



# the international water association

Watershed and River Basin  
Management Specialist Group  
Newsletter

Special Edition - Drought in  
Focus

October 2015

**Disclaimer:** *This is not a journal but a newsletter issued by the IWA Specialist Group on Watershed and River Basin Management. Statements made do not necessarily represent the view of the Specialist Group or IWA.*

## Contents

Welcome.....	2
IWA Basins of the Future Programme Update.....	2
South Africa - Future Shortages of Water.....	3
California Faces Most Severe Drought Ever Recorded: Crisis and Opportunity....	4
Challenges facing the water supply to the water crisis in the most important Brazilian basins.....	6
The drought condition and effect of climate change to Malaysia.....	7
Integrated drought Management project in Central and Eastern Europe.....	8
Addressing the California Drought through Innovations in Water Education.....	9
Compendium of Water Quality Regulatory Frameworks: Which Water for Which Use?.....	9
Study about faecal pollution on the most important bivalve mollusc production region in Brazil.....	10
News Items from the UK and Europe....	11
The Water Shed and River Basin Management Field Trip in the Sonoma Valley, California, September 2014.....	12
News from IWA Headquarters.....	13
NEW journal papers from IWA Publishing.....	14

## Welcome

### John Riddiford, Australia, Chair

Welcome to the second Watershed & River Basin Management (WRBM) newsletter for 2015. After the success of the WRBM specialist conference held last year in San Francisco I am delighted



to announce that the next specialist conference will be held in South Africa in 2017. Both Gareth McConkey and Inga Jacobs from the WRBM specialist group together with their South African colleagues have developed a comprehensive proposal to host the 2017 conference. Many of the challenges of water resource management will be taken up at this conference.

### Water Resource Management Challenges

Following the San Francisco conference a number of water resource management challenges were identified;

- Identifying the key challenges and management options for managers of watersheds under climate change impacts.

- Seeking out different approaches for water resource management under climate change from various international and multi-jurisdictional perspectives.
- Identifying the main challenges and feasible solutions for river basin management of multi-nationally shared river basins and what mechanisms would be recommended for effective transboundary watershed management.
- Identifying the key research topics over the next 20 years for the IWA family in facing climate change.
- Engaging with IWA's strategic partners (international agencies and organisations in the sector).
- Enabling international leaders in the sector to participate in the Congress.
- To participate in further ongoing IWA activities (from Specialist Groups, Task Groups, Programmes).

We will be exploring these challenges further at a special workshop at the IWA Water Development and Congress to be held in Jordan this year, further information [iwa-network.org/WDCE2015](http://iwa-network.org/WDCE2015). And we will be further developing these themes through the *Basins of the Future* programme and at the Brisbane 2016 World Water Congress. If you have any suggestions on content or process please drop me a line at [riddifordjohn@gmail.com](mailto:riddifordjohn@gmail.com).

### Basins of the Future Programme

One of the key IWA programs that the WRBM specialist group is involved in is *Basins of the Future* programme.

This programme focuses on cities and the competing water demands in their river basins centred on the practical reality of managing the nexus of water, food and energy. It builds on the work of various IWA specialist groups and clusters including the WRBM and the Water Reuse specialist groups as well as the Alternative Water Cluster. Members of the WRBM are encouraged to be involved in this programme.

### Drought – A very Real Water Resource Management Challenge

In this newsletter we will be providing some case studies on the very real challenges of drought. With the onset of climate change we are not only faced with the challenge of incremental change, but also face the challenge of episodic events. I encourage you to read about these matters in this newsletter.

### New Management Committee Members: are you interested?

The WRBM specialist group currently has sixteen members on its Management Committee. We are seeking expressions of interest for new members to join this the group. Members must be current IWA members, have an interest and specialist skills related to watershed and river basin management, and have a commitment to participate within the group.

I will be accepting nominations for consideration by the wider management committee. Please email your interest to me at [riddifordjohn@gmail.com](mailto:riddifordjohn@gmail.com)

## IWA Basins of the Future Programme Update

Many of you are aware of the Basins of the Future (BoF) programme, which is one IWA's thematic programme areas. The [BoF](#) programme focuses on cities and the competing water demands in their river basins centred on the practical reality of managing the demands for users to secure water, food and energy. The updated vision of the programme is: *Restoring basins and their water bodies, while mitigating climate risks (flood and droughts) for urban and industrial areas through actions at the catchment level.*

The programme is working very closely with the Watershed and River Basin Management (WRBM) Specialist Group (SG). At the [IWA Water and Development Congress](#) in Amman, Jordan on Oct 19-22, the BoF programme and WRBM SG will have a workshop on "Basin Challenges under Climate Change". The workshop will provide an opportunity to not only define the key problems, but also the mechanisms to change. For example, to address increasing climate variability, cities and utilities will need to diversify water supply options, (i.e. turn to alternative water sources); and optimise water infrastructure for multiple

purposes. However, to do this requires better linkages with their catchment areas.

The workshop will also be an opportunity to shape a set of principles to restoring lakes and rivers in basins, while mitigating climate risks (flood and droughts) for urban and industrial areas through actions at the catchment level. The discussions will be a stepping stone to the [IWA 2016 World Water Congress](#) in Brisbane, Australia.

**For more information, please contact [katharine.cross@iwahq.org](mailto:katharine.cross@iwahq.org)**

## South Africa - Future Shortages of Water

**Gareth McConkey Cape Town, South Africa**

South Africa is not a country that is blessed with an abundance of water. Many engineering, scientific and business publications are warning about future shortages of water.

Recently, to ease water shortages in the Free State Province, the Department of Water and Sanitation granted approval for the release of water from the Lesotho Highlands Water Project (LHWP). The water was released from the Katse dam at the Clarens release point and augmented the supplies in the province, where dam levels are low, owing to below-normal rainfall. Water restrictions have been implemented in the Province to achieve a saving of at least 20% of the water use from the Caledon–Modder river systems. Mangaung Metropolitan Council (Bloemfontein) within this area is now experiencing water restrictions for the first time in 32 years.

The LHWP is a bi-national project between South Africa and Lesotho and the Katse and Mohale dams were built which supply South Africa with 780-million cubic metres a year of water.

Phase 2 of this project was launched in March 2014 and is expected to cost about R17.5-billion by the time it is completed in about 2024. This will increase water supply from Lesotho to South Africa by up to 1.26-billion cubic metres a year and will entail the construction of the Polihali dam, the extension of the Muela hydro-electric complex, the construction of a 38.2 km water transfer tunnel connecting the Polihali reservoir with the hydro-electric complex, and all the related infrastructure.

The LHWP is of great importance to the future supply of water to the Witwatersrand which is the hub of industry and mining in South Africa.

Water restrictions are also being experienced in the northern areas of eThekweni Metro (Durban) because the Hazelmere Dam is only about 28% full.



Katse Dam- Lesotho Highlands Water Project

working around the clock to minimise the impact to consumers and to get them to stick to the published water schedules. This year, the Western Cape, which relies on winter rainfall from May to August, has not had very good rains and storage dams are not at the same levels that they were this time last year.

It was not too long ago when the Southern Cape experienced very dry conditions and desalination plants were hurriedly built to augment the water supplies to areas between Plettenburg Bay and Mossel Bay. Fortunately, the weather patterns changed and these areas had an abundance of rain to fill all the important supply reservoirs. The desalination plants have now been moth-balled to be used during the next dry period.

During a recent conference, South African water experts from the CSIR were saying that it is no longer debatable that South Africa is experiencing a water crisis given that there are already serious problems in supplying enough water of sufficient quality to meet the country's social and economic needs or to sustain the country's ecological baseline.

CSIR researchers specialising in water quality and aquatic ecology agreed that with over 98% of South Africa's available water resources already allocated across various sectors, the country could face a water quantity deficit of between 2% and 13% by 2025, depending on economic performance.

CSIR researchers have also said that evaporation, which is already high in South Africa, is expected to rise along with temperatures. They say that while modelling future rainfall patterns are difficult, they are currently predicting significant warming of between 5 °C and 8 °C over the South African interior by the end of this century.

The South African government are concerned about the availability of water to communities, industry and mining and recently launched a "War on Leaks" Program. Being a water scarce country, the supply-demand curve shows that SA could face a supply-demand deficit of around 17% - 3.8 billion kilolitres of water by the year 2030. The Government have prioritized the implementation of measures to reduce water losses as well as increasing water use efficiency. They are also tackling water leaks in the urban water supply reticulation systems and raising the awareness of people around the efficient use of water.



Hazelmere Dam - KwaZulu-Natal

Water rationing has already been implemented in other areas north of Durban that are supplied with water from Hazelmere Dam. The Metro are



# California Faces Most Severe Drought Ever Recorded: Crisis and Opportunity

**William T. Stringfellow, University of the Pacific, Stockton, CA, USA**

California "This is the new normal, and we'll have to learn to cope with it." –Jerry Brown, Governor of California (USA)

## California experiencing critical drought conditions

Water is a major economic driver in California and supports a \$50 billion agricultural industry. The drought in California is now in its fourth year and is widely considered the worst since records began to be collected in the 1800s. More than 70 percent of California is now in "extreme" drought, with nearly half of the state in "exceptional" drought, the most serious category, according to the U.S. Drought Monitor (Figure 1). Last winter ended up among the driest on record, exacerbated by record-high temperatures, and California reservoirs are critically low (Figure 2).

Evidence is building that droughts of ten years or more (mega-droughts) are not unusual over geologic time and it is likely that the period in which California was developed has been an unusually wet period. California has been affected more by this drought than by any previous one, however, in part because of the synergistic effects of climate change. In most years, about half of the precipitation falls in the months of December, January and February, with much falling as snow in the Sierra Nevada Mountains. The snow pack in the Sierras is the largest reservoir in California and the storage and distribution of water is dependent on the retention and slow release of snow-melt over the course of the summer to replenish groundwater, rivers, and reservoirs. In the last two-years, the Sierra snowpack has been 25% of normal in 2014 and in 2015 it was approximately 15% of normal, the least snow accumulation ever recorded. It is clear that the current system of water management, which is reliant on the snowpack, will not be sustainable in the face of mega-droughts and rising temperatures.

## Urban reductions exceeded mandates

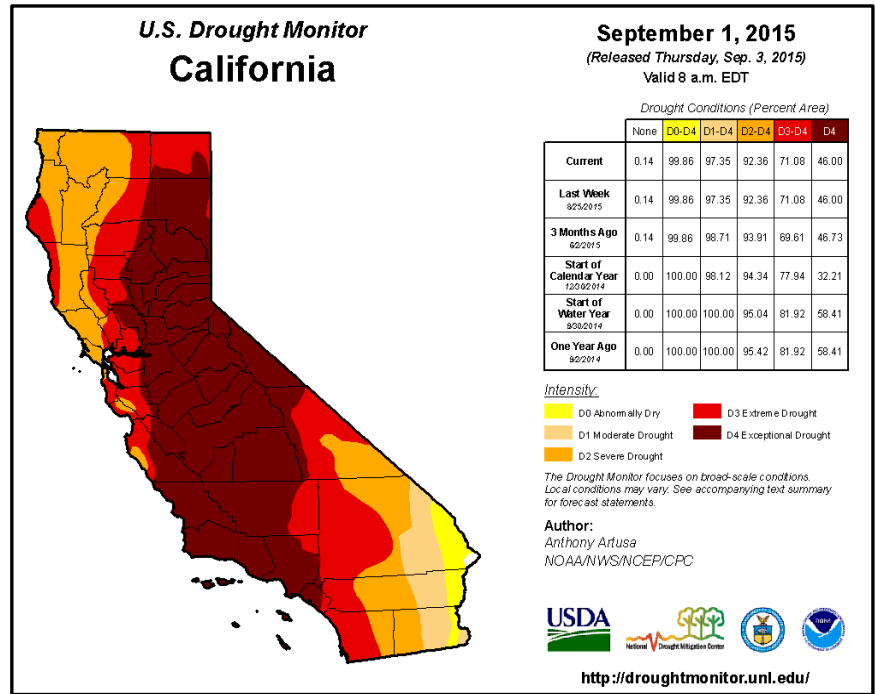
In response to the fourth year of drought, California Governor Jerry Brown imposed mandatory cutbacks in urban water use in April 2015. Under the order, urban water districts must up to 36% of their water use, compared to what they used during the same month in 2013.

The response to Governor Brown's call to reduce water consumption in April has been astounding. In May, after the executive order was issued and an extensive publicity campaign was begun, water use declined 28.9%. Californians, caught in a conservation fervor, removed or quit watering lawns, shut off fountains, shamed neighbors for excessive water use, changed their household habits, and otherwise managed to reduce water use by 27.3% in June and a whopping 31.3% in July, far exceeding the Governor's 25% goal.

## Agricultural water use remains problematic

California has an estimated 9 million acres of farmland and by some estimates agriculture consumes up to 80% of human water use in the state. The State Water Board has curtailed water rights under the drought

Figure 1. Map of drought severity in California



emergency and is restricting water diversions in critically dry watersheds. Farmers have faced deep cuts or even elimination of their surface water allotment, and many are instead relying on pumping groundwater for irrigation.

## Ground water extraction & land subsidence

Although surface water use is tightly managed in California, groundwater use is largely unregulated. In the absence of controls, groundwater pumping will offset almost 70% of the surface water curtailments and only about 5% of farmland will be fallowed for lack of water. Farmers use groundwater even in wet years to supplement surface supplies, but in dry years, like the current one, groundwater can make up as much 60% percent of irrigation. Yet this is only a short term response because without rain and snow, the groundwater supply is not being replenished and several years of normal rainfall would be needed to restore supplies.

One unintended consequence of the massive groundwater withdrawals is land subsidence. Subsidence caused by groundwater pumping in the Central Valley has been a problem for decades, but a recent study by the National Aeronautics & Space Administration (NASA) has shown that land subsidence is accelerating and that areas of California that were not previously shown to be subsiding are now sinking. It is unknown how this land subsidence may affect the groundwater storage capacity or recharge rates in these watersheds.

**(Continued on next page)**

## California Faces Most Severe Drought Ever Recorded: Crisis and Opportunity (Continued)

### What is next for California

California is clearly facing a severe crisis that is already impacting the lifestyles and livelihoods of millions. Since California is a major food producing region, the drought is expected to affect food prices nationally and perhaps globally. Combined with the expected effects of climate change, including higher temperatures and more intense but less frequent precipitation events, a continuing drought, especially a mega-drought, will result in significant ecological and economic disruption.

Everyone in California is hoping for rain, but the severity of the drought presents an opportunity to change the way we manage water. If the El Niño this year bring rain, California will avoid a fifth year of crisis, but we need to learn from past crisis to avoid future disaster. The California water delivery system is facing long term structural problems that must be resolved. As mean temperatures increase, the reliability of the snowpack--our largest reservoir--is decreasing, and alternatives must be found. The decline of the snowpack has increased the demand for new storage capacity, but more and larger dams are anathema to environmentally conscious Californians. There has yet to be a sustained call to manage groundwater storage capacity as an alternative to increased surface storage, but the need is apparent. It needs to be determined if land subsidence, and the associated compression of the aquifer, is reversible or if groundwater storage capacity is being irreversible lost. The crisis has disrupted the status quo and opened the door to rewriting the law on groundwater management and ultimately water rights, the sacred cow of water management in California. Obviously, Californians need to start thinking out of the box if they are to survive the mega-drought that science suggests is a definite part of our future.

### Sources of further information

<https://www.drought.gov/drought/area/ca>

<http://ww2.kqed.org/science/series/california-drought-watch/>

<http://www.scp.org/news/2015/04/15/50941/10-things-to-know-about-california-water-use/>

Richard E. Howitt, Duncan MacEwan, Josué Medellín-Azuara, Jay R. Lund, Daniel A. Sumner (2015). "Economic Analysis of the 2015 Drought for California Agriculture". Center for Watershed Sciences, University of California – Davis, Davis, CA, 16 pp.

<http://www.water.ca.gov/waterconditions/droughtinfo.cfm>

[http://www.nytimes.com/2015/04/14/science/californias-history-of-drought-repeats.html?\\_r=0](http://www.nytimes.com/2015/04/14/science/californias-history-of-drought-repeats.html?_r=0)

<http://pacinst.org/new-data-show-residential-per-capita-water-use-across-california/>

<http://www.jpl.nasa.gov/news/news.php?feature=4693>

Figure 2. California reservoirs are at historic lows. (Photo Department of Water Resources)



## Challenges facing the water supply to the water crisis in the most important Brazilian basins

**Heloíse Mara Geraldino Maia<sup>(1)</sup>** and **Daniel Manzi<sup>(2)</sup>**

(1) Environmental Engineer and Sanitation Infrastructures Post Graduated

(2) Civil Engineer and Master in Hydraulic and Sanitation. Professor of Sanitation Infrastructures Post Graduation Program of Piracicaba School of Engineering (Brazil)

The basins of the Piracicaba, Capivari and Jundiaí rivers - PCJ Basins, located in one of the most economically important regions of the country and recognized for its pioneering implementation of water resources management tools, such as charging for water use, experiences a frame unpreceded of water scarcity.

With an estimated population of 5.3 million inhabitants in 2010, and being a supplier to the largest share of water that supplies the Metropolitan Area of São Paulo through the Cantareira System (a important water reservation system, formed by lakes and tunnels, for water transposition from PCJ Basins to the Metropolitan Area of São Paulo), these rivers had a 2014 year with rainfall and flows less than expected, causing some losses for its

population and for the water supply of Metropolitan Area of São Paulo, that is considered - financially and economically - the most important region in Brazil.

The methodology developed in the study consisted of a questionnaire to 46 municipalities located in or near this basin, in order to get to know the greatest obstacles found in operating their water systems, due to operational and financial problems, because to the water crisis. The results pointed to a large recurrence of operational problems caused by the low level of water sources, and by a significant lack of knowledge about financial impacts related to water scarcity, as shown in Figure 1.

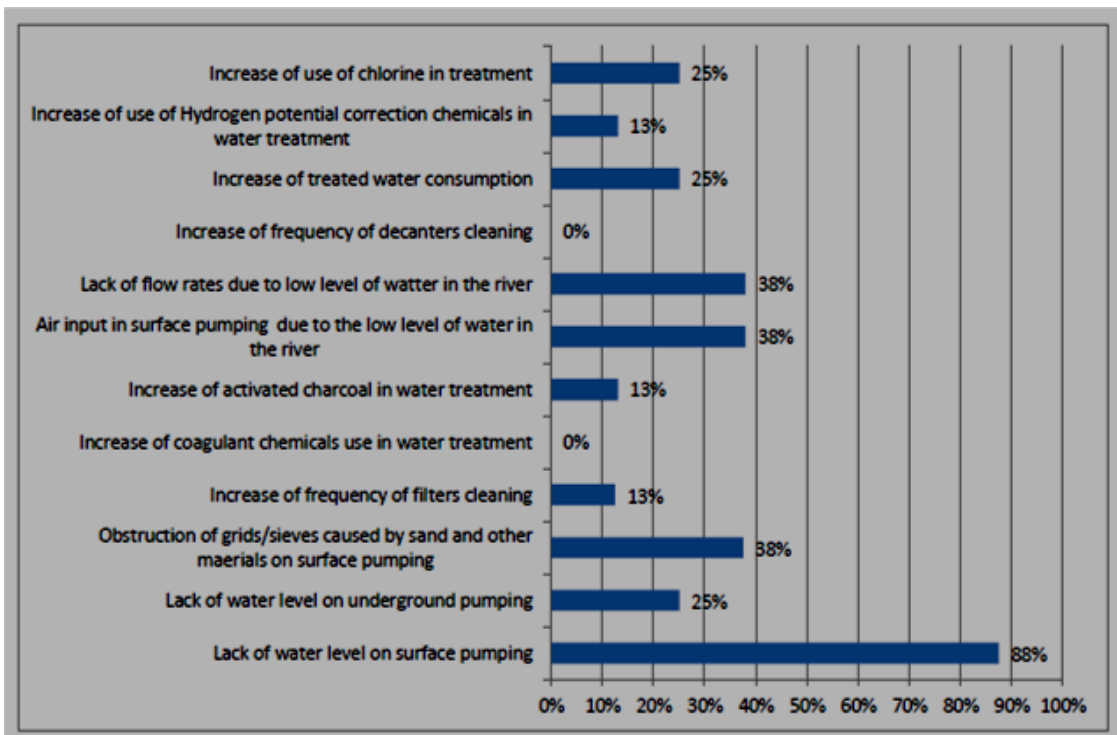


Figure 1 – Reported operational problems caused by the low level of water sources

## The drought condition and effect of climate change to Malaysia

**Ho Yeek Chia, Nurul Izma Mohammed, and Lavania Baloo** discuss on the deteriorating condition caused by climate changes – highlighting the impact to the environment which includes (1) unusual precipitation, (2) impact to the nation, and (3) action taken.



Recent years, the unusual rainfall or precipitation has caused serious problem to Malaysia where the incidence of drought and flood occurred are more noticeable, frequent and the impacts were greater and more disastrous. As what follows, the cases of landslide and reduction in crops production are becoming significant.

Quoting from the previous Newsletter (June 2015) on Water ethics and justice, noted that in a circumstance, the value, experiences, and expectation of people contributed to the perspective of oneself on the right action. Thus, as Malaysian, we are concerning on the climate changes that will bring effect to the sustainable of future generation. Hereby, we discuss the significant effect in the recent years and stern actions taken.

In 2014, a serious drought condition occurred in Malaysia, particularly in Klang Valley, Sabah, Kelantan and Terengganu due to the climate change effect. Figure 1 showed the water level condition in Malaysia (Sg Selangor dam in Kuala Kubu Baru).

Obviously, the water level from Mar-Sep 2014 was at very low level, where leads to the stopping of the water treatment plant operation. In

conjunction to this issue, several cases of water rationing in the affected area. Further, the drought condition facilitate the widespread of dengue cases due to the life cycle of Aedes mosquito was sped-up.

However, short after that, in Dec 2014, Malaysia experienced heavy downpour that caused flooding in many parts of the country. Of course, the black zone of east coastal was momentarily hit by flood. This incidence marked many casualties and the homeless. Similarly, due to the heavy downpour, Sungai Selisek Water treatment Plant was forced to shut down. Heavy rainfall may cause several impacts such as landslides (Cameron Highland), drown, loss of home, the possibility of disease outbreak such as cholera, leptospirosis, melioidosis, and the disruption of school learning time. Also, the facility and sanitation of the temporary home is minimal. Lately, the climate changes led to an occurrence of mini-tornado at Pendang, Kedah (Nov 2014).

The government of Malaysia recognizes that climate change will have adverse effects on human wellbeing, threatened the sustainability of natural resources and would further undermine the development including the security of the country. Hence, Malaysian Government took stern action over the climate changes that may affect the well-being in Malaysia.

Way back in 2009, in Copenhagen Climate Conference 15, Datuk Seri Najib Tun Razak, the Prime Minister of Malaysia had committed to reduce carbon intensity up to 40% by 2020. Since then, Malaysia has taken various steps in mitigating the CO<sub>2</sub> emissions which regards as the main contributor to global warming that ultimately lead to climate changes. Other engagements includes Kyoto protocol in 1997, National Green Technology Policy (NTP) in 2009.

Another highlight the Government worth to mention is transforming Iskandar Malaysia into a sustainable metropolis with low carbon emission and ensuring the climate resilient (Ho Chin Siong, 2014). The benefits and findings of this project is aimed to be disseminated towards other cities in Asian countries as well.

Funding was provided to support research activities related to climate changes. For instance, one significant fund with the amount of RM 5 million was awarded to Prof. Dr. Abdul Rahman Mohammed from Universiti Sains Malaysia. Moreover, Malaysia has put in effort in reducing the use and dependent to fossil fuel in the aspect of transportation by (1) blending in 5% of bio-diesel, (2) reducing the tax in owning a hybrid car,

(3) developing public transportation, and (4) shift to natural gas utilization which has low carbon emission.

Nonetheless, the government has outlined and executed with green building policy where all governmental building has set the air-conditioning to 24 °C and above. Also, in view of energy usage that tremendous increasing in recent years due to high population, the Government is planning to build a nuclear plant with the intention to reduce the dependence to fossil fuel for electricity generation. However, using nuclear energy as a source of renewable energy is still in debate due to its societal and environmental impacts. On the other hand, the Government is looking in the other possibility to produce renewable energy. In what follows, one of the initiatives was capturing and utilization of bio-gas (mainly methane) as a source of renewable energy from anaerobic process in the wastewater treatment plant. A study that has been conducted for this initiative is located in Felda plant, Sungkai. Besides, there are many researchers are actively involved in producing bio-oil from waste materials such as tire, and biomass via pyrolysis process.

Through these initiatives, we are confident that Malaysia has played a pivotal role in combating climate change which is happening now. Knowledge in science to harness the impacts arising from climate change is still in scarce. In what follows, on route to realize the security of food-energy-environment-water nexus, fundamental knowledge and prominent solutions in curbing the climate change issue need to be sought.

### Reference:

Jerome Kugan, 2014, URL: <http://www.thestar.com.my/Lifestyle/Features/2014/12/15/Dry-muddy-and-very-windy-Malaysian-weather-gets-extreme-in-2014/> accessed on 3 Aug 2015.

Bernard Cheah, 2014 URL: <http://www.thesundaily.my/news/1253848> accessed on 3 Aug 2015.

Malaysia Reiterates Commitments Towards Climate Change Reduction at UN Climate Summit, [http://www.mpoc.org.my/Malaysia\\_Reiterates\\_Commitments\\_Towards\\_Climate\\_Change\\_Reduction\\_at\\_UN\\_Climate\\_Summit.aspx#sthash.S7wsZUPF.dpuf](http://www.mpoc.org.my/Malaysia_Reiterates_Commitments_Towards_Climate_Change_Reduction_at_UN_Climate_Summit.aspx#sthash.S7wsZUPF.dpuf) accessed on 4 Aug 2015.

Ho Chin Siong, 2014 URL: <http://www.env.go.jp/earth/coop/eco-csrjapan/en/dr-ho.htm> accessed on 09 Aug 2015.



## Integrated drought Management project in Central and Eastern Europe

Compiled by: Dr. János Fehér, Past Chair of W&RBM SG of IWA and Danube Strategy Task Force Leader of Global Water Partnership Central and Eastern Europe

In the past few decades it has become evident that several Central-East European countries are affected by droughts which are becoming more and more long lasting and severe. Reduced precipitation being one of the key phenomena leading to drought is a recurrent feature of the European climate that is not restricted to the Mediterranean. Droughts can occur as well in high and low rainfall areas and in any season<sup>1</sup>. Although Mediterranean countries are particularly affected by water scarcity and drought episodes due to their geographic and climatic characteristics, the consequences of drought also cause damages in other European countries<sup>2</sup>. Recent severe and prolonged droughts have highlighted Central Europe's vulnerability to this natural hazard and alerted the public, governments, and operational agencies to the many socio-economic problems accompanying water shortage and to the need for drought mitigation measures<sup>3</sup>.

In February 2013 Global Water Partnership (GWP) and World Meteorological organization (WMO) launched a joint Integrated Drought Management Programme (IDMP) to improve monitoring and prevention of one of the world's greatest natural hazards<sup>4</sup>. The 2.5 year programme involved more than 40 organizations from 10 CEE countries. It was structured to provide both policy advices and practical solutions in drought management. The value added of this programme was that it focused on integrated approaches rather than fragmented solutions.

<sup>1</sup> European Environmental Agency (2001): EEA signals 2015 - Living in a changing climate.

<sup>2</sup> Lloyd-Hughes, Benjamin and Mark A. Saunders (2002), A drought climatology for Europe, International Journal of Climatology, Vol. 22, Issue 13, pages 1571-1592.

<sup>3</sup> Sabina Bokal, Ania Grobicki, Janusz Kindler and Danka Thalmeinerova (2014): From national to regional plans – the Integrated Drought Management Programme of the Global Water Partnership for Central and Eastern Europe. *Weather and Climate Extremes, Volume 3, June 2014, Pages 37–46.*

<sup>4</sup> WMO/GWP (2011), Integrated Drought Management Programme, A joint WMO-GWP Programme, Concept Note, Version 1.2.

The specific objectives of the IDMP CEE were to:

- Develop understanding and knowledge and promote state-of-the-art technology, through documentation, consultative workshops, dialogues and networking for integrated drought management.
- Map and assess the impact of droughts, promote the adaptation of best practices, incorporate risk mitigation/reduction and develop drought policies based on scientific knowledge.
- Initiate case studies (demonstration projects) in pilot basins involving local communities.
- Support and facilitate national governments to incorporate assessments on drought management into their national programs and policies.
- Synthesize country findings and develop regional drought policy, including a drought declaration, monitoring framework and a regional drought management platform.
- Raise awareness about severe drought conditions through efficient dissemination mechanisms, such as learning platforms, training and workshops/seminars.

The proposed activities, including policy advice, aimed to increase the resilience of CEE societies to water scarcity and drought events. Consequently, populations in drought-prone areas and all stakeholders vulnerable to drought were the ultimate target groups for the project. At the planning and implementation level, the primary beneficiaries of the Programme are government institutions and agencies responsible for developing drought management policies and/or implementing systems for drought monitoring and prediction and drought risk mitigation and response, at multiple time scales and regional, national and local spatial scales. The secondary beneficiaries are decision makers and managers whose task is to implement these policies, including drought mitigation and adaptation. These beneficiaries also include non-governmental institutions involved in regional and national drought advocacy, awareness and response efforts.

During the 2,5 years the GWP CEE experts have prepared several guidance documents and publications, such as the *Guidelines for preparation of the Drought Management Plans* as part of River Basin Management Plans, as well as *Guidelines on Small Water Retention Measures and IDMP CEE Good Practice Compendium*, which summarised not only the main achievements of the programme, but also good practices from other drought projects. It provides examples of Drought Management Plans, which are already functioning (for example in Romania, Greece, Great Britain).

Detailed information can be read about the IDMP project in general and the outcomes of the work at <http://www.gwp.org/en/GWP-CEE/IDMPCEE/>

Budapest, 31 August 2015



## Addressing the California Drought through Innovations in Water Education

By Nicole Rosenleaf Ritter, Project WET Foundation

Given the length and severity of the drought in California, it is unsurprising that the water education options offered by California's Project WET (Water Education for Teachers) program, hosted in that state by the Water Education Foundation since 1996, would be impacted. California Project WET, which trains more educators each year than any other Project WET program in the United States, has had to respond to increasing demand for water education workshops in general and water conservation education in particular.

California Project WET Coordinator Brian Brown calls 2011 his "last wet year" as a California water educator. That year, precipitation measured at or above long-term average levels statewide, and the hundreds of teacher trainings that Brown and his network of facilitators (Project WET master trainers) conducted focused primarily on general water education topics. California educators by the thousands learned how to teach about all aspects of water using Project WET's interactive, science-based methods in professional development workshops across the state. He didn't see much change during the first year of the drought, which officially began in 2012, but he says that by 2013, the landscape was shifting.

"From 2013 until now, we have seen tons more interest in water education in general and in water conservation education specifically," Brown notes. "One of the big shifts I'm seeing is the desire to focus on the different roles of water users—from individuals to agencies—and how everyone can play a part in addressing the drought."

Specific Project WET lessons such as "Water Audit", which helps students perform home and school water audits to determine how water is used,

Flood and Drought Management Tools project: Planning for Climate Impacts

Flood and drought events are a well-known and natural occurrence. Climate change, which is altering weather and water patterns, and human activities (to meet growing demands across sectors) that are influencing ecosystems, are, however, changing the frequency, severity and predictability of flood and drought events, complicating efforts for better water management and planning for their impacts.

The IWA in partnership with [DHI](#), and the [United Nations Environment Programme](#) are working on the [Flood and Drought Management Tools](#) (FDTM) project. The project was initiated to improve planning around extreme weather events, positioning itself as an important bridge between and within countries to mitigate the risks associated with flood and drought events through proactive planning and response. The project will develop a computer software-based decision support system (DSS), containing tools to support improved planning from catchment to consumer by including better information on changing climatic scenarios and land-use influencing flood and drought events. Through continued consultations with stakeholders across three pilot basins (Chao Phraya, Lake Victoria and Volta), the developed methodology; i.e. the DSS, will help inform decision-making to guide short term (operations) and long term (strategic) planning around flood and drought management. The functionality of the DSS will be carried out through technical trainings carried out in the three basins to ensure the needs of the stakeholders are addressed in the DSS. The project will run from 2014 - 2018.

**If you are interested in learning more about the project, or even being part of the review group, please contact [raul.glotzbach@iwahq.org](mailto:raul.glotzbach@iwahq.org).**

**And if you would like to showcase a relevant initiative, project, activity or event through our bi-monthly newsletter, contact [raul.glotzbach@iwahq.org](mailto:raul.glotzbach@iwahq.org).**

where inefficiencies exist and if actions can be taken to conserve water, have become more popular not only in the classroom but also among non-formal educators. Water districts and other municipal water utilities are partnering with educators—or funding outreach positions within their own staffs—to support teaching students real-world conservation skills that promote positive behavior change.

## Compendium of Water Quality Regulatory Frameworks: Which Water for Which Use?

The "Compendium of Water Quality Regulatory Frameworks: Which Water for Which Use?" will be launched at the [IWA Water and Development Congress](#) in Amman, Jordan on Oct 19<sup>th</sup> at 13:00 at the IWA Stand.

The Compendium is a reference tool of laws and policies regulating water quality for different uses at a variety of geographical scales. It is a living document that will continuously improve its aims as information about policy and legal instruments and their implementation is updated by the users. The tool provides a basis by which to assess policy and regulatory instruments, and to identify what makes an efficient and effective guideline, standard, regulation or policy. The Compendium of Water Quality Regulatory Frameworks is a UN-Water initiative developed in collaboration with the International Water Association (IWA) and the United Nations Environment Programme (UNEP).

**For more information, please contact**

With California Governor Jerry Brown ordering cuts of 25 percent to the state's overall water use—and fines possible for water overuse—the focus on water conservation education makes sense. That is especially true in light of studies such as a 2008 report from the ROUS WATER Early Childhood Water Aware Centre Program in Australia that suggest that educating children about water can instill an improved conservation ethic not only in the children themselves but also with their parents at home.

As the state continues to struggle with the drought, education stands out as a tool for communities to encourage wise water use. Thanks to the ongoing efforts of water educators like Brian Brown, water education can address these ideas in ways that even California's youngest water users can understand.

For more information about Project WET, which is active in all 50 U.S. states and more than 65 countries around the world, visit [projectwet.org](http://projectwet.org). To learn more about California Project WET, visit [watereducation.org](http://watereducation.org).

## Study about faecal pollution on the most important bivalve mollusc production region in Brazil

Luis Hamilton Pospissil Garbossa; Robson Ventura de Souza

Scientists from Epagri ([www.epagri.sc.gov.br](http://www.epagri.sc.gov.br)), a state company for research and agriculture extension from the Brazilian state of Santa Catarina are developing studies to understand the impacts of the faecal pollution generated by the human population inhabiting the Santa Catarina Island Bays (SCIB) region. Surrounding the region the largest population cluster in the state of Santa Catarina takes place, where more than 700,000 people live (Figure 2). The SCIB have great importance for economic activities such as tourism and shellfish aquaculture. Florianópolis (the municipality where the island is politically inserted) is the second most visited city by foreign tourists in Brazil. Associated to that, 17,150 tons of bivalve molluscs were produced in the limits of these bays in the year of 2012, what accounts for approximately 70% of the Brazilian bivalve production. Despite their economic importance, the tourism and aquaculture activities have been impaired by the increase of pollution levels. The monitoring of faecal indicator organisms in beach waters and shellfish flesh by the competent authorities has shown that faecal pollution is a raising concern, and legal restrictions have been applied to bathing and shellfish aquaculture in some areas. The main goals of the Brazilian scientists are to determine the faecal indicator organisms' loads generated in the surrounding watersheds that drains into the bays and to address how it affects the water quality and mollusc production of the region.

The scientists performed a sanitary survey with guidance from the Centre for Environment, Fisheries and Aquaculture ([www.cefas.co.uk](http://www.cefas.co.uk)), generating a spatialized databased about pollution sources in the coastline. Based on the results of freshwater discharge measurements and microbiological monitoring in part of the rivers and streams, statistical models were developed to estimate the faecal indicator organism's loads for all the watersheds that drain to the bays. The scientists also developed a 2DH hydrodynamic model, using the water modelling system MOHID ([www.mohid.com](http://www.mohid.com)). The model is already validated for current speed, direction and sea level, through comparisons between the model outputs and data obtained in field using an Acoustic Doppler Current Profiler. The faecal indicator organisms' loads are now being integrated to the hydrodynamic model to simulate the bacteria decay and the pollution dispersion (Figure 1) and the validation of the model will be performed based on the official monitoring led by the Brazilian public health and environmental authorities.

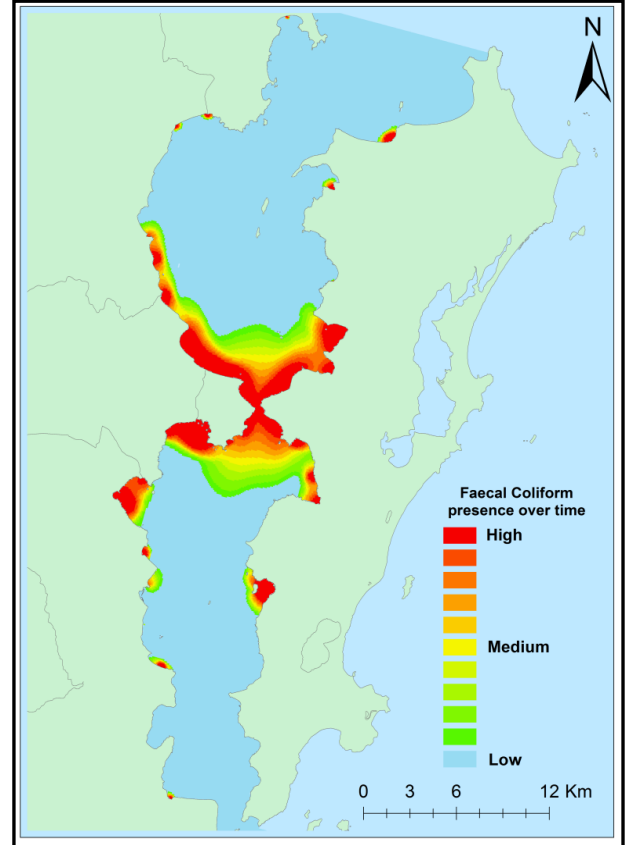


Figure 1 - Preliminary outputs from hydrodynamic pollution dispersion model.

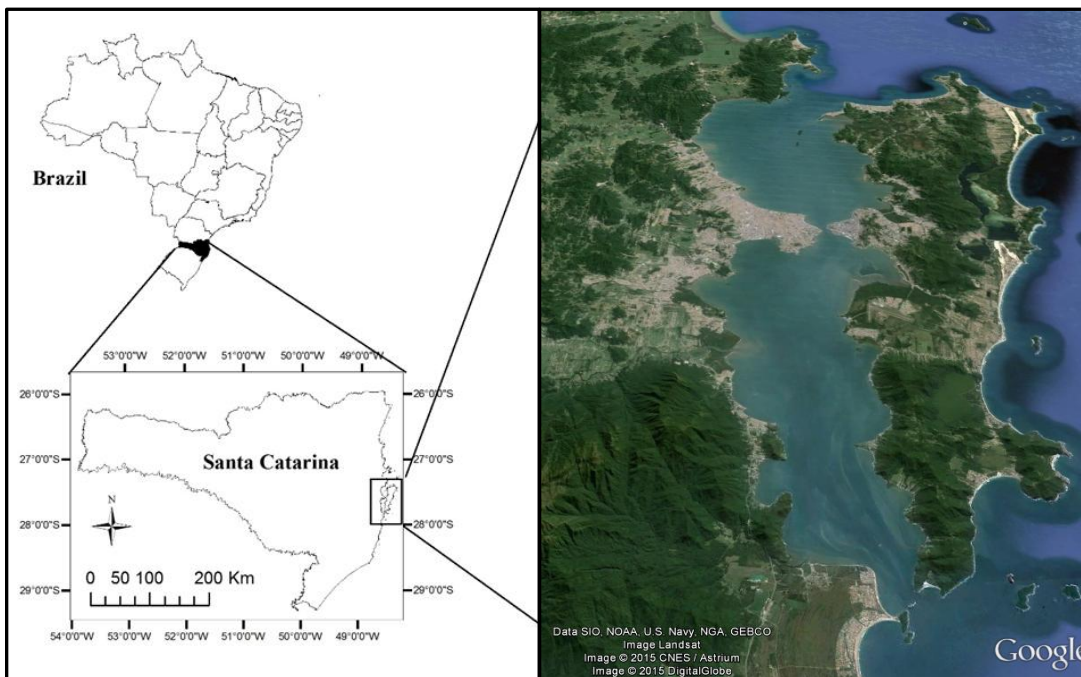


Figure 2 - The Santa Catarina Island Bays.

## News Items from the UK and Europe

Collated by Bob Crabtree

### Water & Land Use – Evidence – Demonstration Test Catchments DTC – Newsletter Autumn 2014

This newsletter edited by Bob Harris is a mine of valuable research *results and evidence* on catchment management. [Click here to see the report DTC Newsletter Oct 2014](#).

### IPCC Releases Climate Change Synthesis Report

Climate change is taking hold and will bring worrying impacts—but there is still time to limit the damage. That, in a nutshell, is the message delivered by a new report that synthesizes the findings of three massive studies issued by the Intergovernmental Panel on Climate Change (IPCC) over the past year. The [Synthesis Report](#), released at a meeting in Copenhagen, caps work on the fifth assessment of climate science and mitigation that the IPCC has completed since 1990.

### Regulation for Water Quality – How to Safeguard the Water Environment, January 2015

This new book published by FWR titled **“Regulation for Water Quality – How to Safeguard the Water Environment”** has been published to make environmental water quality regulatory principles and best practice available to

all – policy makers, regulators, water industry practitioners and environmental NGOs. It provides a reasonably comprehensive, innovative and structured guide to the wealth of information on water regulation and catchment planning. It is

available in free electronic format from the FWR: <http://www.fwr.org/WOreg/index.htm>

### UK fails compliance with Urban Wastewater Treatment Directive, May 2015

The European Commission is referring the United Kingdom to Court over its failure to ensure that urban waste water is adequately treated in 17 agglomerations. In four of the agglomerations in question treatment is inadequate, and one agglomeration, Gibraltar, has no treatment plant at all. The case also concerns excessive spills from storm water overflows in collecting systems serving 2 e agglomerations. The deadline for having in place compliant collecting systems for these agglomerations was end 2000. The Commission is referring the case to the Court of Justice of the EU. To read more go to: [http://europa.eu/rapid/press-release\\_IP-15-4672\\_en.htm](http://europa.eu/rapid/press-release_IP-15-4672_en.htm)

### New SuDS Regulations – Where Now for SuDS?

A brave new world for SuDS began when new planning regulations came into force last month, designed to ensure, where possible, that Sustainable Drainage Systems are used on major new developments in England. With a much-needed push for new homes underway, it ought to be a relief that more than 10 years of wrangling over legislation to make SuDS compulsory is over. But with publication of just two pages of technical standards, the rules are a mere shadow of what many had hoped for – with some going so far as to call them ‘pathetic’. To read more go to: [http://www.engineeringnatureway.co.uk/2015/new-suds-regulations-now-suds/?dm\\_i=TOF,3DBBS,3WFA49,C1XF7,1](http://www.engineeringnatureway.co.uk/2015/new-suds-regulations-now-suds/?dm_i=TOF,3DBBS,3WFA49,C1XF7,1)

### England’s bathing waters: cleanest since records began the start of a new era, June 2015

In 2014, the English coast was the cleanest since records began, with 99.5% of swimming spots passing water quality tests compared to just 65% in 1988. However, England’s beaches will be under the microscope this summer as much tougher new EU standards come into force. The new European standards will be twice as tough to pass in a bid by the EU to drive up standards across Europe. In response the Environment Agency is urging water companies, businesses, farmers, local authorities and householders to continue to take action, reduce pollution and improve bathing water quality. The Environment Agency will carry out its annual water quality testing program at more than 400 beaches and lakes. The results will then be made available to beach-goers in close to real-time on the Environment Agency’s new [Bathing Water Explorer website](#).

### Progress for Thames Tideway Tunnel Project in London, August 2015

Thames Water has named the Bazalgette consortium to deliver the Thames Tunnel Project. Tunnel project was confirmed by Ofwat ahead of issuing the consortium a project license to deliver the £4.2 billion super sewer project. The confirmation from Ofwat means Bazalgette is wholly responsible for delivering the Thames Tideway Tunnel scheme, which is due to be completed by 2023, and includes the provision for Bazalgette to operate and maintain the infrastructure once it has been constructed. <http://utilityweek.co.uk/news/thames-tideway-ip-licence-goes-to-bazalgette-says-ofwat/1160902#.VdMQHP-FOp>



## The Water Shed and River Basin Management Field Trip in the Sonoma Valley, California, September 2014.

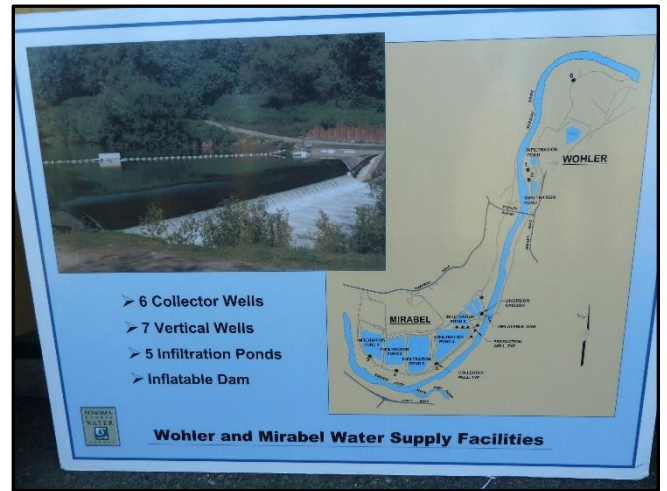
Approximately forty delegates representing over twenty countries attended the Sonoma County Water Agency field trip. This trip was organised as part of the specialist conference held in San Francisco last year. Delegates travelled north from San Francisco to the Russian River and Dry Creek catchments to inspect innovative groundwater pumps, captive fish breeding research facilities, a river restoration program and a leisurely lunch in the very pretty Sonoma Valley township of Healdsburg.

The Sonoma County Water Agency have an innovative system to capture groundwater through infiltration ponds. A number of pumpwells then distribute high quality groundwater through the supply system.

At the Russian River complex the water agency has a large and comprehensive captive fish breeding program to ensure the ongoing survival of threatened Chinook salmon and threatened steelhead fish species.

The water agency also has a comprehensive river restoration program in Dry Creek engaging much of the local community. The reach specific \$4m program includes the construction of habitat modifications within the Dry Creek Valley along Dry Creek from approximately ½ mile upstream of Lambert Bridge Rd to ½ mile downstream of Lambert Bridge Road, near the City of Healdsburg, California. Work includes habitat modification including new side channels, ponds, alcoves, and rock weir riffles; enhancements to existing pools through selective grading, installation of woody debris, log jams, and large boulders as anchor material; vegetation planting; installation of erosion control measures; excavation; and dewatering.

**Images:** Top to bottom on the right: 1) Inflatable Dam on the Russian River. 2) Delegates learn about the Russian River captive fish breeding program. 3) Dr Will Stringfellow enjoys feeding the salmon and steelhead. And below 4) Delegates inspect the Dry Creek rehabilitation demonstration site.



## News from IWA Headquarters

### Welcome to the IWA Online Network Database

The [IWA Online Network Directory](#) is your gateway to access the full IWA 10,000-strong global network of professionals. Connect and grow your network to enhance and achieve your professional goals. You can actively manage your engagement with the network, including the ability to renew your membership.

This is just the start, in 2015 we will take your [IWA network experience](#) to new heights. We want to enable you to reach out in a more meaningful way to connect with people across the network based on your preferences and interests. We have ambitious plans, and new features will be added regularly.

### 2015 IWA Membership Renewals

As you may have seen, the renewal process is quite different this year so this is a quick reminder of the key steps to proceeding to your IWA renewal in case you have not done so already:

1. Login into the [Online Network Directory](#) and go to My Profile > Settings
  2. Go to Account Summary tab and review your personal data.
  3. In the Renewal tab select your 2015 membership package and proceed to payment via credit card or PayPal.
- Once you have completed your renewal, a receipt of your membership will be available to download under the Renewals tab in your profile.

If you experience any difficulties with your renewal then we are here to help! Feel free to send us an email at [members@iwahq.org](mailto:members@iwahq.org) or call us on +31 (0) 70 8903524 and we will get back to you as quickly as possible.

### IWA Water and Development Congress & Exhibition, Jordan, 18- 22 October 2015 --- Water Security for Sustainable Growth

The Water and Development Congress & Exhibition organized by the International Water Association (IWA) (Jordan, 18 – 22 October 2015), is the global event on water solutions focusing on emerging economies and developing countries. The event brings together thought leaders, decision makers, leading scientist and business



representatives from within and outside the water sector.

Connecting science and research with the private sector and financial institutions, the Congress acts as a catalyst for sustainable water development. It provides a space where water professionals can meet and exchange information and know-how. It brings to the fore the latest regulatory initiatives and leading-edge practices. It presents new research findings, technology developments and business opportunities.

[Register now](#) for the Water and Development Congress & Exhibition to deliver sustainable water management solutions.

### IWA World Water Congress & Exhibition, Australia, 8-13 October 2016

The [IWA World Water Congress & Exhibition 2016](#) will cover 5 programme themes: Cities, Utilities and Industries Leading Change; Re-Charting the Course of Water Resources; Enabling Progress with Good Governance, Sustainable Finance and ICT; Water Quality, Safety and Human Health and Water and Wastewater Processes and Treatments, which will highlight the impact of extractive industries on water (mining and resource extraction), and the response to water scarcity (basin management, direct potable use and desalination).

Contribute to present global best practice, advances in fundamental science, innovative research, policy developments and solutions to challenges faced by water professionals worldwide.

Click [here](#) to download the Call for Paper.

[Submit papers](#) before the **15 October 2015** and join in Brisbane, Queensland, Australia!

### Water21 is Changing

After more than fifteen years as the magazine of the International Water Association, the June edition of Water 21 was the final edition.

Water21 has been an integral and valued part of the membership experience since it first published

in 1999; but our new Strategic Plan has led us to review all our communications and engagement activities. Independent consultants from Ogilvy carried out a review of Water21 in 2014, working with a Water21 Review Committee led by our Director of Communications and Engagement. Their recommendations have guided our decisions for evolving the magazine.

Why are we changing? Recognising the changing external environment within which we work, and changing consumer attitudes and behaviours, the way we communicate with our members and those outside of the IWA is also changing. The magazine function will be incorporated into the overarching IWA communications and engagement strategy.

How are we changing? Beginning in autumn 2015, IWA members will receive the new IWA magazine combining a rich digital experience – online and as an app - with an editorial focus on thought leadership that connects the water sector with business, social sciences, economics and political sciences.

If anyone would like more information on the new magazine, please contact [Paul Bell](#) at the IWA Communications and Engagement Team.



The IWA Water  
Wiki!

[www.iwawaterwiki.org](http://www.iwawaterwiki.org)

There have been a number of exciting additions to the WaterWiki over the past few months.

### Journal Authors Guest Blogs

We have been asking recently published journal authors to write blog posts to introduce their papers. This has resulted in a diverse range of topics being covered on the blog, including:

- [Microbial indicators, pathogens and methods for their monitoring in water environment](#)
- [Fish tracking in fishways using computer vision](#)



- [Reporting progress on the human right to water and sanitation through JMP and GLAAS](#)
- [Non-revenue water and cost recovery in urban India: The case of Bangalore](#)

And [many many others](#).

#### Author Interviews

To keep readers up to date on the latest, exciting books from IWA Publishing, we have asked the authors of the newest books for interviews. These have already begun coming through, and our first two interviews are from:

- [Andrew Segrave, editor of The Foreseeable Future of Water Planning: Time to Change](#)
- [Ana Lillebø, editor of Coastal Lagoons in Europe: Integrated Water Resource Strategies](#)

New author interview blogs will be posted over the summer.

#### Free eBooks

The WaterWiki's [library of free eBooks](#) continues to grow, with recently added titles including:

- Integrated River Basin Governance – Bruce Hooper
- Benchmarking Para Servicios de Agua – Enrique Cabrera Jr., Peter Dane, Scott Haskins, Heimo Theuretzbacher-Fritz
- Process Control of Activated Sludge Plants by Microscopic Investigation – Dick H. Eikelboom

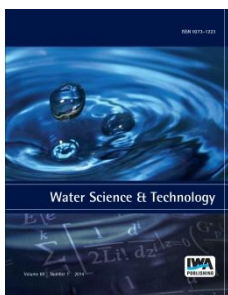
---

#### Alex Cruden

#### IWA WaterWiki Community Manager

[acruden@iwap.co.uk](mailto:acruden@iwap.co.uk)

## NEW journal papers from IWA Publishing



### Catchment delineation and morphometric analysis using geographical information system

**Manoj Kumar, Rohitashw Kumar, P. K. Singh, Manjeet Singh, K. K. Yadav and H. K. Mittal**

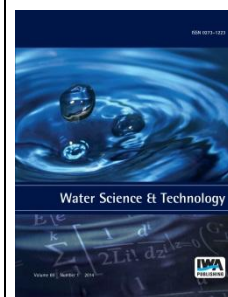
Water Science & Technology Vol 72 No 7 pp 1168–1175 © IWA Publishing 2015  
doi:10.2166/wst.2015.303

<http://www.iwaponline.com/wst/07207/wst072071168.htm>

The geographical information system (GIS) has emerged as an efficient tool in delineation of drainage patterns of watershed planning and management. The morphometric parameters of basins can address linear, areal and relief aspects. The study deals with the integrated watershed management of Baliya micro-watersheds, located in the Udaipur district of Rajasthan, India. Morphometric analysis in hydrological investigation is an important aspect and it is inevitable in the development and management of drainage basins. The determination of linear, areal and relief parameters indicate fairly good significance. The low value of the bifurcation ratio of 4.19 revealed that the drainage pattern has not been distorted by structural disturbance. The high value of the elongation ratio (0.68) compared to the circulatory ratio (0.27) indicates an elongated

shape of the watershed. The high value of drainage density (5.39 km/km<sup>2</sup>) and stream frequency (12.32) shows that the region has impermeable subsoil material under poor vegetative cover with a low relief factor. The morphometric parameters of relief ratio (0.041) and relative relief (0.99%) show that the watershed can be treated using GIS techniques to determine the morphometric presence of dendritic drainage pattern, with a view to selecting the soil and water conservation measures and water harvesting.

### Agricultural biomass monitoring on watersheds based on remote sensed data



**János Tamás, Attila Nagy and János Fehér**

Water Science & Technology In Press, Uncorrected Proof © IWA Publishing 2015 | doi:10.2166/wst.2015.423

<http://www.iwaponline.com/wst/up/wst2015423.htm>

There is a close quality relationship among the harmful levels of all three drought indicator groups (meteorological, hydrological and agricultural). However, the numerical scale of the relationships among them is unclear and the conversion of indicators is unsolved. Droughts affecting different areas with different forms of drought cannot be compared. For example, from the evaluation of meteorological drought using the standardized precipitation index (SPI) values of a river basin cannot be stated how many tonnes of maize will be lost during a given drought period.

A reliable estimated rate of yield loss would be very important information for the planned interventions (i.e. by farmers or river basin management organisations) in terms of time and cost. The aim of our research project was to develop a process, which could provide information for estimating relevant drought indexes and drought related yield losses more effectively from remote sensed spectral data and to determine the congruency of data derived from spectral data and from field measurements. The paper discusses a new calculation method, which provides early information on physical

**IWA Head Office:**  
Alliance House  
12 Caxton Street  
London SW1H 0QS  
UK

**IWA Global Operational Office:**  
New Babylon - Den Haag  
Anna van Buerenplein 48, 11th floor  
2595 DA Den Haag  
The Netherlands

Tel: +44 207 654 5500  
Fax: +44 207 654 5555

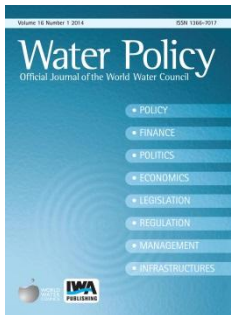
General e-mail: [water@IWAhq.org](mailto:water@IWAhq.org) Membership e-mail:  
[members@iwahq.org](mailto:members@iwahq.org)  
Web site: <http://www.iwa-network.org/>

Company registered in England No. 3597005  
Registered Charity (England) No. 1076690



implementation of drought risk levels. The elaborated method provides improvement in setting up a complex drought monitoring system, which could assist hydrologists, meteorologists and farmers to predict and more precisely quantify the yield loss and the role of vegetation in the hydrological cycle. The results also allow the conversion of different purpose drought indices, such as meteorological, agricultural and hydrological ones, as well as more water-saving agricultural land use alternatives could be planned in the river basins.

### Misalignment of watershed and jurisdictional boundaries: the importance of scale



Neil S. Grigg

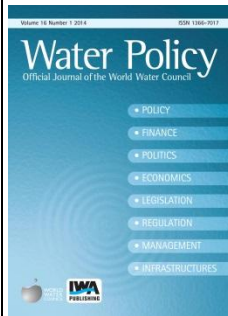
Water Policy In Press,  
Uncorrected Proof ©  
IWA Publishing 2015 |  
doi:10.2166/wp.2015.174

<http://www.iwaponline.com/wp/up/wp2015174.htm>

The misalignment of the boundaries of watersheds and jurisdictions is cited often as a barrier to effective water governance, but the validity of the assertion depends on watershed scale and the decisions or processes involved. The paper probes these decision processes and their alignment with scales of natural watersheds and with governance processes. Two examples from the U.S. provide context and data to inform the discussion, one from the humid eastern part and one from the drier western part. Ultimately, the spatial and governance scales determine the complexity of decisions. The major issue is the level and nature of negotiations and how stakeholders communicate and work with each other to resolve issues in a form of pragmatic federalism, where the concept merges into decentralization to the subwatershed level. At smaller scales negotiations can be worked out in person-to-person venues but at larger scales institutions have their own trajectories and inertia. Ultimately, watershed boundaries can be effective for joint planning and assessment, but decisions follow governance patterns. Basin boundaries do provide venues for coordination mechanisms to mediate conflicts.

-----

### A global assessment of Basin Plans: Definitions, lessons, recommendations



Jusipbek Kazbekov,  
Emelder  
Tagutanazvo and  
Jonathan Lautze

Water Policy In Press,  
Uncorrected Proof ©  
IWA Publishing 2015 |  
doi:10.2166/wp.2015.028

<http://www.iwaponline.com/wp/up/wp2015028.htm>

Basin plans have become a core element of water management in the 21st century. Systematic analytical scrutiny of the contents of basin plans is nonetheless scant. This paper develops a framework for assessing basin plans and systematically applies it to understand how contents of basin plans vary. The paper synthesizes a definition of 'basin plan', generates a classification system for basin plans, and proceeds to classify a regionally diverse set of 23 basin plans. Major findings are that basin plans typically contain the components and sub-components suggested in best practice guidelines. Focus on some issues that are presumably central to water management such as water quality and quantity is nonetheless comparatively low. Disaggregating basin plans suggests that developing country transboundary plans are more geared toward hydropower development, navigation and coping with uncertainty, while developed country and national plans appear to focus more on issues such as water quality and fish management. It is hoped that findings contained in this paper support future basin plan development by informing those crafting basin plans of the options available to them.

-----

For more information on IWA Publishing products or to buy online visit [www.iwapublishing.com](http://www.iwapublishing.com)

Or contact one of IWA Publishing's distributors:

#### UK, Europe and Rest of World:

Turpin Distribution Ltd  
Pegasus Drive  
Stratton Business Park  
Biggleswade  
Bedfordshire  
SG18 8TQ  
United Kingdom  
Tel: +44 (0)1767 604800  
Fax: +44 (0)1767 601640

E-mail: [iwap@turpin-distribution.com](mailto:iwap@turpin-distribution.com)

#### North America:

BookMasters, Inc.  
P.O. Box 388  
Ashland  
OH 44805, USA  
Tel: +1 800 247-6553 (+1 419 281-1802 from Canada)  
Fax: +1 419 281-6883  
Email: [order@bookmasters.com](mailto:order@bookmasters.com)

## Philosophy of the IWA WRBM Specialist Group

The goal of the Watershed and River Basin Management (WRBM) Specialist Group is to promote the understanding, utilization, and values of integrated watershed management approaches for the beneficial and sustainable use of rivers and watersheds worldwide. It seeks to achieve this by sharing of expertise and experience among its members and with other interested individuals and organizations, organizing specialist conferences, issuance of newsletters, undertaking of cooperative projects, and engaging in other activities under the auspices of the International Water Association.

Edited by: Chelsea Spier, USA. For questions, comments, or suggestions for the next issue email: [clspier@gmail.com](mailto:clspier@gmail.com)

Or for more information on the Specialist group you can contact: John Riddiford, IWA WRBM Chair at: [riddifordjohn@gmail.com](mailto:riddifordjohn@gmail.com).

