lake interaction on the drought and water resources in the Poyang Lake basin

Zhang, Zengxin; Chen, Xi; Xu, Chong-Yu; et al.

In recent years, the Poyang Lake basin is in a prolonged drought which has placed immense pressure on the water resources utilization. In this paper, we explore the spatial and temporal distributions of extreme droughts in the Poyang Lake basin by using the methods of SPI (Standardized Precipitation Index) and EOF (Empirical Orthogonal Function) for the period of 1956-2009, which are influenced by regional precipitation anomalies and river-lake interaction due to water impounding of the Three Gorges Dam (TGD). The results show that: (I) the Poyang Lake basin experienced six extreme droughts during the past 60 years, which lead to decreases in streamflow from five tributary rivers down to the Poyang Lake. The droughts in the 1960s and the 2000s were the most serious ones. However, there was an increasing trend of streamflow in the upper and middle Yangtze in the 1960s, and a decreasing trend appeared in the 2000s. The decline of streamflow in the upper Yangtze reaches has lowered the water level of lower Yangtze River which has-caused more outflow from the Poyang Lake to the Yangtze River; (2) the operation of the Three Gorges Dam (TGD) has altered the seasonal pattern of flow regimes in the Poyang Lake and significantly reduced the water level in the lower Yangtze River during the TGD impounding period from late September to early November; and (3) the conjunction of extreme droughts in the Poyang lake and the upper Yangtze reaches coincided with the impounding of the TGD is the main cause of the low water level in the Poyang Lake. Although the impact of the recent droughts in the Poyang Lake and upper Yangtze reaches has played a crucial role in the low water level of Poyang lake, more attention should be paid to its sensitivity to the influence of the large dam-induced changes in the interaction between river and lake, particularly during impounding periods.

（来源：JOURNAL OF HYDROLOGY, 2015, 522: 510-521）

## 热点关注

### PNAS 文章：平衡中国未来水资源与粮食安全

2015 年 3 月，美国国家科学院院刊（PNAS）在线发表题为《平衡中国未来水资源保护与粮食安全》（Balancing Water Resources Conservation and Food Security in China）的文章，全面地评估了水资源约束对我国农业生产和粮食安全的影响。该项研究由中国人民大学的仇焕广教授与美国普林斯顿大学、日本国家环境研究所的学者合作完成。

随着持续的城镇化和工业化，未来几十年里中国经济增长也将持续。城镇化和工业化的过程会导致土地、水资源等资源需求的增加，从而加剧了可持续地维持人们生活和平衡农业与环境政策的挑战。其中，粮食安全和水安全是影响中国社会经济和生态环境可持续发展的重要因素。然而，这两者却存在矛盾，保障粮食安全需要增加农业用水，而为了保障社会经济生活用水和生态用水则需要减少农业用水。如何平衡未来水资源保护与粮食安全是一个亟需解决的重大问题。

该研究将经济模型耦合在水文模型来预测中国未来至 2030 年的粮食交易模式，并嵌入水资源以分析减少灌溉量对系统的影响，尤其是农业耗水量和粮食供给的充足性。利用大众均衡福利模型和线性项目优化模拟了省际和国际粮食交易模式，得到了基于水文模型的省际农产品中虚拟水分配量。

研究发现，减少高度依赖水量匮乏的河流和不可更新地下水资源的灌溉农田，例如内蒙古和北京地区，可以提高农业和粮食交易的水资源效率。同时，也可以避免中国境内重大的灌溉水调用消耗（高达 14.8 $km^3$/year，减少 14%），而相对较小的国家粮食供给的减少（例如，小麦减少 3%）。同时，研究人员指出，对于整个国家，而不仅仅是某个地区，减少 5% 的灌溉用水量的水资源政策几乎等同于相似的对粮食产量的影响。
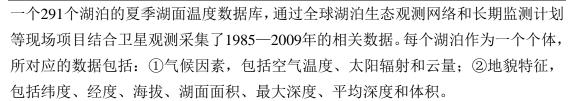
原文来源：http://www.pnas.org/content/early/2015/03/26/1504345112

（来源：科学研究动态监测快报 2015-05-15，10 期总第 172 期）

### Scientific Data 文章公布全球湖泊表面温度数据库

日前自然出版集团旗下的《科学数据》（Scientific Data）杂志在线发表题为《依靠原位和卫星方法收集的1985—2009年全球湖泊表面温度数据库》（A Global Database of Lake Surface Temperatures Collected by In Situ and Satellite Methods from 1985–2009）的文章，介绍了20多个国家的82位研究人员收集了北美、南美、欧洲、亚洲和大洋洲的主要湖泊表面温度数据，指出这些数据有助于气候变化研究。

全球和区域性的气候变化会对陆地和水生生态系统产生重要影响，近期研究表明全球不同地区的湖泊经历了明显的水温变暖，但对其变化的趋势和程度仍然缺乏了解。来自加拿大约克大学（York University）的研究人员和他们的国际同行建立了

一个291个湖泊的夏季湖面温度数据库,通过全球湖泊生态观测网络和长期监测计划等现场项目结合卫星观测采集了1985—2009年的相关数据。每个湖泊作为一个个体,所对应的数据包括:①气候因素,包括空气温度、太阳辐射和云量;②地貌特征,包括纬度、经度、海拔、湖面面积、最大深度、平均深度和体积。

该数据库是自2010年开始运行的"全球湖泊温度合作项目"(Global Lake Temperature Collaboration project,GLTC)的成果之一,科研人员计划未来收集更多湖泊的、更长时间段内的垂直温度分布数据,这些湖泊热量状况数据将会为研究环境变化及其生态影响提供宝贵基础。

原文来源:<u>http://www.nature.com/articles/sdata20158</u>

（来源:科学研究动态监测快报 2015-04-15,8期总第170期）

## 我国国际重要湿地干扰退化高于全球平均水平

"我国多数湿地保护区面积没发生明显变化,但内部结构即性质正发生改变。"在4日举行的《全球生态环境遥感监测2014年度报告》发布会上,该监测工作顾问组专家、遥感科学国家重点实验室主任施建成研究员说的"改变",指的是"部分自然湿地向人工湿地的转变"。

例如,黑龙江兴凯湖保护区内虽然湿地总面积没有发生变化,但超过3万公顷的永久性草本沼泽转变为水田,约占保护区面积的16%。

《全球生态环境遥感监测2014年度报告》首次将湿地这一极具生态功能和服务价值的指标纳入其中,专题报告《大型国际重要湿地》对2001年和2013年全球100处大型国际重要湿地以及中国20处国际重要湿地的状况及变化进行了客观的评价。监测显示,13年间,中国20处国际重要湿地面积净减少2万多公顷,占总面积的不到1%,湿地面积基本保持稳定;但部分区域干扰和退化现象明显,致使其生态功能也受到影响。

"反映湿地质量的重要指标之一——干扰度,全球国际重要湿地的干扰度平均值最高为20%,而中国约为30%。这说明中国的国际重要湿地面积的干扰/退化的程度高于国际平均水平。"报告编写组组长、中科院遥感与数字地球研究所牛振国研究员认为,这些既与我国面临更多的资源压力有关,也警示湿地的监测和管理不仅要关注数量,也要关注质量。

报告显示,从区域上,东北区域的国际性重要湿地面临的压力最大。黑龙江珍宝岛和东方红湿地保护区不仅内部有水田的存在,而且也有部分旱田。

"这可能与当地发展农业种植等经济活动有关。当自然湿地变成人工湿地之后,其湿地生态系统对自然的调节功能就会退化,如影响鸟类迁徙,造成其栖息地破碎化;破坏涵养水源、缓冲洪水等功能。"牛振国说。

报告还对滨海地区的江苏盐城、上海崇明东滩2处重要湿地进行监测,结果显示

保护区内湿地面积均有所增长。其中，江苏盐城自然保护区增加的湿地主要为养鱼虾池/盐场等人工湿地，增加面积超过4万公顷，占保护区面积1％左右，而滨海沼泽、滩涂等自然湿地却减少；崇明东滩除存在少量水田外，增加湿地部分更多地与陆地向海的扩展有关。

除了东北、滨海地区外，此次遥感监测还涉及我国中西部地区。20处典型国际重要湿地中湿地景观完整性较好的有江西鄱阳湖、青海鄂陵湖和扎陵湖、湖南西洞庭湖以及湖北洪湖共计5处重要湿地，而较差的有黑龙江东方红、江苏盐城、上海崇明东滩3处。

从湿地生态系统的干扰/退化来看，干扰/退化指数均小于5％的有江西鄱阳湖、湖南西洞庭湖、四川若尔盖、青海鄂陵湖和扎陵湖湿地5个保护区，说明其受人类活动或自然变化影响较小。由于保护区内农业经济行为（水田/水产养殖/堤坝建设等），受人类干扰活动超过30％的有湖北沉湖、江苏盐城、上海崇明东滩、黑龙江珍宝岛和东方红湿地保护区5处。

当然专家也指出，部分保护区（如东方红）由于列入《湿地名录》时间较短，监测结果不能完全说明其保护情况。需要继续开展监测，以确定其被列为国际重要湿地后，保护区内湿地生态系统是否得到改善。

我国是世界上湿地类型齐全、数量丰富的国家之一。为了保护湿地生态系统的多样性，牛振国建议，"我国湿地保护必须法规跟上，资金到位，政策落实"。他也坦承，我国湿地管理部门涉及林业、国土、农业、环保、水利、海洋等，存在空间重叠、部门交叉、多头管理的问题，应加强协调统一。同时，他也建议在我国土地利用分类系统中，引入"生态用地"概念，使土地使用在考虑经济用途之外，也要重视其生态功能。

（来源：《科技日报》 2015-06-05）

## 生物多样性是生态系统稳定关键

美国明尼苏达大学和牛津大学的一项研究发现，人类活动会影响草原地块的生产力，其中降低的生物多样性会削弱生态系统的稳定性，换言之，生物多样性是保持生态系统强劲的关键。该研究成果发表在最新一期的《科学》杂志上。

该研究团队在英国东伯特利附近的锡达河生态系统科学保护区的实验草块中，通过观测收集了28年的植物生长数据，包括品种数量、生态系统稳定性和暴露于变化中的氮、二氧化碳、火灾、放牧和水的状况。

研究人员说："我们发现，任何环境变化的动因都会导致植物多样性的减少，进而随着时间降低植物生物量的稳定。生物多样性在某种程度上是一个特殊的情况，因为它不仅是生态系统变化的因素，还对其他系统的变化是个响应。"

据物理学家组织网近日报道，该研究不仅观察了影响生态系统稳定性的几个因

素，还设置在很长时间内保持其他潜在变量不变。之所以重要是因为理解生态系统的因果级联变化，是对人类行动参与影响的关键，以及最小化减少对自然系统的损坏，以加强我们这个星球为继人类生命的能力。

研究人员说："如果我们想继续从我们的生态系统所提供的服务中获得好处，就应该格外珍惜和保护生物多样性。"

该研究合著者之一、锡达河生态系统科学保护区副主任佛雷斯特·伊斯贝尔强调，这个研究站点在获得研究结果中发挥了重要作用。与锡达河生态系统科学保护区相比，世界范围内鲜少有这么彻底对自然生态系统的调查。而来自世界各地的生态学家，不断被吸引到锡达河，并激发出去做更多的新发现，刷新人们对自然界的理解。

基于研究结果，研究人员正在扩大其研究，探讨多样性下降是否会影响天然草原，同时提供多种生态效益的能力。这项工作将通过一个网络平台协调，实现在世界各地同步对多样的草原生态进行研究，在快速变化的世界中有助于保持生态系统的健康。

（来源：《科技日报》2015-05-02）

## 第三极地区冰湖系统分类研究获进展

冰湖相对于面积较大的湖泊对气候变化响应更敏感，同时冰湖溃决会对下游地区的人员与财产造成较大的危害。日前，中科院青藏高原地球科学卓越创新中心在第三极地区冰湖研究领域获进展，相关成果发布在《地球和行星变化》上。

科研人员利用landsat遥感数据对近30年第三极地区的冰湖进行了系统编目。该研究将冰湖划分为冰面湖、与冰川末端相连和非相连湖泊三种类型。在分类的基础上，研究冰湖在第三极地区各流域数量与面积、不同大小面积变化幅度、与冰川距离远近、有冰川融水径流补给与非冰川融水径流补给变化差异、随海拔梯度变化特征等内容。

该研究还提供了第三极地区详细的冰湖编目，第三极地区2010年大于0.003平方公里的冰湖共有5701个，总面积约在682.4平方公里左右。研究结果表明，雅鲁藏布江（39%）、印度河（28%）和阿姆河（10%）流域冰湖分布较多，冰川融水径流补给湖比非冰川融水径流补给湖显示了更快的面积扩张,冰川融水是冰湖扩张的主因。

（来源：《中国科学报》 2015-06-18）

## 农用杀虫剂对全球地表水产生极大威胁

日前霍尔姆斯环境研究中心（UFZ）、德国科布伦茨-兰道大学等研究人员发表文章《农用杀虫剂对全球地表水产生极大威胁》（Agricultural insecticides pose

a global risk to surface water bodies)指出，占据全球陆地表面大约 40%的地表河流由于杀虫剂的使用受到威胁，并绘制出首张全球范围内由杀虫剂导致地表水污染的图谱。图谱显示地中海、美国、中美洲和东南亚地区存在的污染风险尤其巨大。

与其他化学物质不同，农用杀虫剂被大量地使用在虫害控制、除草和其他可能威胁农业产出的虫害防治中。因此，杀虫剂不仅影响陆地生态系统而且通过地表径流影响地表水体。根据估算，每年有大约 400 万吨，相当于全球陆地表面每亩 0.27 千克的农用杀虫剂投入使用。随着从传统的扩张模式向更为主观的模式的转变，许多发展中国家的农民加大了杀虫剂的使用。直到现在，由于杀虫剂引发的全球范围内的潜在水体污染仍存在许多未知。

绘制的风险图反映了人类利用土地所承受的风险。在欧洲中部，科学家评估了水体受污染的风险为中级到高级。在北半球，杀虫剂径流体现出一种相对较强的纬度梯度。由于平均温度的上升而增加杀虫剂投入量，在欧洲、北美和亚洲呈现出由北至南的潜在受污染风险梯度上升的趋势。由于南半球许多国家的人口与经济的快速增长，科学家认为这些国家在未来会增加农业产量而投入更多的杀虫剂使用量。世界上的许多地区有可能在风险图上的颜色仍会发生较大改变。现在，地中海、美国、中部美洲和东南亚地区尤为脆弱。

原文来源：http://www.ufz.de/index.php?en=33597

（来源：科学研究动态监测快报 2015-04-1，7 期总第 252 期）

## 欧洲科学家指出气候变化会加剧未来的洪水和干旱问题

2015年4月12—17日,欧洲地球科学联盟（EGU）大会在奥地利首都维也纳召开，会议专门安排了一部分针对全球变暖下干旱和洪水的交流汇报，本文对相关研究汇报的主要结论进行整理，以供参考。

欧洲委员会联合研究中心（JRC）的科研人员公布一项新研究，通过结合IPCC最高排放情景1下的区域气候预测与复杂的水循环模拟，探索欧洲未来的洪水风险情况。结果表明，未来全球变暖给整个欧洲带来的洪水损害可能远远大于原先预想。如果不采取减排措施，如今每100年一遇的极端河流洪水的发生频率在未来100年里可能会增加2倍，意味着21世纪末气候变化对欧洲陆地、资产和人民造成的损害平均会增加200%。到2080年欧洲22个较大的河流流域中有9个总的年均降雨量会增加，造成欧洲主要河流的水流将会增加73%。

国际应用系统分析研究所（IIASA）研究人员，结合5个不同的全球气候模型和未来气候变化的2种RCP情景，预测未来全球干旱情况。结果表明，RCP 8.5情景下，气候变化会导致2050年前地球某些地区出现史无前例的干旱，其中包括地中海和美国西部。气候变化导致干旱的严重程度和频率都比以前增加。

## 本世纪加拿大西部冰川将大量消融

一项最新研究发现，加拿大西部的大部分冰川将在本世纪内融化，这将给当地淡水生态系统和水力发电等造成巨大压力。

加拿大不列颠哥伦比亚大学等机构研究人员在新一期《自然·地球科学》杂志发表了这项研究。在长达10年的研究中，他们持续观测加拿大西部地区的冰川变化，并结合大量相关参数，如地球重力场分布、降水量变化等，最终模拟并预测出未来这一地区的冰川消融过程。

报告预测，到2100年，加拿大西部不列颠哥伦比亚省70％的冰川将消失，位于内陆落基山脉的冰川将消融90％，邻近的艾伯塔省境内也将有大量冰川消融，2020到2040年消融速度最快。

研究人员认为，这种消融是长期全球变暖所致，减排等措施可助减缓消融速度，但不能停止这一过程。过去的1.2万年间，冰川一直为这一地区补充淡水资源，一旦消失将会给当地生态系统带来严峻挑战。

（来源：《科技日报》 2015-04-10）

## 业界动态

## 国务院印发《水污染防治行动计划》

国务院关于印发水污染防治行动计划的通知

国发〔2015〕17 号

各省、自治区、直辖市人民政府，国务院各部委、各直属机构：

现将《水污染防治行动计划》印发给你们，请认真贯彻执行。

国务院

2015 年 4 月 2 日

（此件公开发布）

### 水污染防治行动计划

水环境保护事关人民群众切身利益，事关全面建成小康社会，事关实现中华民族伟大复兴中国梦。当前，我国一些地区水环境质量差、水生态受损重、环境隐患多等问题十分突出，影响和损害群众健康，不利于经济社会持续发展。为切实加大水污染防治力度，保障国家水安全，制定本行动计划。

总体要求：全面贯彻党的十八大和十八届二中、三中、四中全会精神，大力推

进生态文明建设，以改善水环境质量为核心，按照"节水优先、空间均衡、系统治理、两手发力"原则，贯彻"安全、清洁、健康"方针，强化源头控制，水陆统筹、河海兼顾，对江河湖海实施分流域、分区域、分阶段科学治理，系统推进水污染防治、水生态保护和水资源管理。坚持政府市场协同，注重改革创新；坚持全面依法推进，实行最严格环保制度；坚持落实各方责任，严格考核问责；坚持全民参与，推动节水洁水人人有责，形成"政府统领、企业施治、市场驱动、公众参与"的水污染防治新机制，实现环境效益、经济效益与社会效益多赢，为建设"蓝天常在、青山常在、绿水常在"的美丽中国而奋斗。

工作目标：到 2020 年，全国水环境质量得到阶段性改善，污染严重水体较大幅度减少，饮用水安全保障水平持续提升，地下水超采得到严格控制，地下水污染加剧趋势得到初步遏制，近岸海域环境质量稳中趋好，京津冀、长三角、珠三角等区域水生态环境状况有所好转。到 2030 年，力争全国水环境质量总体改善，水生态系统功能初步恢复。到本世纪中叶，生态环境质量全面改善，生态系统实现良性循环。

主要指标：到 2020 年，长江、黄河、珠江、松花江、淮河、海河、辽河等七大重点流域水质优良（达到或优于Ⅲ类）比例总体达到 70% 以上，地级及以上城市建成区黑臭水体均控制在 10% 以内，地级及以上城市集中式饮用水水源水质达到或优于Ⅲ类比例总体高于 93%，全国地下水质量极差的比例控制在 15% 左右，近岸海域水质优良（一、二类）比例达到 70% 左右。京津冀区域丧失使用功能（劣于 V 类）的水体断面比例下降 15 个百分点左右，长三角、珠三角区域力争消除丧失使用功能的水体。
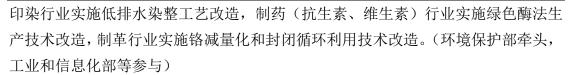
到 2030 年，全国七大重点流域水质优良比例总体达到 75% 以上，城市建成区黑臭水体总体得到消除，城市集中式饮用水水源水质达到或优于Ⅲ类比例总体为 95% 左右。

一、全面控制污染物排放

（一）狠抓工业污染防治。取缔"十小"企业。全面排查装备水平低、环保设施差的小型工业企业。2016 年底前，按照水污染防治法律法规要求，全部取缔不符合国家产业政策的小型造纸、制革、印染、染料、炼焦、炼硫、炼砷、炼油、电镀、农药等严重污染水环境的生产项目。（环境保护部牵头，工业和信息化部、国土资源部、能源局等参与，地方各级人民政府负责落实。以下均需地方各级人民政府落实，不再列出）

专项整治十大重点行业。制定造纸、焦化、氮肥、有色金属、印染、农副食品加工、原料药制造、制革、农药、电镀等行业专项治理方案，实施清洁化改造。新建、改建、扩建上述行业建设项目实行主要污染物排放等量或减量置换。2017 年底前，造纸行业力争完成纸浆无元素氯漂白改造或采取其他低污染制浆技术，钢铁企业焦炉完成干熄焦技术改造，氮肥行业尿素生产完成工艺冷凝液水解解析技术改造，

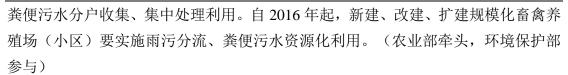印染行业实施低排水染整工艺改造，制药（抗生素、维生素）行业实施绿色酶法生产技术改造，制革行业实施铬减量化和封闭循环利用技术改造。（环境保护部牵头，工业和信息化部等参与）

集中治理工业集聚区水污染。强化经济技术开发区、高新技术产业开发区、出口加工区等工业集聚区污染治理。集聚区内工业废水必须经预处理达到集中处理要求，方可进入污水集中处理设施。新建、升级工业集聚区应同步规划、建设污水、垃圾集中处理等污染治理设施。2017 年底前，工业集聚区应按规定建成污水集中处理设施，并安装自动在线监控装置，京津冀、长三角、珠三角等区域提前一年完成；逾期未完成的，一律暂停审批和核准其增加水污染物排放的建设项目，并依照有关规定撤销其园区资格。（环境保护部牵头，科技部、工业和信息化部、商务部等参与）

（二）强化城镇生活污染治理。加快城镇污水处理设施建设与改造。现有城镇污水处理设施，要因地制宜进行改造，2020 年底前达到相应排放标准或再生利用要求。敏感区域（重点湖泊、重点水库、近岸海域汇水区域）城镇污水处理设施应于 2017 年底前全面达到一级 A 排放标准。建成区水体水质达不到地表水Ⅳ类标准的城市，新建城镇污水处理设施要执行一级 A 排放标准。按照国家新型城镇化规划要求，到 2020 年，全国所有县城和重点镇具备污水收集处理能力，县城、城市污水处理率分别达到 85%、95%左右。京津冀、长三角、珠三角等区域提前一年完成。（住房城乡建设部牵头，发展改革委、环境保护部等参与）

全面加强配套管网建设。强化城中村、老旧城区和城乡结合部污水截流、收集。现有合流制排水系统应加快实施雨污分流改造，难以改造的，应采取截流、调蓄和治理等措施。新建污水处理设施的配套管网应同步设计、同步建设、同步投运。除干旱地区外，城镇新区建设均实行雨污分流，有条件的地区要推进初期雨水收集、处理和资源化利用。到 2017 年，直辖市、省会城市、计划单列市建成区污水基本实现全收集、全处理，其他地级城市建成区于 2020 年底前基本实现。（住房城乡建设部牵头，发展改革委、环境保护部等参与）

推进污泥处理处置。污水处理设施产生的污泥应进行稳定化、无害化和资源化处理处置，禁止处理处置不达标的污泥进入耕地。非法污泥堆放点一律予以取缔。现有污泥处理处置设施应于 2017 年底前基本完成达标改造，地级及以上城市污泥无害化处理处置率应于 2020 年底前达到 90%以上。（住房城乡建设部牵头，发展改革委、工业和信息化部、环境保护部、农业部等参与）

（三）推进农业农村污染防治。防治畜禽养殖污染。科学划定畜禽养殖禁养区，2017 年底前，依法关闭或搬迁禁养区内的畜禽养殖场（小区）和养殖专业户，京津冀、长三角、珠三角等区域提前一年完成。现有规模化畜禽养殖场（小区）要根据污染防治需要，配套建设粪便污水贮存、处理、利用设施。散养密集区要实行畜禽

粪便污水分户收集、集中处理利用。自 2016 年起，新建、改建、扩建规模化畜禽养殖场（小区）要实施雨污分流、粪便污水资源化利用。（农业部牵头，环境保护部参与）

控制农业面源污染。制定实施全国农业面源污染综合防治方案。推广低毒、低残留农药使用补助试点经验，开展农作物病虫害绿色防控和统防统治。实行测土配方施肥，推广精准施肥技术和机具。完善高标准农田建设、土地开发整理等标准规范，明确环保要求，新建高标准农田要达到相关环保要求。敏感区域和大中型灌区，要利用现有沟、塘、窖等，配置水生植物群落、格栅和透水坝，建设生态沟渠、污水净化塘、地表径流集蓄池等设施，净化农田排水及地表径流。到 2020 年，测土配方施肥技术推广覆盖率达到 90%以上，化肥利用率提高到 40%以上，农作物病虫害统防统治覆盖率达到 40%以上；京津冀、长三角、珠三角等区域提前一年完成。（农业部牵头，发展改革委、工业和信息化、国土资源部、环境保护部、水利部、质检总局等参与）

调整种植业结构与布局。在缺水地区试行退地减水。地下水易受污染地区要优先种植需肥需药量低、环境效益突出的农作物。地表水过度开发和地下水超采问题较严重，且农业用水比重较大的甘肃、新疆（含新疆生产建设兵团）、河北、山东、河南等五省（区），要适当减少用水量较大的农作物种植面积，改种耐旱作物和经济林；2018 年底前，对 3300 万亩灌溉面积实施综合治理，退减水量 37 亿立方米以上。（农业部、水利部牵头，发展改革委、国土资源部等参与）

加快农村环境综合整治。以县级行政区域为单元,实行农村污水处理统一规划、统一建设、统一管理,有条件的地区积极推进城镇污水处理设施和服务向农村延伸。深化"以奖促治"政策，实施农村清洁工程，开展河道清淤疏浚，推进农村环境连片整治。到 2020 年，新增完成环境综合整治的建制村 13 万个。（环境保护部牵头，住房城乡建设部、水利部、农业部等参与）

（四）加强船舶港口污染控制。积极治理船舶污染。依法强制报废超过使用年限的船舶。分类分级修订船舶及其设施、设备的相关环保标准。2018 年起投入使用的沿海船舶、2021 年起投入使用的内河船舶执行新的标准；其他船舶于 2020 年底前完成改造，经改造仍不能达到要求的，限期予以淘汰。航行于我国水域的国际航线船舶，要实施压载水交换或安装压载水灭活处理系统。规范拆船行为，禁止冲滩拆解。（交通运输部牵头，工业和信息化、环境保护部、农业部、质检总局等参与）

增强港口码头污染防治能力。编制实施全国港口、码头、装卸站污染防治方案。加快垃圾接收、转运及处理处置设施建设，提高含油污水、化学品洗舱水等接收处置能力及污染事故应急能力。位于沿海和内河的港口、码头、装卸站及船舶修造厂，分别于 2017 年底前和 2020 年底前达到建设要求。港口、码头、装卸站的经营人应

制定防治船舶及其有关活动污染水环境的应急计划。（交通运输部牵头，工业和信息化部、住房城乡建设部、农业部等参与）

二、推动经济结构转型升级

（五）调整产业结构。依法淘汰落后产能。自 2015 年起，各地要依据部分工业行业淘汰落后生产工艺装备和产品指导目录、产业结构调整指导目录及相关行业污染物排放标准，结合水质改善要求及产业发展情况，制定并实施分年度的落后产能淘汰方案，报工业和信息化部、环境保护部备案。未完成淘汰任务的地区，暂停审批和核准其相关行业新建项目。（工业和信息化部牵头，发展改革委、环境保护部等参与）
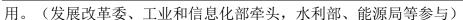
严格环境准入。根据流域水质目标和主体功能区规划要求，明确区域环境准入条件，细化功能分区，实施差别化环境准入政策。建立水资源、水环境承载能力监测评价体系，实行承载能力监测预警，已超过承载能力的地区要实施水污染物削减方案，加快调整发展规划和产业结构。到 2020 年，组织完成市、县域水资源、水环境承载能力现状评价。（环境保护部牵头，住房城乡建设部、水利部、海洋局等参与）

（六）优化空间布局。合理确定发展布局、结构和规模。充分考虑水资源、水环境承载能力，以水定城、以水定地、以水定人、以水定产。重大项目原则上布局在优化开发区和重点开发区，并符合城乡规划和土地利用总体规划。鼓励发展节水高效现代农业、低耗水高新技术产业以及生态保护型旅游业，严格控制缺水地区、水污染严重地区和敏感区域高耗水、高污染行业发展，新建、改建、扩建重点行业建设项目实行主要污染物排放减量置换。七大重点流域干流沿岸，要严格控制石油加工、化学原料和化学制品制造、医药制造、化学纤维制造、有色金属冶炼、纺织印染等项目环境风险，合理布局生产装置及危险化学品仓储等设施。（发展改革委、工业和信息化部牵头，国土资源部、环境保护部、住房城乡建设部、水利部等参与）

推动污染企业退出。城市建成区内现有钢铁、有色金属、造纸、印染、原料药制造、化工等污染较重的企业应有序搬迁改造或依法关闭。（工业和信息化部牵头，环境保护部等参与）

积极保护生态空间。严格城市规划蓝线管理，城市规划区范围内应保留一定比例的水域面积。新建项目一律不得违规占用水域。严格水域岸线用途管制，土地开发利用应按照有关法律法规和技术标准要求，留足河道、湖泊和滨海地带的管理和保护范围，非法挤占的应限期退出。（国土资源部、住房城乡建设部牵头，环境保护部、水利部、海洋局等参与）

（七）推进循环发展。加强工业水循环利用。推进矿井水综合利用，煤炭矿区的补充用水、周边地区生产和生态用水应优先使用矿井水，加强洗煤废水循环利用。鼓励钢铁、纺织印染、造纸、石油石化、化工、制革等高耗水企业废水深度处理回

用。（发展改革委、工业和信息化部牵头，水利部、能源局等参与）

促进再生水利用。以缺水及水污染严重地区城市为重点，完善再生水利用设施，工业生产、城市绿化、道路清扫、车辆冲洗、建筑施工以及生态景观等用水，要优先使用再生水。推进高速公路服务区污水处理和利用。具备使用再生水条件但未充分利用的钢铁、火电、化工、制浆造纸、印染等项目，不得批准其新增取水许可。自 2018 年起，单体建筑面积超过 2 万平方米的新建公共建筑，北京市 2 万平方米、天津市 5 万平方米、河北省 10 万平方米以上集中新建的保障性住房，应安装建筑中水设施。积极推动其他新建住房安装建筑中水设施。到 2020 年，缺水城市再生水利用率达到 20%以上，京津冀区域达到 30%以上。（住房城乡建设部牵头，发展改革委、工业和信息化部、环境保护部、交通运输部、水利部等参与）
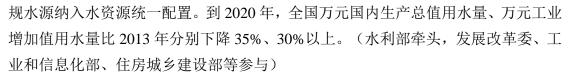
推动海水利用。在沿海地区电力、化工、石化等行业，推行直接利用海水作为循环冷却等工业用水。在有条件的城市，加快推进淡化海水作为生活用水补充水源。（发展改革委牵头，工业和信息化部、住房城乡建设部、水利部、海洋局等参与）

三、着力节约保护水资源

（八）控制用水总量。实施最严格水资源管理。健全取用水总量控制指标体系。加强相关规划和项目建设布局水资源论证工作，国民经济和社会发展规划以及城市总体规划的编制、重大建设项目的布局，应充分考虑当地水资源条件和防洪要求。对取用水总量已达到或超过控制指标的地区，暂停审批其建设项目新增取水许可。对纳入取水许可管理的单位和其他用水大户实行计划用水管理。新建、改建、扩建项目用水要达到行业先进水平，节水设施应与主体工程同时设计、同时施工、同时投运。建立重点监控用水单位名录。到 2020 年，全国用水总量控制在 6700 亿立方米以内。（水利部牵头，发展改革委、工业和信息化部、住房城乡建设部、农业部等参与）

严控地下水超采。在地面沉降、地裂缝、岩溶塌陷等地质灾害易发区开发利用地下水，应进行地质灾害危险性评估。严格控制开采深层承压水，地热水、矿泉水开发应严格实行取水许可和采矿许可。依法规范机井建设管理，排查登记已建机井，未经批准的和公共供水管网覆盖范围内的自备水井，一律予以关闭。编制地面沉降区、海水入侵区等区域地下水压采方案。开展华北地下水超采区综合治理，超采区内禁止工农业生产及服务业新增取用地下水。京津冀区域实施土地整治、农业开发、扶贫等农业基础设施项目，不得以配套打井为条件。2017 年底前，完成地下水禁采区、限采区和地面沉降控制区范围划定工作，京津冀、长三角、珠三角等区域提前一年完成。（水利部、国土资源部牵头，发展改革委、工业和信息化部、财政部、住房城乡建设部、农业部等参与）

（九）提高用水效率。建立万元国内生产总值水耗指标等用水效率评估体系，把节水目标任务完成情况纳入地方政府政绩考核。将再生水、雨水和微咸水等非常

规水源纳入水资源统一配置。到 2020 年，全国万元国内生产总值用水量、万元工业增加值用水量比 2013 年分别下降 35%、30%以上。（水利部牵头，发展改革委、工业和信息化部、住房城乡建设部等参与）

抓好工业节水。制定国家鼓励和淘汰的用水技术、工艺、产品和设备目录，完善高耗水行业取用水定额标准。开展节水诊断、水平衡测试、用水效率评估，严格用水定额管理。到 2020 年，电力、钢铁、纺织、造纸、石油石化、化工、食品发酵等高耗水行业达到先进定额标准。（工业和信息化部、水利部牵头，发展改革委、住房城乡建设部、质检总局等参与）

加强城镇节水。禁止生产、销售不符合节水标准的产品、设备。公共建筑必须采用节水器具，限期淘汰公共建筑中不符合节水标准的水嘴、便器水箱等生活用水器具。鼓励居民家庭选用节水器具。对使用超过 50 年和材质落后的供水管网进行更新改造，到 2017 年，全国公共供水管网漏损率控制在 12%以内；到 2020 年，控制在 10%以内。积极推行低影响开发建设模式，建设滞、渗、蓄、用、排相结合的雨水收集利用设施。新建城区硬化地面，可渗透面积要达到 40%以上。到 2020 年，地级及以上缺水城市全部达到国家节水型城市标准要求，京津冀、长三角、珠三角等区域提前一年完成。（住房城乡建设部牵头，发展改革委、工业和信息化部、水利部、质检总局等参与）

发展农业节水。推广渠道防渗、管道输水、喷灌、微灌等节水灌溉技术，完善灌溉用水计量设施。在东北、西北、黄淮海等区域，推进规模化高效节水灌溉，推广农作物节水抗旱技术。到 2020 年，大型灌区、重点中型灌区续建配套和节水改造任务基本完成，全国节水灌溉工程面积达到 7 亿亩左右，农田灌溉水有效利用系数达到 0.55 以上。（水利部、农业部牵头，发展改革委、财政部等参与）
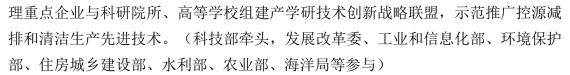
（十）科学保护水资源。完善水资源保护考核评价体系。加强水功能区监督管理，从严核定水域纳污能力。（水利部牵头，发展改革委、环境保护部等参与）

加强江河湖库水量调度管理。完善水量调度方案。采取闸坝联合调度、生态补水等措施，合理安排闸坝下泄水量和泄流时段，维持河湖基本生态用水需求，重点保障枯水期生态基流。加大水利工程建设力度，发挥好控制性水利工程在改善水质中的作用。（水利部牵头，环境保护部参与）

科学确定生态流量。在黄河、淮河等流域进行试点，分期分批确定生态流量（水位），作为流域水量调度的重要参考。（水利部牵头，环境保护部参与）

四、强化科技支撑

（十一）推广示范适用技术。加快技术成果推广应用，重点推广饮用水净化、节水、水污染治理及循环利用、城市雨水收集利用、再生水安全回用、水生态修复、畜禽养殖污染防治等适用技术。完善环保技术评价体系，加强国家环保科技成果共享平台建设，推动技术成果共享与转化。发挥企业的技术创新主体作用，推动水处

理重点企业与科研院所、高等学校组建产学研技术创新战略联盟，示范推广控源减排和清洁生产先进技术。（科技部牵头，发展改革委、工业和信息化部、环境保护部、住房城乡建设部、水利部、农业部、海洋局等参与）

（十二）攻关研发前瞻技术。整合科技资源，通过相关国家科技计划（专项、基金）等，加快研发重点行业废水深度处理、生活污水低成本高标准处理、海水淡化和工业高盐废水脱盐、饮用水微量有毒污染物处理、地下水污染修复、危险化学品事故和水上溢油应急处置等技术。开展有机物和重金属等水环境基准、水污染对人体健康影响、新型污染物风险评价、水环境损害评估、高品质再生水补充饮用水水源等研究。加强水生态保护、农业面源污染防治、水环境监控预警、水处理工艺技术装备等领域的国际交流合作。（科技部牵头，发展改革委、工业和信息化部、国土资源部、环境保护部、住房城乡建设部、水利部、农业部、卫生计生委等参与）

（十三）大力发展环保产业。规范环保产业市场。对涉及环保市场准入、经营行为规范的法规、规章和规定进行全面梳理，废止妨碍形成全国统一环保市场和公平竞争的规定和做法。健全环保工程设计、建设、运营等领域招投标管理办法和技术标准。推进先进适用的节水、治污、修复技术和装备产业化发展。（发展改革委牵头，科技部、工业和信息化部、财政部、环境保护部、住房城乡建设部、水利部、海洋局等参与）
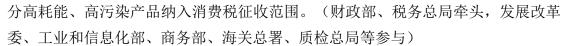
加快发展环保服务业。明确监管部门、排污企业和环保服务公司的责任和义务，完善风险分担、履约保障等机制。鼓励发展包括系统设计、设备成套、工程施工、调试运行、维护管理的环保服务总承包模式、政府和社会资本合作模式等。以污水、垃圾处理和工业园区为重点，推行环境污染第三方治理。（发展改革委、财政部牵头，科技部、工业和信息化部、环境保护部、住房城乡建设部等参与）

五、充分发挥市场机制作用

（十四）理顺价格税费。加快水价改革。县级及以上城市应于 2015 年底前全面实行居民阶梯水价制度，具备条件的建制镇也要积极推进。2020 年底前，全面实行非居民用水超定额、超计划累进加价制度。深入推进农业水价综合改革。（发展改革委牵头，财政部、住房城乡建设部、水利部、农业部等参与）

完善收费政策。修订城镇污水处理费、排污费、水资源费征收管理办法，合理提高征收标准，做到应收尽收。城镇污水处理收费标准不应低于污水处理和污泥处理处置成本。地下水水资源费征收标准应高于地表水，超采地区地下水水资源费征收标准应高于非超采地区。（发展改革委、财政部牵头，环境保护部、住房城乡建设部、水利部等参与）

健全税收政策。依法落实环境保护、节能节水、资源综合利用等方面税收优惠政策。对国内企业为生产国家支持发展的大型环保设备，必需进口的关键零部件及原材料，免征关税。加快推进环境保护税立法、资源税税费改革等工作。研究将部

分高耗能、高污染产品纳入消费税征收范围。（财政部、税务总局牵头，发展改革委、工业和信息化部、商务部、海关总署、质检总局等参与）

（十五）促进多元融资。引导社会资本投入。积极推动设立融资担保基金，推进环保设备融资租赁业务发展。推广股权、项目收益权、特许经营权、排污权等质押融资担保。采取环境绩效合同服务、授予开发经营权益等方式，鼓励社会资本加大水环境保护投入。（人民银行、发展改革委、财政部牵头，环境保护部、住房城乡建设部、银监会、证监会、保监会等参与）

增加政府资金投入。中央财政加大对属于中央事权的水环境保护项目支持力度，合理承担部分属于中央和地方共同事权的水环境保护项目，向欠发达地区和重点地区倾斜；研究采取专项转移支付等方式，实施"以奖代补"。地方各级人民政府要重点支持污水处理、污泥处理处置、河道整治、饮用水水源保护、畜禽养殖污染防治、水生态修复、应急清污等项目和工作。对环境监管能力建设及运行费用分级予以必要保障。（财政部牵头，发展改革委、环境保护部等参与）

（十六）建立激励机制。健全节水环保"领跑者"制度。鼓励节能减排先进企业、工业集聚区用水效率、排污强度等达到更高标准，支持开展清洁生产、节约用水和污染治理等示范。（发展改革委牵头，工业和信息化部、财政部、环境保护部、住房城乡建设部、水利部等参与）

推行绿色信贷。积极发挥政策性银行等金融机构在水环境保护中的作用，重点支持循环经济、污水处理、水资源节约、水生态环境保护、清洁及可再生能源利用等领域。严格限制环境违法企业贷款。加强环境信用体系建设，构建守信激励与失信惩戒机制，环保、银行、证券、保险等方面要加强协作联动，于 2017 年底前分级建立企业环境信用评价体系。鼓励涉重金属、石油化工、危险化学品运输等高环境风险行业投保环境污染责任保险。（人民银行牵头，工业和信息化部、环境保护部、水利部、银监会、证监会、保监会等参与）

实施跨界水环境补偿。探索采取横向资金补助、对口援助、产业转移等方式，建立跨界水环境补偿机制，开展补偿试点。深化排污权有偿使用和交易试点。（财政部牵头，发展改革委、环境保护部、水利部等参与）

六、严格环境执法监管

（十七）完善法规标准。健全法律法规。加快水污染防治、海洋环境保护、排污许可、化学品环境管理等法律法规制修订步伐，研究制定环境质量目标管理、环境功能区划、节水及循环利用、饮用水水源保护、污染责任保险、水功能区监督管理、地下水管理、环境监测、生态流量保障、船舶和陆源污染防治等法律法规。各地可结合实际，研究起草地方性水污染防治法规。（法制办牵头，发展改革委、工业和信息化部、国土资源部、环境保护部、住房城乡建设部、交通运输部、水利部、农业部、卫生计生委、保监会、海洋局等参与）

完善标准体系。制修订地下水、地表水和海洋等环境质量标准，城镇污水处理、污泥处理处置、农田退水等污染物排放标准。健全重点行业水污染物特别排放限值、污染防治技术政策和清洁生产评价指标体系。各地可制定严于国家标准的地方水污染物排放标准。（环境保护部牵头，发展改革委、工业和信息化部、国土资源部、住房城乡建设部、水利部、农业部、质检总局等参与）

（十八）加大执法力度。所有排污单位必须依法实现全面达标排放。逐一排查工业企业排污情况，达标企业应采取措施确保稳定达标；对超标和超总量的企业予以"黄牌"警示，一律限制生产或停产整治；对整治仍不能达到要求且情节严重的企业予以"红牌"处罚，一律停业、关闭。自 2016 年起，定期公布环保"黄牌"、"红牌"企业名单。定期抽查排污单位达标排放情况，结果向社会公布。（环境保护部负责）
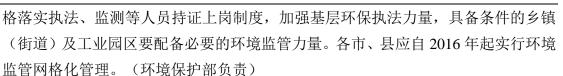
完善国家督查、省级巡查、地市检查的环境监督执法机制，强化环保、公安、监察等部门和单位协作，健全行政执法与刑事司法衔接配合机制，完善案件移送、受理、立案、通报等规定。加强对地方人民政府和有关部门环保工作的监督，研究建立国家环境监察专员制度。（环境保护部牵头，工业和信息化部、公安部、中央编办等参与）

严厉打击环境违法行为。重点打击私设暗管或利用渗井、渗坑、溶洞排放、倾倒含有毒有害污染物废水、含病原体污水，监测数据弄虚作假，不正常使用水污染物处理设施，或者未经批准拆除、闲置水污染物处理设施等环境违法行为。对造成生态损害的责任者严格落实赔偿制度。严肃查处建设项目环境影响评价领域越权审批、未批先建、边批边建、久试不验等违法违规行为。对构成犯罪的，要依法追究刑事责任。（环境保护部牵头，公安部、住房城乡建设部等参与）

（十九）提升监管水平。完善流域协作机制。健全跨部门、区域、流域、海域水环境保护议事协调机制，发挥环境保护区域督查派出机构和流域水资源保护机构作用，探索建立陆海统筹的生态系统保护修复机制。流域上下游各级政府、各部门之间要加强协调配合、定期会商，实施联合监测、联合执法、应急联动、信息共享。京津冀、长三角、珠三角等区域要于 2015 年底前建立水污染防治联动协作机制。建立严格监管所有污染物排放的水环境保护管理制度。（环境保护部牵头，交通运输部、水利部、农业部、海洋局等参与）

完善水环境监测网络。统一规划设置监测断面（点位）。提升饮用水水源水质全指标监测、水生生物监测、地下水环境监测、化学物质监测及环境风险防控技术支撑能力。2017 年底前，京津冀、长三角、珠三角等区域、海域建成统一的水环境监测网。（环境保护部牵头，发展改革委、国土资源部、住房城乡建设部、交通运输部、水利部、农业部、海洋局等参与）

提高环境监管能力。加强环境监测、环境监察、环境应急等专业技术培训，严

格落实执法、监测等人员持证上岗制度，加强基层环保执法力量，具备条件的乡镇（街道）及工业园区要配备必要的环境监管力量。各市、县应自2016年起实行环境监管网格化管理。（环境保护部负责）

七、切实加强水环境管理

（二十）强化环境质量目标管理。明确各类水体水质保护目标，逐一排查达标状况。未达到水质目标要求的地区要制定达标方案，将治污任务逐一落实到汇水范围内的排污单位，明确防治措施及达标时限，方案报上一级人民政府备案，自2016年起，定期向社会公布。对水质不达标的区域实施挂牌督办，必要时采取区域限批等措施。（环境保护部牵头，水利部参与）

（二十一）深化污染物排放总量控制。完善污染物统计监测体系，将工业、城镇生活、农业、移动源等各类污染源纳入调查范围。选择对水环境质量有突出影响的总氮、总磷、重金属等污染物，研究纳入流域、区域污染物排放总量控制约束性指标体系。（环境保护部牵头，发展改革委、工业和信息化部、住房城乡建设部、水利部、农业部等参与）

（二十二）严格环境风险控制。防范环境风险。定期评估沿江河湖库工业企业、工业集聚区环境和健康风险，落实防控措施。评估现有化学物质环境和健康风险，2017年底前公布优先控制化学品名录，对高风险化学品生产、使用进行严格限制，并逐步淘汰替代。（环境保护部牵头，工业和信息化部、卫生计生委、安全监管总局等参与）
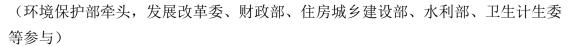
稳妥处置突发水环境污染事件。地方各级人民政府要制定和完善水污染事故处置应急预案，落实责任主体，明确预警预报与响应程序、应急处置及保障措施等内容，依法及时公布预警信息。（环境保护部牵头，住房城乡建设部、水利部、农业部、卫生计生委等参与）

（二十三）全面推行排污许可。依法核发排污许可证。2015年底前，完成国控重点污染源及排污权有偿使用和交易试点地区污染源排污许可证的核发工作，其他污染源于2017年底前完成。（环境保护部负责）

加强许可证管理。以改善水质、防范环境风险为目标，将污染物排放种类、浓度、总量、排放去向等纳入许可证管理范围。禁止无证排污或不按许可证规定排污。强化海上排污监管，研究建立海上污染排放许可证制度。2017年底前，完成全国排污许可证管理信息平台建设。（环境保护部牵头，海洋局参与）

八、全力保障水生态环境安全

（二十四）保障饮用水水源安全。从水源到水龙头全过程监管饮用水安全。地方各级人民政府及供水单位应定期监测、检测和评估本行政区域内饮用水水源、供水厂出水和用户水龙头水质等饮水安全状况，地级及以上城市自2016年起每季度向社会公开。自2018年起，所有县级及以上城市饮水安全状况信息都要向社会公开。

（环境保护部牵头，发展改革委、财政部、住房城乡建设部、水利部、卫生计生委等参与）

强化饮用水水源环境保护。开展饮用水水源规范化建设，依法清理饮用水水源保护区内违法建筑和排污口。单一水源供水的地级及以上城市应于 2020 年底前基本完成备用水源或应急水源建设，有条件的地方可以适当提前。加强农村饮用水水源保护和水质检测。（环境保护部牵头，发展改革委、财政部、住房城乡建设部、水利部、卫生计生委等参与）

防治地下水污染。定期调查评估集中式地下水型饮用水水源补给区等区域环境状况。石化生产存贮销售企业和工业园区、矿山开采区、垃圾填埋场等区域应进行必要的防渗处理。加油站地下油罐应于 2017 年底前全部更新为双层罐或完成防渗池设置。报废矿井、钻井、取水井应实施封井回填。公布京津冀等区域内环境风险大、严重影响公众健康的地下水污染场地清单，开展修复试点。（环境保护部牵头，财政部、国土资源部、住房城乡建设部、水利部、商务部等参与）

（二十五）深化重点流域污染防治。编制实施七大重点流域水污染防治规划。研究建立流域水生态环境功能分区管理体系。对化学需氧量、氨氮、总磷、重金属及其他影响人体健康的污染物采取针对性措施，加大整治力度。汇入富营养化湖库的河流应实施总氮排放控制。到 2020 年，长江、珠江总体水质达到优良，松花江、黄河、淮河、辽河在轻度污染基础上进一步改善，海河污染程度得到缓解。三峡库区水质保持良好，南水北调、引滦入津等调水工程确保水质安全。太湖、巢湖、滇池富营养化水平有所好转。白洋淀、乌梁素海、呼伦湖、艾比湖等湖泊污染程度减轻。环境容量较小、生态环境脆弱，环境风险高的地区，应执行水污染物特别排放限值。各地可根据水环境质量改善需要，扩大特别排放限值实施范围。（环境保护部牵头，发展改革委、工业和信息化部、财政部、住房城乡建设部、水利部等参与）

加强良好水体保护。对江河源头及现状水质达到或优于III类的江河湖库开展生态环境安全评估，制定实施生态环境保护方案。东江、滦河、千岛湖、南四湖等流域于 2017 年底前完成。浙闽片河流、西南诸河、西北诸河及跨界水体水质保持稳定。（环境保护部牵头，外交部、发展改革委、财政部、水利部、林业局等参与）

（二十六）加强近岸海域环境保护。实施近岸海域污染防治方案。重点整治黄河口、长江口、闽江口、珠江口、辽东湾、渤海湾、胶州湾、杭州湾、北部湾等河口海湾污染。沿海地级及以上城市实施总氮排放总量控制。研究建立重点海域排污总量控制制度。规范入海排污口设置，2017 年底前全面清理非法或设置不合理的入海排污口。到 2020 年，沿海省（区、市）入海河流基本消除劣于 V 类的水体。提高涉海项目准入门槛。（环境保护部、海洋局牵头，发展改革委、工业和信息化部、财政部、住房城乡建设部、交通运输部、农业部等参与）

推进生态健康养殖。在重点河湖及近岸海域划定限制养殖区。实施水产养殖池

塘、近海养殖网箱标准化改造，鼓励有条件的渔业企业开展海洋离岸养殖和集约化养殖。积极推广人工配合饲料，逐步减少冰鲜杂鱼饲料使用。加强养殖投入品管理，依法规范、限制使用抗生素等化学药品，开展专项整治。到 2015 年，海水养殖面积控制在 220 万公顷左右。（农业部负责）

严格控制环境激素类化学品污染。2017 年底前完成环境激素类化学品生产使用情况调查，监控评估水源地、农产品种植区及水产品集中养殖区风险，实施环境激素类化学品淘汰、限制、替代等措施。（环境保护部牵头，工业和信息化部、农业部等参与）

（二十七）整治城市黑臭水体。采取控源截污、垃圾清理、清淤疏浚、生态修复等措施，加大黑臭水体治理力度，每半年向社会公布治理情况。地级及以上城市建成区应于 2015 年底前完成水体排查，公布黑臭水体名称、责任人及达标期限；于 2017 年底前实现河面无大面积漂浮物，河岸无垃圾，无违法排污口；于 2020 年底前完成黑臭水体治理目标。直辖市、省会城市、计划单列市建成区要于 2017 年底前基本消除黑臭水体。（住房城乡建设部牵头，环境保护部、水利部、农业部等参与）

（二十八）保护水和湿地生态系统。加强河湖水生态保护，科学划定生态保护红线。禁止侵占自然湿地等水源涵养空间，已侵占的要限期予以恢复。强化水源涵养林建设与保护，开展湿地保护与修复，加大退耕还林、还草、还湿力度。加强滨河（湖）带生态建设，在河道两侧建设植被缓冲带和隔离带。加大水生野生动植物类自然保护区和水产种质资源保护区保护力度，开展珍稀濒危水生生物和重要水产种质资源的就地和迁地保护，提高水生生物多样性。2017 年底前，制定实施七大重点流域水生生物多样性保护方案。（环境保护部、林业局牵头，财政部、国土资源部、住房城乡建设部、水利部、农业部等参与）

保护海洋生态。加大红树林、珊瑚礁、海草床等滨海湿地、河口和海湾典型生态系统，以及产卵场、索饵场、越冬场、洄游通道等重要渔业水域的保护力度，实施增殖放流，建设人工鱼礁。开展海洋生态补偿及赔偿等研究，实施海洋生态修复。认真执行围填海管制计划，严格围填海管理和监督，重点海湾、海洋自然保护区的核心区及缓冲区、海洋特别保护区的重点保护区及预留区、重点河口区域、重要滨海湿地区域、重要砂质岸线及沙源保护海域、特殊保护海岛及重要渔业海域禁止实施围填海，生态脆弱敏感区、自净能力差的海域严格限制围填海。严肃查处违法围填海行为，追究相关人员责任。将自然海岸线保护纳入沿海地方政府政绩考核。到 2020 年，全国自然岸线保有率不低于 35%（不包括海岛岸线）。（环境保护部、海洋局牵头，发展改革委、财政部、农业部、林业局等参与）

九、明确和落实各方责任

（二十九）强化地方政府水环境保护责任。各级地方人民政府是实施本行动计划的主体，要于 2015 年底前分别制定并公布水污染防治工作方案，逐年确定分流域、

分区域、分行业的重点任务和年度目标。要不断完善政策措施，加大资金投入，统筹城乡水污染治理，强化监管，确保各项任务全面完成。各省（区、市）工作方案报国务院备案。（环境保护部牵头，发展改革委、财政部、住房城乡建设部、水利部等参与）

（三十）加强部门协调联动。建立全国水污染防治工作协作机制，定期研究解决重大问题。各有关部门要认真按照职责分工，切实做好水污染防治相关工作。环境保护部要加强统一指导、协调和监督，工作进展及时向国务院报告。（环境保护部牵头，发展改革委、科技部、工业和信息化部、财政部、住房城乡建设部、水利部、农业部、海洋局等参与）

（三十一）落实排污单位主体责任。各类排污单位要严格执行环保法律法规和制度，加强污染治理设施建设和运行管理，开展自行监测，落实治污减排、环境风险防范等责任。中央企业和国有企业要带头落实，工业集聚区内的企业要探索建立环保自律机制。（环境保护部牵头，国资委参与）

（三十二）严格目标任务考核。国务院与各省（区、市）人民政府签订水污染防治目标责任书，分解落实目标任务，切实落实"一岗双责"。每年分流域、分区域、分海域对行动计划实施情况进行考核，考核结果向社会公布，并作为对领导班子和领导干部综合考核评价的重要依据。（环境保护部牵头，中央组织部参与）
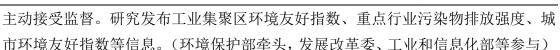
将考核结果作为水污染防治相关资金分配的参考依据。（财政部、发展改革委牵头，环境保护部参与）

对未通过年度考核的，要约谈省级人民政府及其相关部门有关负责人，提出整改意见，予以督促；对有关地区和企业实施建设项目环评限批。对因工作不力、履职缺位等导致未能有效应对水环境污染事件的，以及干预、伪造数据和没有完成年度目标任务的，要依法依纪追究有关单位和人员责任。对不顾生态环境盲目决策，导致水环境质量恶化，造成严重后果的领导干部，要记录在案，视情节轻重，给予组织处理或党纪政纪处分，已经离任的也要终身追究责任。（环境保护部牵头，监察部参与）

十、强化公众参与和社会监督

（三十三）依法公开环境信息。综合考虑水环境质量及达标情况等因素，国家每年公布最差、最好的 10 个城市名单和各省（区、市）水环境状况。对水环境状况差的城市，经整改后仍达不到要求的，取消其环境保护模范城市、生态文明建设示范区、节水型城市、园林城市、卫生城市等荣誉称号，并向社会公告。（环境保护部牵头，发展改革委、住房城乡建设部、水利部、卫生计生委、海洋局等参与）

各省（区、市）人民政府要定期公布本行政区域内各地级市（州、盟）水环境质量状况。国家确定的重点排污单位应依法向社会公开其产生的主要污染物名称、排放方式、排放浓度和总量、超标排放情况，以及污染防治设施的建设和运行情况，

主动接受监督。研究发布工业集聚区环境友好指数、重点行业污染物排放强度、城市环境友好指数等信息。（环境保护部牵头，发展改革委、工业和信息化部等参与）

（三十四）加强社会监督。为公众、社会组织提供水污染防治法规培训和咨询，邀请其全程参与重要环保执法行动和重大水污染事件调查。公开曝光环境违法典型案件。健全举报制度，充分发挥"12369"环保举报热线和网络平台作用。限期办理群众举报投诉的环境问题，一经查实，可给予举报人奖励。通过公开听证、网络征集等形式，充分听取公众对重大决策和建设项目的意见。积极推行环境公益诉讼。（环境保护部负责）

（三十五）构建全民行动格局。树立"节水洁水，人人有责"的行为准则。加强宣传教育，把水资源、水环境保护和水情知识纳入国民教育体系，提高公众对经济社会发展和环境保护客观规律的认识。依托全国中小学节水教育、水土保持教育、环境教育等社会实践基地，开展环保社会实践活动。支持民间环保机构、志愿者开展工作。倡导绿色消费新风尚，开展环保社区、学校、家庭等群众性创建活动，推动节约用水，鼓励购买使用节水产品和环境标志产品。（环境保护部牵头，教育部、住房城乡建设部、水利部等参与）

我国正处于新型工业化、信息化、城镇化和农业现代化快速发展阶段，水污染防治任务繁重艰巨。各地区、各有关部门要切实处理好经济社会发展和生态文明建设的关系，按照"地方履行属地责任、部门强化行业管理"的要求，明确执法主体和责任主体，做到各司其职，恪尽职守，突出重点，综合整治，务求实效，以抓铁有痕、踏石留印的精神，依法依规狠抓贯彻落实，确保全国水环境治理与保护目标如期实现，为实现"两个一百年"奋斗目标和中华民族伟大复兴中国梦作出贡献。

（来源: 中国政府网 http://www.gov.cn）

## 全球生态环境遥感监测 2014 年度报告发布

6月4日，在第44个"世界环境日"到来之际，科技部国家遥感中心今天正式发布《全球生态环境遥感监测2014年度报告》，围绕大宗粮油作物生产形势、大型国际重要湿地、非洲土地覆盖、中国—东盟区域生态环境状况四大专题开展监测分析

报告显示，2014年全球玉米、水稻、小麦和大豆四种大宗粮油作物总产量达到27.64亿吨，同比增产1.2％，其中玉米、水稻产量基本持平，小麦和大豆产量好于上年；2014年中国大宗粮油作物总产量与2013年基本持平；2014年全球大宗粮油作物供应形势良好，中国大豆进口来源国生产形势乐观，玉米、水稻和小麦进口来源国产量小幅下降。

"大型国际重要湿地"专题在国际上首次利用卫星遥感技术在全球范围内对大型国际重要湿地进行监测分析。报告显示，2001—2013年，全球100处大型国际重要湿地面积保持稳定，但欧洲罗马尼亚多瑙河三角洲、南美洲阿根廷奇基塔湖泊、亚

洲伊朗乌尔米耶湖、非洲乍得境内乍得湖等部分湿地的干扰和退化现象较为严重；受气候波动和人类活动的影响，2001—2013年国际重要湿地内的各种湿地类型呈现了明显的年际间转化特征。

报告建立了目前现势性最强的非洲土地覆盖数据库。结果显示，非洲土地覆盖中面积占比最大的裸地、灌丛、草地和森林四种土地覆盖类型，所占比例分别为31.78％、26.56％、18.42％和13.74％；2000—2014年期间，埃及尼罗河流域农田面积净增加11.19％，维多利亚湖周边随着人口不断增长，以城市为主的人造地表覆盖面积增加了143.97％，草原植被在萨赫勒地带大多数地区呈现增长趋势。

"中国—东盟区域生态环境状况"专题是国际上首次针对该区域生态环境状况开展的综合遥感监测。监测显示，该区域内森林资源丰富，总生物量近400亿吨，中国、印度尼西亚森林生物量分别占区域总量的41.0％和34.8％，森林年固碳能力近20亿吨。

该报告自2013年首次发布以来，相关数据集产品总下载量超过60万条。据悉，明年将把"一带一路"热点区域的生态环境监测纳入年报。

2014年度报告和数据集产品已在中国搜索门户网站（http://www.chinaso.com/）、国家综合地球观测数据共享平台（http:/www.chinageoss.org/）和国家遥感中心门户网站（http:/www.nrscc.gov.cn/）发布。

（来源：《科技日报》 2015-06-05）

## 联合国呼吁重视水资源保护及相关公共卫生问题

联合国副秘书长埃利亚松 3 月 30 日表示，水与卫生问题对全球发展和人类生活至关重要，国际社会应继续推动解决水资源保护及相关公共卫生问题。

第 69 届联大当天举行高级别对话会，回顾在 2005 年至 2015 年"生命之水"国际行动期间，国际社会在供水、卫生服务以及水资源可持续管理方面所取得的成绩和存在的问题。

埃利亚松在会上说，水是全球发展以及人类有尊严生活的最优先事项之一，也是维护和平与安全的重要因素。到 2025 年，三分之二的世界人口可能面临用水紧张问题，到 2050 年，全球用水需求将提高 40％。当前，25 亿人缺乏足够的卫生设施，健康受到威胁。水资源紧张还可能引发地区局势紧张和冲突。

冰岛常驻联合国代表贡纳松在会上代表联大主席库泰萨致辞说，过去 10 年来，在水资源保护和相关卫生设施获取途径方面取得了很大进展，今年国际社会对 2015年后发展议程进行谈判是一次历史性机遇，谈判应重视水资源保护和相关公共卫生问题。

联合国大会 2003 年 12 月宣布 2005 年至 2015 年为"生命之水"国际行动十年，目的是促进国际社会作出努力，在 2015 年前实现在水和与水有关的问题上作出的各项国际承诺。

## 水利部：今年新开工 27 项重大水利工程

在国新办3月31日举行的新闻发布会上，水利部副部长矫勇表示，国务院确定的172项节水供水重大水利工程已开工57个项目，今年计划再开工27个项目，特别是在西部地区开工建设一批重大水利工程项目。目前，各项工作正在加快推进。

矫勇指出，加快重大水利工程建设，要多渠道筹集建设资金，统筹利用好中央、地方和社会资金。为调动社会资本参与水利项目建设和管理的积极性，国家发改委、财政部、水利部日前联合出台了《鼓励和吸引社会资本投入重大水利工程建设运营的实施意见》及试点工作方案。"争取今年推出一批吸引社会资本投入的重大水利项目"。

一批重大水利工程的集中建设是否会给生态环境带来不利影响，是公众关切的问题之一。对此，矫勇回应称，172项重大节水供水工程都是按照"确有需要、生态安全、可以持续"的原则来确定和立项的，节水本身对生态环境保护的作用是非常明显的。同时，重大水利工程有着非常扎实的规划和前期工作基础，还要经过规划环评和项目环评两道关口。"有这些措施做保障，这些重大水利工程一定能建成资源节约型、环境友好型的工程。"
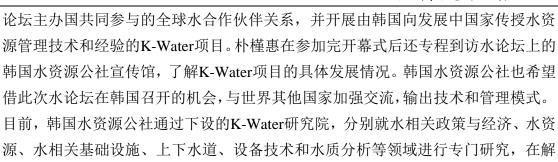
（来源：《科技日报》 2015-04-06）

## 开启水的蓝金时代——第七届世界水论坛在韩国举行

4月12日，第七届世界水论坛在韩国大邱国际会展中心拉开帷幕，全球1800余名政商学界人士参加了开幕式。本届世界水论坛从12日至17日在韩国大邱国际会展中心及庆尚北道庆州和白会展中心（HICO）两地同时举行。论坛的口号是"水——人类的未来"。来自170多个国家和地区的政府工作人员、相关国际机构工作人员、学界人士、企业家等约3.5万人将来到韩国，共商全球面临的水资源问题。世界水论坛每三年举办一次，举办时间在"世界水日（3月22日）"前后，是全球规模最大的有关水资源管理的国际活动。

### 开启蓝金时代

韩国总统朴槿惠出席第七届世界水论坛开幕式并致辞。朴槿惠表示，本届水论坛是在一个分裂的国家举行，希望本届论坛能够提出涉及水问题的国际纠纷的具体解决方案，以尽早实现世界和平。连接韩国和朝鲜的水路，可帮助双方缓和持续70年的紧张关系，韩国将从共同管理河川做起，共建韩朝沟通的渠道。朴槿惠说，如果说20世纪是石油时代、黑金时代，那么21世纪是水的时代、蓝金时代，不管是发达国家还是发展中国家，都应把水问题带来的挑战转换为经济增长的新机遇。为了让本次水论坛的成果转化为现实可持续发展动力，朴槿惠表示将着手设立由历届水

论坛主办国共同参与的全球水合作伙伴关系，并开展由韩国向发展中国家传授水资源管理技术和经验的K-Water项目。朴槿惠在参加完开幕式后还专程到访水论坛上的韩国水资源公社宣传馆，了解K-Water项目的具体发展情况。韩国水资源公社也希望借此次水论坛在韩国召开的机会，与世界其他国家加强交流，输出技术和管理模式。目前，韩国水资源公社通过下设的K-Water研究院，分别就水相关政策与经济、水资源、水相关基础设施、上下水道、设备技术和水质分析等领域进行专门研究，在解决国内问题的同时也在积极寻求开拓海外市场。

### 讨论人类明天

本次水论坛规模为历届最大，与会者将围绕主题、政治、地域和科技等4个版块进行400多场讨论。

最重要的主题讨论版块涵盖了气候变化、灾害、能源等16个主题，围绕这些主题将进行135场讨论。在高级别人士参与的特别讨论中，与会者将探索解决水资源问题的资金筹集方案、商讨相关领域可持续发展目标等。

政治版块讨论将由不同行政级别的30场讨论组成。与会者在经过讨论后将发表有关解决全球水问题的《阁僚宣言书》。在部长级会议上，与会者将围绕水资源与健康、气候变化、可持续水资源管理等8个主题举行圆桌会议，探讨政府层面的解决方案。

地域版块讨论中，与会者将分享全球各大洲的水资源管理经验，围绕共同关心的事宜，商讨亟待解决的水资源管理问题。

科技版块是在韩国提议下新设的讨论版块。相关讨论将围绕水资源有效管理及废水回收与再利用等主题展开，在全球面临相关领域挑战的情况下共享信息，用科学技术的力量解决人类共同面对的水有关难题。

（来源：《科技日报》 2015-04-15）

## EPA 资助超过 800 万美元防治五大湖区物种入侵

2015年3月5日，美国环境保护署（EPA）发布消息称，按照"五大湖恢复倡议"（GLRI）将资助15个项目加强大湖区流域对外来入侵物种的安全管理，总资助金额超过800万美元。这些项目的实施也将有助于降低潜在入侵物种对大湖生态系统的威胁。具体资助信息如表1所示。
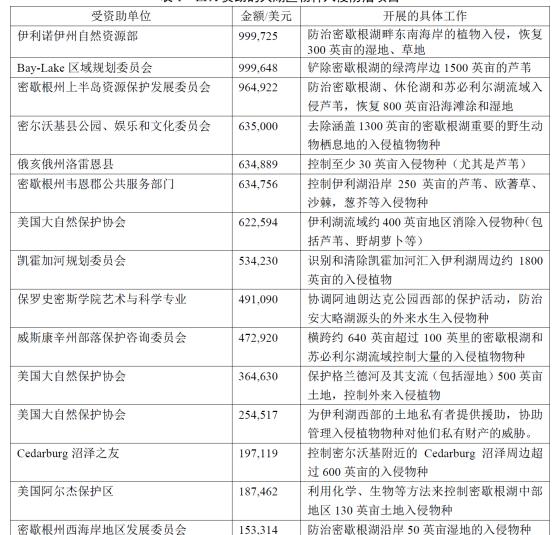
表 1　EPA 资助的大湖区物种入侵防治项目

| 受资助单位 | 金额/美元 | 开展的具体工作 |
| --- | --- | --- |
| 伊利诺伊州自然资源部 | 999,725 | 防治密歇根湖畔东南海岸的植物入侵，恢复 300 英亩的湿地、草地 |
| Bay-Lake 区域规划委员会 | 999,648 | 铲除密歇根湖的绿湾岸边 1500 英亩的芦苇 |
| 密歇根州上半岛资源保护发展委员会 | 964,922 | 防治密歇根湖、休伦湖和苏必利尔湖流域入侵芦苇，恢复 800 英亩沿海滩涂和湿地 |
| 密尔沃基县公园、娱乐和文化委员会 | 635,000 | 去除涵盖 1300 英亩的密歇根湖重要的野生动物栖息地的入侵植物物种 |
| 俄亥俄州洛雷恩县 | 634,889 | 控制至少 30 英亩入侵物种（尤其是芦苇） |
| 密歇根州韦恩郡公共服务部门 | 634,756 | 控制伊利湖沿岸 250 英亩的芦苇、欧蓍草、沙棘，葱芥等入侵物种 |
| 美国大自然保护协会 | 622,594 | 伊利湖流域约 400 英亩地区消除入侵物种（包括芦苇、野胡萝卜等） |
| 凯霍加河规划委员会 | 534,230 | 识别和清除凯霍加河汇入伊利湖周边约 1800 英亩的入侵植物 |
| 保罗史密斯学院艺术与科学专业 | 491,090 | 协调阿迪朗达克公园西部的保护活动，防治安大略湖源头的外来水生入侵物种 |
| 威斯康辛州部落保护咨询委员会 | 472,920 | 横跨约 640 英亩超过 100 英里的密歇根湖和苏必利尔湖流域控制大量的入侵植物物种 |
| 美国大自然保护协会 | 364,630 | 保护格兰德河及其支流（包括湿地）500 英亩土地，控制外来入侵植物 |
| 美国大自然保护协会 | 254,517 | 为伊利湖西部的土地私有者提供援助，协助管理入侵植物物种对他们私有财产的威胁。 |
| Cedarburg 沼泽之友 | 197,119 | 控制密尔沃基附近的 Cedarburg 沼泽周边超过 600 英亩的入侵物种 |
| 美国阿尔杰保护区 | 187,462 | 利用化学、生物等方法来控制密歇根湖中部地区 130 英亩土地入侵物种 |
| 密歇根州西海岸地区发展委员会 | 153,314 | 防治密歇根湖沿岸 50 英亩湿地的入侵物种 |

原文来源：http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/_8689daebdb10c59685257dff005eb396!OpenDocument

（来源：科学研究动态监测快报 2015-04-1，7期总第252期）

## OECD 发布《水治理原则》

2015年6月4日，OECD（经合组织）发布了水治理的12条原则，该原则设立的标准将为政府提供一个更有效、高效和兼具包容性的水管理政策框架。各成员国的部长一致支持该原则并进行实践检验，将从更广泛的经合组织的角度提供水资源管理的经验，同时鼓励政府部门将这些原则付诸于行动。OECD推出的水治理原则基于三个相辅相成的维度，每个维度都涵盖了4个不同的原则，共计12项原则，具体如下：

（1）增强水治理的有效性：①多层次的治理，明晰管理的角色和职责，②集成

的流域管理系统更好地反映当地的情况，并促进不同尺度之间的协调；③通过有效的跨部门协调实现各部门政策的一致性；④提高水部门管理的能力。

（2）增加水治理的高效性：①与水资源相关的数据和信息共享，并使用它们来指导、评估和改善水政策；②确保政府部署的水治理可以帮助调动和分配水专项资金更加高效、透明和及时；③确保良好的水资源管理监管框架有效实施与执行，满足公众的需求；④政府和利益相关者亟需促进采用创新的水治理实践。

（3）确保水治理过程中的信任度和参与度：①水政策的实施要保持完整性和透明度，水管理机构需要主动承担更多的责任；②促使更多的利益相关方参与和了解水政策框架的设计和实施情况；③鼓励水管理部门利用水治理框架权衡农村和城市地区的用水户以及后代人的用水；④定期监测和评价水政策和水治理的适用性，与公众分享结果并及时做出调整。

原文来源：

http://www.oecd.org/gov/regional-policy/OECD-Principles-on-Water-Governance-brochure.pdf

（来源：科学研究动态监测快报 2015-06-15，12期总第257期）

## 美环保局称页岩气开采对饮用水影响小

美国环保局6月4日发布初步研究报告认为，用来开采页岩气的水力压裂技术不会对美国饮用水资源造成广泛、系统性危害，但该技术存在危害饮用水资源的可能性。

2009年，应国会要求，美国环保局开始研究水力压裂技术对油气井附近饮用水源的影响，调查了水力压裂技术与水相关的各个环节，包括水的获取、钻井现场加入的化学物质、注入井下的压裂液，压裂完毕后的废水处理和排放。

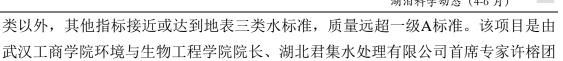美国环保局副局长托马斯·伯克博士表示，此次研究收集了最全面的数据信息，信息采集点超过950处，还包括大量公开发表的论文、技术报告、技术相关各方提供的信息和关于环保局报告的同行评议。

报告表示，水力压裂技术存在危害饮用水资源的可能性，如在缺水的地区抽水、因钻井密封不充分导致天然气、压裂液等液体在地下泄漏、排放未经充分处理的废水以及压裂液或者废水溢出等。但是，这样的案例目前在美国很少出现。

美国石油协会发表声明，对环保局的研究成果表示欢迎。但民间环保组织"山岭俱乐部"认为该报告忽视了水力压裂技术对饮用水资源的严重威胁。

（来源：《科技日报》 2015-06-06）

## 花两元钱让一吨劣五类工业废水变清水

截至4月30日，浙江嵊州市嵊新污水处理厂，已满负荷平稳运行120天，日处理劣五类工业污水15万吨，污水入厂到排出全过程5分钟，处理后的水清澈透明，除盐

类以外，其他指标接近或达到地表三类水标准，质量远超一级A标准。该项目是由武汉工商学院环境与生物工程学院院长、湖北君集水处理有限公司首席专家许榕团队研发的多项创新技术及集成工艺建成的。

许榕介绍，在该项目中，他们创新性的使用高密度粉末活性炭技术，利用活性炭的广谱吸附性，实现了最理想的去污效果。而对于使用一段时间后的活性炭，他们又发明了更为先进的技术，对这些活性炭进行再活化处理，再次活化处理的活性炭，其功能可以恢复99％以上。再次活化活性炭时产生的二氧化碳则注入污水中，降低污水的pH值。

湖北君集水处理有限公司总工程师刘鲁建介绍，该项目还运用了氮磷控制技术、助滤技术、污水处理智能运行技术等；而他们研发团队经过多年探索，自主研发了工业废水、生活废水治理和湖泊修复的多项核心技术，并已获得了19项各类专利。

据了解，使用他们的技术及工艺处理污水，同样的处理能力，占地仅是原来的1/6，处理一吨污水的成本不到两元钱。许榕介绍，如果稍稍增加投入，他们完全可以将劣五类水处理成达到地表三类水的标准。

在今年2月的鉴定会上，中国工程院院士孟伟等专家一致认为，该技术具有建设周期短、自控程度高、抗冲击负荷强等优点，可以调整控制不同出水水质要求；该组合工艺具有创新性，可以在污水处理厂的提标升级和中水回用中运用，工艺技术国内领先。

（来源：《科技日报》 2015-05-13）

## 2015 年全国汛期降水趋势预测的滚动预测

2015 年 5 月 25 日，中国科学院大气物理研究所地球系统理论和模拟研究开放实验室发布 2015 年第 4 期《短期气候预测信息》，对全国汛期（6-8 月）降水趋势进行了滚动预测。预测意见显示：预计 2015 年汛期（6-8 月），江淮流域降水偏多 2-3 成，可能发生局地洪涝。但发生 1998 年的长江流域性洪水的可能性不大。江南北部、黄淮南部、东北地区大部、内蒙古东部、新疆大部、西藏西北部地区以及西南部分地区降水正常略偏多。东南沿海和河套地区降水偏少 2-3 成，我国其它大部分地区降水正常略偏少。

（来源：科学研究动态监测快报 2015-06-15,12 期总第 174 期）

## 浙江启动"五水共治"科技专项行动

近日，浙江省科技厅副厅长曹新安在科技治水新闻发布会上宣布：浙江省正式启动2015年"五水共治"科技专项行动计划，为"青山绿水就是金山银山"提供有力的科技支撑。

"五水共治"工作是浙江省委、省政府在新常态下倒逼经济转型升级、加快"两美浙江"建设的重要战略举措。浙江省科技厅在广泛听取建议的基础上，拓展科技治水工作思路，制定出台了《2015年"五水共治"科技专项行动计划》，全力推进"五水共治"科技治水行动。主要内容包括：抓好技术需求征集，通过科技云平台、科技厅门户网站常年开辟"五水共治技术需求征集"专栏，第一时间了解基层治水技术需求，第一时间提供技术指导服务，为技术攻关和技术服务找准方向和着力点；抓好专家精准服务，建立常态化科技治水服务的工作机制，成立11个"五水共治"科技工作组，对口服务全省11个地市，成立科技专家服务组，组织省内治水专家常年为基层提供技术服务；抓好技术难题攻关，建立五水共治重大科技专项，每年安排财政科研经费2000万元，围绕五水共治重大技术难题，设计重大科技项目，组织科技力量，进行重点集中攻关，加快转化推广和示范应用一批先进成熟技术成果；抓好科技成果示范，浙江省科技厅将视情召开科技治水经验交流会，加快节水、治污、水生态修复等方面先进技术成果的推广应用，加快实施科技惠民示范项目，抓好环保产业提升；抓好节能环保产业科技提升行动，抓实诸暨现代环保装备产业技术创新综合试点工作，带动环保装备产业做大做强。培育一批环保节能领域高新技术企业，新建10家省级企业研究院。

（来源：《科技日报》 2015-04-08）

## 长江松花江流域今年或出现汛情

4月15日，国家防总召开2015年全国水库安全度汛视频会议。国家防总副总指挥、水利部部长陈雷在会上表示，据预测，今年厄尔尼诺现象持续发展发酵，我国气象年景总体偏差，长江、松花江流域可能出现较重汛情，西南地区强降水引发的山洪地质灾害偏重，台风登陆地点集中、强度偏强，水库安全度汛形势不容乐观。

陈雷指出，目前全国仍有1万多座小型病险水库，有2000多座除险加固小型水库需跨汛期施工，还有大量已完成除险加固的水库未蓄水验收，未经历大洪水考验。多数水库监测设施不健全，险情判定主要依靠人工经验，洪水预报能力不足，预警设施缺乏，监测手段滞后等状况尚未改观。

陈雷强调，2015年要全力做好水库安全度汛工作，确保大型和重点中型水库不垮坝，一般中型和小型水库遇设计标准内洪水不垮坝，确保水库上下游地区人民生命安全，充分发挥水库防洪减灾和蓄洪兴利效益。

（来源：《科技日报》 2015-04-16）

## 黄河防总：黄河旱涝急转是常态

日前从黄河防总在郑州召开的 2015 年黄河防汛抗旱视频会议上了解到，今年厄尔尼诺现象持续发展，我国气象年景总体偏差。黄河流域位于我国气候的中间过渡带，地域跨度大，气候复杂，汛情特殊，是历史上气象年景偏差年份，黄河非涝即旱、旱涝急转是常态，防汛抗旱任务艰巨。

黄河防总总指挥、河南省省长谢伏瞻说，黄河防汛抗旱呈现出新特点：洪涝灾害的威胁远未消除，干旱缺水问题日益凸显，防汛抗旱工程体系不完善，防汛抗旱非工程措施仍显薄弱，滩区防洪保安与经济发展矛盾依然突出。他强调，要全面落实防汛抗旱责任制，牢牢把握防汛抗旱工作主动权，加快提升防汛抗旱整体能力，凝聚防汛抗旱工作合力。

黄河防总常务副总指挥、黄河水利委员会主任陈小江在工作报告中提出了今年黄河防汛抗旱的总体目标：确保黄河干流堤防防御标准内洪水不决口，确保黄河大型和重点中型水库、大中城市防洪安全，努力保证中小河流和一般中小型水库安全度汛。统一合理调配水资源，在确保沿黄城乡居民生活用水安全的前提下，合理安排生产、输沙和生态用水及外流域调水。

（来源：《科技日报》 2015-05-13）