Stockholm Water Prize Laureates

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704, Aditi Ribera
Aundh - Balewadi link Road
Baner, Pune

DTP & Type Setting
Aarti Kulkarni

Cover Design & Interior Decoration
Ajay Deshkar

Published By :
Ajay Prakashan
A - 201, Mirabel Apartments
Near Pan Card Club,
Baner, Pune.

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Index

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Introduction

It is a great pleasure for me to hand over this book to the water lovers interested in water development, which contains information about the distinguished 'Stockholm Water Prize Laureates ' for their brilliant achievements in the field of water development at the global level. In fact, it is a collection of my articles published successively in the magazine 'Jalsamwad'.

The main objective of those articles in Jalsamvad was to reach the general public and enlighten them about the work of these great Laureates who played an important role in development of water sector. My special thanks to Dr. Datta Deshkar, editor of the "Jalsamvad" magazine for taking up this important topic and also for publishing it in book form now.

Pune **Gajanan Dinkarrao Deshpande**
January 1, 2024

1
David W. Schindler, Canada

Set against the backdrop of Canada's mountainous rocky lakes, David W. Schindler is an aspiring scientist. He is Professor of Biology at the University of Alberta, Edmonton. This beautiful part of Canada is protected by a wide range of national park ranges. It has become a major summer attraction for millions of people for tourism. This nature lover, who is constantly searching for something related to his work from his boat in the lake, has undoubtedly lived a life experiencing the pleasures of the beautiful nature. The nature-loving man in the canoe is no doubt enjoying the beautiful scenery around him. However, he is so much involved in his work that yet he has not come to Jasper National Park as a tourist.

His usual business is to collect samples of aquatic plants and animals from the lake with the help of nets and fill them in his boat, dig up the bottom mud with a tool and stick them on the boat, and collect samples of water from different layers of the lake in plastic bottles. It provides knowledge about the abundance of specific species in the lake, its biodiversity, the acidity level of the water as well as the factual content of nutrients, toxic metals as well as the density of chlorinated organic matter. He is very keen in going in deeper and study some of these matters.

David Schindler has been involved in research on mountain lakes and waters of Canada for more than three decades. In 1968, he set up an experimental lake project in Ontario for the Department of Fisheries and Oceans of Canada, and it has been running ever since. He headed this research work for 22 consecutive years till 1989. As a Lake Scientist and Ecologist, his goal was to create a lake as an integrated ecosystem.

Schindler’s results, particularly from the late 1970s and early 1980s, were to be instrumental in convincing regulators in the United

States and Canada to introduce stricter controls on phosphates and acidifying pollutants such as sulphur dioxide. Measurements of eutrophication levels showed quite clearly that atmospheric nitrogen and carbon have important effects in maintaining phosphorus limitation in lakes, as well as promoting blooms of blue-green algae.

A photograph of a lake in Canada drew the world's attention to the effects of sulfur and was later widely praised. It has been instrumental in building public support for tackling the growing problem of decay. Excess of nutrients - This is the main problem caused by atrophy which is a very serious environmental threat to the ecosystem. Freshwater as well as semi-enclosed water reservoirs such as the Baltic Sea will have to deal with these adverse effects. Since then, the photograph has been re-displayed hundreds of times for the enlightenment of students, scientists and the general public.

Equally important was the research that showed that the effects of acidification can work their way through the food chain, and once again photographic documentation was a crucial factor in shaping public opinion. Many of the results of the project have proved to be highly relevant in the context of sustainable development worldwide.

Dr. After Schindler received his Water Prize in 1991, he embarked on a number of innovative programs to study the fate and effects of organic pollutants, as well as to increase the ambient temperature around mountains and boreal lakes in the Arctic. Many of the findings from these projects are consistently relevant to sustainable development around the world.

Dr. Schindler received several awards for his work. In 1998, he was promoted to Pvt. He also received the Volvo Environmental Award jointly with Malin Falkenmark. In short, he was honored for his special insights into the process of atrophication and acidification of sweeteners and the ways in which they can be remedied.

Schindler has received a number of additional awards for his work. In 1998, he and Professor Malin Falkenmark shared the Volvo Environment Prize; in particular, he was cited for his "insights in the processes of eutrophication and acidification of freshwater and of ways to counteract these processes Dr. Schindler has also received the Gerhard Herzberg Gold Medal for Science and Engineering, Canada's highest scientific honour, and he has been elected to the U.S. National Academy of Sciences, the Royal Society of London, and the Royal Swedish Academy of Engineering Sciences.

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2
Department of Environmental Engineering
Technical University of Denmark

The 1992 Stockholm Water Award went to the "Department of Environmental Engineering, Technical University of Denmark". The award ceremony was attended by a large number of researchers. Prof. Dr. Paul Harremoes, who has been the head of that department since 1969, received the award on behalf of the department.

The success of the department was due to the research work stemmed from a collective effort carried out by the various branches of the University in a conducive environment required for the creation. In 1969 the department had only one member. By 1992, that number had risen to 50. The award recognizes that the department's success is the result of the coordination of a group working together for the common cause under the energetic and influential leadership of the department head Dr. Paul Harremoes.

The distinctive feature of the Department of Environmental Engineering is the in-depth research work it has carried out in these various fields. Based on this research, mathematical replicas were developed and implemented worldwide. In addition, great efforts were made to educate and train a new generation of experts on this research.

He also developed technologies to protect these vital water resources while imparting knowledge of many factors that pollute groundwater. This is considered to be the most important contribution of this department. Research by the organization on how to minimize groundwater pollution caused by urban sewage and sewage overflows was a top priority. They developed the basic science for the process of eliminating nitrogen from sewage and sludge.

Speaking on the occasion of award ceremony, Dr. Paul Harremoes said "When we started the nitrogen research project in the early 1970's, many people didn't believe it would be technically successful. But being a leader in this work, we did not give up. As a

result, it proved successful throughout Scandinavia and later throughout Europe. We've been able to do this with a lot of important personal contributions and that's why we've had this success."

Developed to meet the expected results, the technology is now being used in wastewater treatment plants around the world. By the time the department received the Stockholm Water Award, it was planned to set up 500 such plants in Scandinavia by the year 2000, which would combine the process of removing Potassium and Nitrogen from wastewater.

The research carried out on metals in wastewater sludge showed sludge to be a minor contributor of metals to agricultural land, compared with the much larger inputs from fertilisers and the atmosphere.

The department was at the forefront in enhancing our understanding of the need for an integrated approach to the total system: sewerage, wastewater treatment and receiving waters.

To summarize the citation for the award, the department received the Prize for its research and development programme, its scientific approach, its international collaboration with the water industry in search of practical applications, and its contributions to water pollution abatement, in Scandinavia and worldwide.

The Institute of Environment & Resources, as it is called today, headed by Professor Mogens Henze, is one of the leading and largest environmental engineering university institutes in Europe, with a staff of 90 scientists and 40 technicians. Twenty-five per cent of the staff is international researchers. New significant activities at the Institute since 1992 are in solid waste management, groundwater geochemistry, eco-toxicology and remediation of contaminated sites. The Institute

has a unique flat research and teaching structure where the faculty can float freely between research areas. This allows it to develop new cross disciplinary activities on the boundaries between single specialisation. Since 1995, teaching at the master level has been in English, and 80 master students graduate each year.

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3
Dr.Madhav Atmaram Chitale - India

Honourable Dr. Madhav Atmaram Chitale was honored with the 1993 Stockholm Water Prize for his outstanding achievements in the water sector. Dr. Madhav Chitale has played a major role in inculcating the idea among strategic planners in India that water is a resource and its quality and availability must be protected.

Dr.Madhav Chitale obtained the 'Bachelor of Engineering' degree from the University of Pune in the year 1955 with first class distinction. From 1956 he was appointed as Direct recruity Class-I rank Officer in the Irrigation Department.

He accomplished the important feat of restarting Pune's water supply, which was disrupted after the Panshet Dam burst in 1961. The works for this purpose were completed without getting stuck in the government red tape restoring the water supply to Pune on the given date and the city was spared from being evacuated due to lack of water.
In 1962, Dr. Chitale was appointed specially on the Mula earthen Dam in Ahmednagar district of Maharashtra having a cut-off of 50 meters high and 30 meters deep. The idea of building a dam on the Mula river had begun in the year 1864 during the British period. However, this was not possible due to major technical difficulties in the geological conditions in foundation of the dam. How to build a strong dam on it, was a problem. French experts were invited by the government. But their experiment was not applicable for Mula Dam conditions. This responsibility was then given to Dr.Chitale, who was just 27 that time. Having a proper understanding of the scope and complexity of the work, he literally devoted himself to the construction of this dam overcoming the issues with the help of geologists. After through studies, the work of Mula Dam was taken and completed successfully making sure in the laboratory by adopting new planning and appropriate measures of construction.

In 1966, Dr. Chitale was appointed as the Superintending Engineer on the Bhatsa Project, which was planned to supply more water to the city of Mumbai. Dr. Chitale played a major role in finalizing the concept of constructing a stone masonry dam by changing the pre-planned concrete form of this 88.5 meter high dam, the highest in Maharashtra. Also decided to build this project without the help of the World Bank and actually achieved it.

In 1969, he was appointed to the Koyna Hydroelectric Project, hailed as the 'Landmark of Maharashtra'. It was specially done in the background of the terrible earthquake that had happened in the area recently. Dr. Chitale also successfully worked on the Koyna project's under-river tunnel, facing many challenges.

Princeton University Scholarship:

In 1974-75, Chitale received a special scholarship to study international and public affairs at the Woodrow Wilson School of Public and International Affairs of the famous Princeton University in the United States. He diligently availed this opportunity of interacting with selected scholars from various countries. He stood First there too in that course. He was awarded "Best Parvin Fellow of the University". Chitale was asked if he was interested in working there? But, he promptly told that he would work in his country only. This was his own motivation. A special achievement of this study at Princeton is that he, who was an engineer, has been able to grasp different subjects like governance, environment, economic and financial management and those areas have been opened up to him.

From 1981 to 1983, he was worked as Secretary (CAD) in the Department of Irrigation. Then in 1984, he was appointed as the Commissioner of River Basin Authority, Government of India. From 1985 to 1989, he was the Chairman of the Central Water Commission, an apex body in India in the field of water resources development.

Dr. Chitale held various positions in important places. During 1986-87 he was the Chairman of 'Indian National Committee on Large Dams', Indian National Committee of I.C.I.D. (1986-87) and Indian National Committee on Hydrology' (1985-88) as well as Chairman of various national committees like 'Indian Water Resources Society' (1989-90). During 1989-1991, he worked as the Vice President of the International Water Resources Association. He was a member of the United Nations Environmental Program Water Advisory Committee since 1989 and was the Vice President of the Indian National Academy of Engineering during 1992-93. He was the initiator of the Ganga Allocation Plan-GAP, a mega project on India. It is an ambitious country-wide development program involving several rivers. He handled many other national / international responsibilities with distinction. From 1989 to 1992, he held the highest post in the country as the Secretary of the Ministry of Water Resources of the Central Government and retired from service from there.

Important contributions after retirement:

Government of Maharashtra decided to establish 'Maharashtra Water and Irrigation Commission' in 1996. The chairmanship of this commission was entrusted to Dr. Chitale. Water planning in Maharashtra for the next 35 years was to be done by this commission. His commission report has become a landmark in the irrigation sector. Today, according to its instructions, drastic changes are taking place in the water sector.

When there was a proposal to appoint a committee before the Maharashtra government to overcome the flood situation in Mumbai on July 26, 2006 and suggest solutions, this responsibility was also entrusted to Dr. Chitale. He has played a big role in solving the issue of

Pedhi project in Vidarbha and getting the work of the project on track. He was entrusted with the responsibility of the chairmanship of the committee appointed by the government to stabilize the water supply of the city of Mumbai and the water supply of the Mumbai metropolitan region in the long term.

International Contribution to Water Development:

Dr.Chitale had earned a great reputation during the reign of late Prime Minister Rajiv Gandhi and late Narasimha Rao as a very close confidant and learned officer/engineer and contributed immensely to the country. Due to his role in the water issues between Nepal and India, the public unrest there subsided. Bhutan is our friendly country in the Himalayas. With the intention of increasing the friendship between these two countries and making more progress with each other, Dr. Chitale was specially deployed by the Prime Minister as a special envoy for some strategic meetings to be held at the highest level with the king of that country and also with the functionaries of that government. The background of the growing influence of other neighboring countries might also have behind this. Dr. Chitale met the King of Bhutan, who is in highly educated. The King was was very much impressed by the discussion with the indian delegates. Chitale convinced the king that due to the high elevated location of Bhutan and the abundance of water in the country, if hydropower projects are built there and the hydroelectric power generated by it is sold to neighboring countries like India, the prosperity of Bhutan will increase and the trade and progress of both countries will also be greatly contributed. After that, a favorable environment was created for the Indo-Bhutan Joint Project on the Sankosh River. Now India helps Bhutan to build power plants and Bhutan sells that power to India and gets richer from it. This has resulted in the per capita income of that country being higher than that of India.

Ideally, in the water sharing agreement negotiations on behalf of the Indian government in between India-Bangladesh and India-Nepal, Dr. Chitale's role was unmatched. When he went to Pakistan to solve the mutual water issues with that country, there were big protests

on the roads flashing banners like 'Chitale Go Back', and there were signs that the upcoming meeting would be very tense. But by successfully courting the meeting, he resolved the issue amicably. The feeling of trust in him in the international community might have been the main reason behind it, as he has many good friends in that country.

In 1993, a new international responsibility came to him. The International Commission on Irrigation and Drainage (ICID) asked him to become the Secretary General of that organisation for the next six years. There was a sense of deep belief of that organization that to fulfill this very important responsibility in the international field, there is no one as qualified and competent as Dr. Chitale, and it was entrusted unanimously to him. From 1993 to 1997, he served as the first full-time Secretary-General of this 84 nation affiliated International Commission. During his five year tenure, he raised the prestige and stature of the work of the International Commission and changed the entire atmosphere of the Commission.

A new concept emerged on the world stage just around the time of the International Drainage and Irrigation Commission's decommissioning. Of course, Chitale's initiative was much more in this. A new forum called 'Global Water Partnership' was established to discuss how future water management should be done in 10 parts of the world. The concept was completely new. It was a very difficult task to convey and establish this new idea that the people working in the water sector in different parts of the country should organize and set up various organizations around water issues, and all of them together would set up the 'water partnership' of that country, region or basin. For this, a global office was started in Stockholm. A full time responsibility of those organizations as Executive Secretary was entrusted to Dr. Chitale with full trust.

The South Asia region of the Global Water Partnership includes India, Pakistan, Bangladesh, Sri Lanka, Nepal and Bhutan. It was insisted that Dr. Chitale should accept the responsibility of the chairmanship of that region. At the time when India-Pakistan relations were very tense, the representative group of Pakistan expressed unequivocally that if Dr.

Chitale accepts to become the chairman of the South Asia water partneship, he would be welcome and promised the necessary cooperation to him.

The global recognition of Dr. Chitale's work is the 1993 Stockholm Water Prize. This award is given by the Royal Swedish Academy of Sciences, an organization in Sweden that awards the Nobel Prize. It has been described as the Nobel Prize of water. Dr. Chitale's work was specially noted for his outstanding social achievements in hydrology and education. In August 1993, he was presented with this world honor at a royal ceremony in Stockholm by the King Carl Gustaf (XVI) of Sweden. For the first time an Indian received this prestigious award. The nature of prize is in the form of cash 1,50,000/- USD and a memento.

In his speech at that time, he expressed a regret in his heart. The United Nations has made significant achievements in the fields of culture, labor, economic development, world peace and many others. However, this organization has neglected the water sector. As a result, the United Nations began to consider the issue of water. Later, two global organizations were formed in the field of water, the World Water Council and the Global Water Partnership. Much of the credit goes to Dr.Chitale; as he had a lion's share in the preliminary activities that were carried out in connection with these creations.

Celebration of World Water Day:

World Water Day is is said to be Dr.Chitale's precious gift to the world. When he was the Chairman of the Central Water Commission in India, the celebration of 'Water Resources Day' started in India from the year 1986 and gradually this concept took root in the people's mind. He also enlightened the international community on this issue at various global forums. The resolution taken by the United Nations to celebrate March 22 as World Water Day is the result of his effort at international level. Subsequently, the United Nations called upon each nation to celebrate this day by planning appropriate programs related to it's water resources.

Foundation of Social Institutions:

After living in cities like Mumbai Delhi for 20 consecutive years, he decided and made up his mind to settle in the districts in Maharashtra which were lagging behind in development. Since it was necessary to have an airport near by for facilatating his working, he chose Aurangabad in the Marathwada region, a city that was entirely new to him .

Dr. Chitale came to live in Aurangabad with a sense of social commitment. As soon as he arrived, he brought with him the innovative ideas like 'Irrigation Cooperation' and 'Ajantha Unmesh'. In order to embody these ideas, he gathered the engineers, agronomists and eminent intellectuals of the area and brainstormed his ideas upon them by freely presenting the outline of his ideas to everyone. In the due course, organizations dealing with various issues related to water were formed and today a movement has emerged from it. An organisation viz: 'Maharashtra Sinchan Sahayog' has been formed, which is having a network of irrigation partnerships spread across the state in 34 districts. Irrigation conferences are organized at various places by this organization and farmers are guided on various irrigation issues.

His work also extends to tracing the relationship between water and culture. The 'Indian Council For Water And Culture, Aurangabad' was established in 2001 with the aim of systematically collecting information on water related development on a large scale, presenting its findings to the Indian society in an orderly manner, and raising public awareness about water availability and its proper use. The council is actively pursuing this by organizing workshops and conferences on various topics all over the country.

India was known as a country of lakes. But many lakes have become extinct in the last three to four hundred years. Not only this, the water pollution in these lakes is increasing to a great extent. Ponds also need attention if this is to be stopped. Realizing this, he established an organization viz: 'Sarovar Savardhini'. Through this organization, people are educated about how to revive the lakes and preserve the purity of its water.

He was also the inspiration behind starting a magazine called 'Jalsamvad' in 2005 to educate people about water issues. This magazine is consistently doing the work of educating people on various topics effectively. Ideally water and electricity are very closely related. For that, he gave valuable guidance to start an organization viz: 'Urja Manch' in Aurangabad.

In the year 2000, his book "A Blue Revolution" in English was published by Firodia Trust. Later the Marathi version of that book came out in the name 'Bharatiya Jalkrantichi Padachinheä'.

Dr. Chitale has received many awards / honours in his lifetime. In 1989, he was awarded an honorary 'Doctor of Science' by the Jawaharlal Nehru University, Hyderabad for his outstanding achievements in water resources engineering. In 1995, he was awarded 'Honorary Doctor of Science' by Kanpur University of Agriculture and Technology for his outstanding achievements in the field of water management and irrigation and in 2006 'Doctor of Literature' by Tilak Maharashtra University for his extensive social awareness.

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Dr. Takeshi Kubo, Japan

Every time when we walk down a suburban street in Tokyo, we see the red brick pavement on the sidewalk and get mesmerized; as these bricks are made from sludge and baked in huge kilns. This hard and resistant material is increasingly used in Japan for foundations of buildings, sidewalks and roads. This is a striking example of any technical solution plan developed specifically from Japanese efforts to treat wastewater and sludge disposal.

The question is how to better manage the sewage system for Tokyo's 12 million people. Kubo had been struggling for a long time. He tackled this question in the early 1960's and spent almost half a century as a guide to the planning of wastewater treatment facilities in Japan, directly up to the age of 74, when he resigned as the Director General of the Sewage Management Research Institute in Japan. He was awarded the Stockholm Water Prize in 1994 for his outstanding work.

In the early 1970's, Tokyo's rivers looked white because of the large amount of foam in them. Most of the rivers were discharged with untreated industrial and domestic effluents, causing a strong odor. This is the dark side of the rapid process of industrialization and urbanization in Japan.

"These things have changed a lot now. We have strict standards for water quality, businesses have to strictly adhere to. Sewage from almost the entire city of Tokyo is connected to wastewater treatment plants," says Kubo.

By 1993, water was supplied to 93 percent of Tokyo's inner city areas from 18 sewage treatment plants, by laying about 22,000 km of pipelines beneath the roads of the capital. Until then, a network of double pipelines had been built in the outer suburbs to separate surface rainwater and sewage. Citizens of Tokyo should thank Dr. Kubo for many of these improvements in the city.

Many of the waterways laying in the dead state for a long time, have been revived by adding processed sewage water to the city. One of them is the 350-year-old Tamgawa canal of the Ido dynasty, which has been revived and is filled with huge carps now. Another example is the "pocket" park in the city, where the addition of a small water supply from the regenerated sewage has added to the beauty of the place.

But without limiting his vision, Takeshi Kubo extends beyond the horizons of Tokyo and Japan. One of Kubo's most important contributions was his involvement with a number of Asian hydrologists and professionals, including Western organizations for ensuring the exchange of knowledge of the country on this subject. To this end, he enlisted the cooperation of Western countries such as Britain, the United States and Germany, and Asian and Pacific countries in the Eastern Water Environment Federation as chair of the RIM Steering Committee. Not only that, Kubo also brought together nations like China and Taiwan to tackle important issues related to wastewater treatment and clean water from a holistic perspective.

Kubo states that “there is a need to be able to control the entire catchment area of the river, including its soil use. This is because whatever chemicals or fertilizers you use to increase agricultural yields are eventually released into the river. Therefore, this problem can never be solved by considering land and water separately. "

Since 1993, Dr. Kubo has officially retired. However, contribution in Annual Water Environment Council continues to pass through several water-councils, such as the Stockholm Water Symposium. For the 3rd World Water Forum, he produced a summary version of the findings from the 10th Stockholm Water Symposium in Japanese.

Hokkaido University of Japan recognized Dr. Kubo and Prof. Takashi Asano, winner of the Stockholm Water prize-2001 and announced a permanent award in recognition of the work of these two distinguished graduates of the university in 2004.

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5
WaterAid, Great Britain

The 1995 Stockholm Water Prize was awarded to the British Water Aid, a social organization in England working in the field of water. Worldwide, about 25,000 children die every day from contagious waterborne infections. Similarly, two billion people are at risk every day from waterborne diseases. Eighty percent of the world's diseases are theoretically caused by poor quality water and inadequate sanitation.

British WaterAid, a social charity, works to educate people living in poor conditions on how to maintain clean water. In particular, before starting such training, care is taken to ensure a permanent supply of pure water to the people of the village. This tangible change helps the women of the village, on whom the organization pays special attention, to better understand the importance of cleanliness than words. Also, reducing the distance they have to walk to get clean water is another fundamental element of the organization's goal. Every household in the UK has a copy of their water bill with a copy of the appeal to support Water Aid projects. All the agencies involved in the establishment of the organization have full confidence in their work and therefore find it heartwarming to appeal to the 23 million families to whom water is supplied.

There is a sense of respect for WaterAid at every level - from the government to the aid agencies and the local people. In 1995, the organization was nominated for the Stockholm Water Prize and WaterAid was chosen as the winner of that year. The award was accepted by John Lane, then director of the organization.

The organization is polite about this success. It works in collaboration with the Ministry of Rural and Health and seeks to use affordable but effective technology to combine local knowledge with practical methods. Another important objective of each such project is to develop a sense of responsibility among the local people for their

limited water resources. E.g. They should pay for every bucket of water they use. All the money paid by the people is deposited in the co-operative bank account, which is used for maintenance and repairs of water supply system and pumps.

Special squads, known as 'Wamma Teams' have been formed for WaterAid-assisted projects in Tanzania, bringing together people from the Ministries of WaterAid, Water-Health and Social Development. The work is carried out by these teams. These teams go to the villages and hold meetings about the projects, helping the villagers to set up water committees. They also help to appoint a supervisor and a technician to operate the pump. They also organize training for the villagers on water conservation and hygiene.

WaterAid is committed to providing sustainable support for development. It is the policy of the organization to hand over the entire responsibility of the projects to the villagers and the Wamma Teams once they learn how to manage their own water. By 1995, three million people in the Third World would have access to abundant pure drinking water through waterAid-supported projects. It helped more than half a million people in Tanzania who did not have adequate water supply over the period 1983-95.

The methods used by WaterAid in Tanzania and twelve other African and Asian countries have proven to be effective in treating

unsafe water issues around the world. Since receiving the award, WaterAid has expanded its programs in the areas of water and sanitation, with an estimated 8 million people in Africa and Asia benefiting from their safe water service. The prize money has been used to establish a 'dedicated research policy and advocacy department'. The development goals have been set to pursue the growth of equitable as well as technically sound and sustainable water supply and sanitation services at the national and international levels.

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6
Prof. Jorg Imberger, Australia

The 1996 Stockholm Water Prize was awarded to Professor George Imberger, an environmental engineer in Australia, for his research on water. Professor Imberger is an environmental engineer, and he has a keen interest in the way water is transported and dispersed in stratified lakes. In this regard, he pays special attention to the lakes but also specializes in rivers, creeks, swamps and coastal waters.

George Imberger is seen as a special person in this field of research. When the most respected critics speak on the subject, it is always in the form of "before Imberger and after Imberger".

Most water bodies are stratified due to salinity or temperature differences. Due to the natural movement of wind and water, they are not always able to mix enough water in the deeper layer. As a result, water samples at short distances in the same water body show different properties. Many of these types of transport in the water bodies that Imberger studied, were previously unknown.

During his research days, Imberger developed a wide range of sophisticated equipment in collaboration with industry. It is said that "Need is the mother of research." According to that statement, this is true for Imberger's research also. Imberger has developed a special plant where he has immersed an equipment in the Swan River near the skyscrapers in city of Perth, where he lives. Visually it looks like a milking machine; however, practically and technically it carries out many tasks. It records accurate data on various parameters of different depths of water. The record was made available through two laptops connected to the plant in his study. Imberger's doctoral students keep a close eye on this. Many graphs are printed from it; from which the physical, chemical and biological data of different layers of water is studied and obtained.

George Imberger says, "We have succeeded in creating computer models by comparing the velocities of currents in different layers of rivers, creeks, and lakes using these techniques. It can be used

for estimating how contaminants are spread in those layers and how quickly they can be dissolved."

Emberger and his students monitor all this work from their computer room at the University of Western Australia, and this extraordinary and beautiful graphical replica records the behavioral changes of currents and substances being tested according to various parameters. A wave of different colours is seen constantly going up and down on the computer screen. There can also be seen an effect on the movement of layers at higher depths of water.

This creates a better understanding of water-related environmental issues; so also it provides a good basis for dealing with the problem, and the response needed to address future aquatic-environmental defects can be predetermined with great certainty. These are some of the environmental benefits of George Imberger's research.

The global scope of Professor Imberger's work was another factor behind the decision to award him the Water Prize. Imberger conducts research work simultaneously on several projects around the world. Examples include the study of tidal currents in the Netherlands, measures to maintain water quality during the construction of the Bacon Dam in Borneo, and the effect of groundwater on the bottom of Valdivia in Chile etc. He is conducting research around the world on a variety of topics, including the impact of waves on the biochemical balance of Lake Kinneret in Israel, the amount of wastewater that can be absorbed in a reservoir in Brazil, and the transportation system in the Biva Reservoir in Japan.

The main advantage of Professor Imberger's global experience is, perhaps the future generation of researchers he has created. Professor Imberger is credited with starting the first environmental engineering course in Australia. He also founded the Department of Environmental Engineering at the University of Western Australia. The achievement of Professor Imberger's work is remarkable, and as a researcher he has gained worldwide excellence; at the same time, he is equally committed to how students can get more and more improved results.

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7

Prof. Peter Eagleson, USA

Professor Peter S. Eagleson, an American Hydrologist, was the recipient of the 1997 World Water Prize. Eagleson's characteristic is that he was not traditionally a traditional hydrologist; but he has a great knowledge of Darwin's ecology and mathematics.

Eagleson reveals in his study the various evolving shapes of forests, their characteristics and functions, and the role that climate plays in this process. Eagleson came up with a number of exciting findings from his seasonal water forecasting equations on how to control plant types due to soil water limitations.

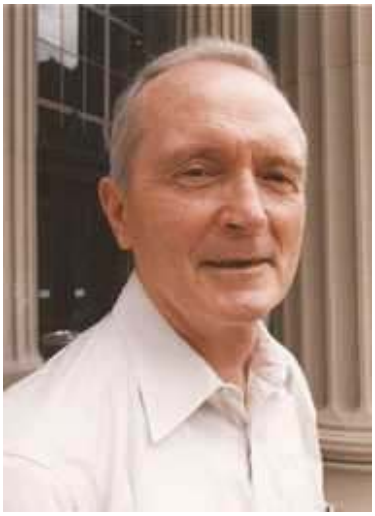
Even before joining Darwin's study, Eagleson made great strides in his research, although hydrology was an established science. E.g. When he first published the book Dynamic Hydrology in 1970, it gave a new modern impetus to the entire branch. Peter Eagleson has worked at the Massachusetts Institute of Technology (MIT) in Cambridge, Boston since 1952. Eagleson, who has been a water expert since 1965, has been working as a professor in the multidisciplinary branch of Civil and Environmental Engineering.

Considering the integrated effects of physics, biology and chemistry on the Earth's ecosystems, he has been working tirelessly for decades to develop new models of dynamic hydrology. Among other achievements, he was honored with the Stockholm Water Award in 1997 for this special work.

Eagleson says, "Given the complexity of the interconnectedness of geography and the environment, we can better predict long-term rainfall if we work extensively on hydrology. We must move away from our view that hydrology is purely physics. In particular, I consider the inseparable relationship between plants and the environment, both locally and globally. When trying to get a complete picture of the weather, we should not forget to mention the role of plants in our

mathematical equations. Because unless we can successfully assess the behavior of a plant - for example, the relationship between productivity and the environment - it will not be possible to make reliable statements about the water balance in the climate. "

Peter Eagleson is such a scientist who has combined ecology and hydrology - what Europeans call ecohydrology - and which he considers to be a new science. Eagleson defines hydrology as a multidimensional global ecological geology from the field of contemporary engineering, in which green as well as biological factors play an important role in ecosystems.



Prof. Peter Eagleson created a new platform for long-term and more reliable weather forecasting at MIT. In which mathematical computer models are created to build a large number of weather forecasts by combining hydrological processes from the combined studies of different science disciplines on weather, water availability or potential water hazards or potential floods.

Prof. Eagleson has been researching Darwin's theories on the relationship between plants and climate since 1997. Its practical purpose is to predict the biological changes that will occur due to climate change. His book, Ecohydrology: Darwinian Expression of Vegetation Forms and Functions, was published in 2002. This book is a link between the fields of hydrology and ecology and introduces new integrated principles based on the concept of natural selection. It also has the ability to determine how plants respond to climate change. He is currently writing another book on geographical expansion and diversity of tree species.

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8
Prof. Gideon Dagan, Israel

Groundwater resources are not bound by political boundaries. However, they are an essential source of water for all who have homes on it. The reservoir does not depend on the country or the political system in which they live. Therefore, research is very important to find out the properties of this water in such a state.

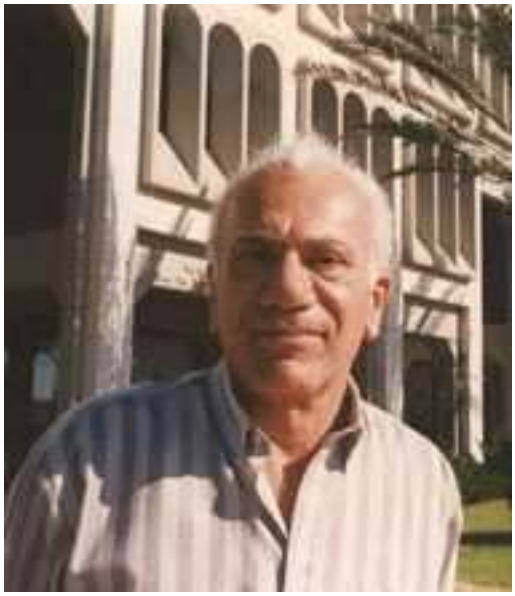
Gideon Dagan, a professor at Tel Aviv University, was awarded the 1998 Stockholm Water Prize for his unique research on groundwater. Dagan must have had an in-depth knowledge of the invisible underground aquatic life, and because of this, his research in the aquifers spread over west bank region, in the interior of mountain ranges is very important.

Groundwater is of paramount importance - especially in arid regions such as the Middle East and North Africa. The prudent management of these limited and important natural resources requires close international cooperation.

Professor Gideon Dagan says - the problem is that we can only record measurements and observations at certain points, which should actually be in a sufficiently large area. Another problem is that groundwater rocks and silt are extremely heterogeneous.

Over the last twenty years, Dagan has developed a number of mathematical models, known as the 'stochastic model' - which provides information on how groundwater flows through porous substances and how pollutants and other substances are transported in it eliminating misunderstandings thereby improving the decision making process. There were improvements. Since this whole process is based on probability, decisions tend to be as realistic as possible.

According to Prof. Gideon, "It takes a long time for the subterranean surface to change, and this means that when it comes to preventing pollution, the consequences are pronounced even more



late."

A working model makes it easier for you to solve problems that arise. It gives us the ability to cash in on pollution or reduce its spread with better forecasting. This kind of advance warning is always useful - since the decision is ultimately up to the politicians, any proposal for action on pollution is even more delayed.

Predictions of possible movements of chemicals, metals or radionuclide can be obtained. For example: Sweden may face some problems in its nuclear program in the future, for eg. when this waste is stored in rocks in the soil, the radioactive material there can then spread through the groundwater. "

Carcinogenic radioactive substances released from nuclear explosions pose a major threat to groundwater. It was recently discovered that plutonium spilled from atomic bomb tests carried out in the 1970s near Las Vegas, Nevada, had spread to the ground within a few kilometers of the test site. In the case of Russia too, there are fears that the scale of such problems could be huge.

Dagan emigrated from Romania to Israel in 1962 as a young engineer. After working for twelve years at the Israel Institute of Technology in Haifa, he became a professor. Two years later, in 1976, he joined the engineering faculty of Tel Aviv University. Prof. Gideon Dagan conducts his research work in collaboration with researchers and universities around the world. In his illustrious career spanning over forty years, he has served as a visiting professor at ten universities. During his tenure, he was drawn to prestigious institutions such as the

University of California at Berkeley, Imperial College, London, Ecole Des Moines, Paris and Princeton University; considering his wisdom in higher education.

Professor Dagan's recent achievements have been recognized by the Institute for Scientific Information, which has named him one of the most outstanding researchers in the field of environment and engineering. Professor Dagan has been honored by the American Geophysical Union with the 2005 Horton Medal.

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9
Prof. Werner Stumm and James Morgan

The winners of the 1999 Stockholm Water Prize were the scientist duo Prof. Werner Stumm of Switzerland and Prof. James J. Morgan of the United States. These two researchers from different countries have been working in association of one another living in their respective countries continuously for forty years.

James Morgan worked at the prestigious California Institute of Technology (Caltech) in Pasadena, USA, while Werner Stumm worked at the Swiss Federal Institute of Technology (ETH) in Zurich from 1934 to 1999. But unfortunately, in the year of water prize in the spring, Professor Stumm died.

Morgan is a one-time PhD student of Stum. He received the award at an awards ceremony in Stockholm. When James Morgan was 20, he became particularly interested in how pollution affects the oxygen balance in rivers. The United States first passed a water law in 1948 and since the mid-1950s it has been forcing paper manufacturers and pulp manufacturers to find ways to prevent pollution from their industry.

In his award speech, Morgan said, recalling his memory "At that time, the foam of phosphate-containing detergents was reaching as high as the waist on the surface of the water, and looking at that undesired view, while I was on the job I was determined to study chemistry for four years."

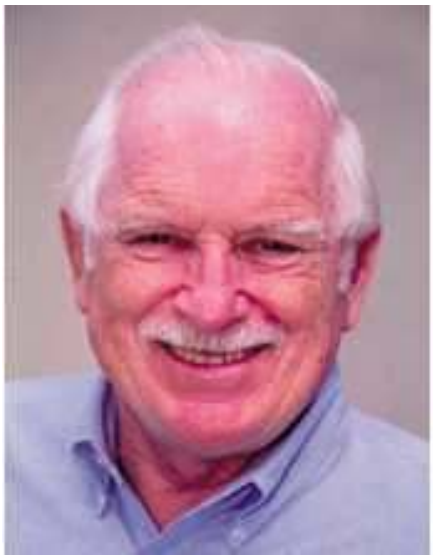
This led to Morgan's research on aquatic iron and manganese. At the same time, Morgan heard about Werner Stumm, a professor at Harvard who had a keen interest in the subject. Morgan met Werner Stumm immediately, and in 1960 he became his PhD student. Professor Werner Stumm was originally a Swiss citizen. At Harvard, he mentored young Morgan and nine other PhD students in teaching and research in aquatic chemistry. These ‘Educational Children and Grandchildren’ of

Prof. Stumm are pioneers in the field of hydrochemistry and work mainly in the world's leading water research centres.

Since then, Stumm and Morgan have studied the science of coagulation as a tool to eliminate pollutants from water. His research papers in this regard are still leading and are still widely quoted. Contaminated water particles carry toxins and are therefore unhealthy. His joint scientific dissertation on the elimination of chemically active contaminants in water and the consequent practical use of that water received a scientific award in 1962 from the American Water Works Association.

"How can manganese (MN) be extracted from water?" They were thinking about this, day and night. Ultimately, their solution for this was to oxidize it into solids.

The oxides in the solution of Mn^{2+} ions are found to be absorbed on the surface of solid particles of MnO_2. This reaction was greatly enhanced by the high pH value - that is due to the increased salinity. As a result of an increase of one pH unit (e.g. due to pH 8 instead of pH 9) the reaction became a hundred times faster. The adsorbed manganese in it was oxidized by oxygen. Furthermore, it was discovered that MnO_2, the substance produced, was itself a catalyst -



which triggered this reaction. These findings also apply to other contaminants such as phosphorus and arsenates.

Asbestos fibre was once found in water in California. By increasing its pH value and adding aluminium, it was possible to remove 99.99% of harmful asbestos in it.

In addition to their studies of coagulation and flocculation, Stumm and Morgan carried on the education of future scientists. Versions of their book, Aquatic Chemistry, have become a bible for scientists and students in the field and are quoted worldwide as scientific references. Over the years, Stumm and Morgan have combined to produce about 75 PhD students. These seventy-five messengers are spreading their vital knowledge around the world.

The following year, James Morgan was promoted to Professor Emeritus at Caltech. Since then, he has given numerous lectures and written extensively on his research into the chemistry and technology of water treatment and the scientific basis for establishing standards and norms for water quality protection as well as the rate of conversion of manganese to freshwater and seawater.

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10
Prof. Kader Asmal, South Africa

The 2000 Stockholm Water Prize was awarded to Prof. Kadar Asmal of South Africa for his special work. Mr. Kadar Asmal is a Professor of Law. He rewrote many of South Africa's water reform laws in 1998 - for which a social foundation had already been laid and which benefited not only the rich in the white community but also the poor black population there.

When he was appointed Minister of Water Resources and Forestry in the Nelson Mandela government in 1994, approximately one million people in South Africa did not have access to safe drinking water. Since then, water has been made available to an estimated ten million people around their homes or in their schools or workplaces.

All these reforms were made possible mainly due to the efforts of Prof. Kadar Asmal. Professor Asmal was tasked with developing an action plan to address the serious water crisis facing South Africa; including the issue of unequal water availability. He enthusiastically set up a comprehensive revised system, taking into account the existing water management policies and practices. Prof. Asmal already had extensive experience of organizational reforms. He was appointed a member of the African National Congress, a group formed by Prof. Nelson Mandela to work on the country's new constitution.

While formulating his action plan, Professor Asmal naturally linked water issues from his previous experience to the three main human concerns - human rights, social justice and environmental sustainability.

The initiatives taken by Prof. Kadar Asmal include Working for Water Program, Social Water Supply and Sanitation Program and National Water Conservation Campaign. At the end of 1998, 24,000 people participated in more than 300 projects across the country through the Working for Water Program - the main objective of which

was to eradicate exotic species that consume large amounts of water and endanger biodiversity. The community water supply and sanitation program launched to care for the health of the people of South Africa has provided employment to three lakh people, mainly women.

Due to the National Water Act of 1998, South Africa's water can no longer be used for racial discrimination. The new law is now described as the most comprehensive and far-reaching law on water in the world. This includes a special concept of 'reserved water'; in which human needs and basic environmental functions are given priority over commercial or industrial interests. The Act covers the right to use water. It is an economic tool that allows the poor to afford it at an affordable rate; while at the same time forcing water-intensive industries and agriculture to pay more. In addition, the law enacted by Kadar Asmal requires neighbouring countries to receive a fair share of water from shared rivers, he said.

Professor Kadar Asmal, a South African teacher and lawyer who studied and worked in Britain and Ireland during his 27 years in exile - is an internationally renowned human rights scholar and activist. He has also served as President of the World Commission on Dams, a global organization aimed at developing international policies and guidelines for those interested in large dams. The Commission has a far-reaching impact on water use and sustainable development. Another task for Professor Asmal is to think about the pros and cons of the 40,000 dams in the world with a height of more than fifteen meters.

When the African National Congress was re-

elected in 1999, Professor Asmal became the Minister of Education in South Africa under President Thabo Mbeki. Although he has now retired as Education Minister, he is still working as an MP. He was chairing a UNESCO forum to discuss the draft cultural diversity. In 2005, he was elected chairman of the Financial Action Task Force. He continues to give lectures and write on water and educational issues at the international level.

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11
Prof. Takashi Asano, USA

The 2001 Stockholm Water Prize was awarded to Prof. Takashi Asano of USA. The award was presented to Professor Takashi Asano by King Carl Gustaf of Sweden on August 16, 2001. It was a great moment that glorified the journey of his life.

He began his journey from the beautiful town of Sapporo on the northern Japanese island of Hokkaido where he was born and moved on to Berkeley, California, transitioning from the social and scientific epoch-defining period of the 1960s and further to the forefront with many notable government and academic pursuits.

Until receiving the award, Professor Asano spent more than 20 years engaging in both theoretical and practical research on wastewater recovery and recycling. The basic study was conducted in the 1980's and 1990's. As a result, it became clear as to how to use the recovered water safely and it set out the rules and procedures for water recycling in the state of California. This research provided a reference point for most international projects on how to use water efficiently. Professor Asano used the original research to promote agriculture, irrigation, groundwater recharge, industry and the environment globally.

He expanded his original research and the concept was adopted in developed and developing countries. Reliability, health protection and public acceptance as the promoters of the concept were his main achievements considering the scientific basis and the approach of risk management for the present and future in the complex world of technology. Significant achievements of his work include his concept of microbial risk assessment and the expansion of that concept in the field of wastewater recycling. He and his colleagues combined reliable and anticipated virus-monitoring data with new approaches using statistical evaluation and simulation methods. This area is now rapidly

expanding as a tool of policy and management.

His contributions to science and technology have gone beyond his role as an educator and former government employee. He acted as a catalyst for technological advancement. He also acted as a mediator between scientists, practitioners and politicians in arid and semi-arid Asian and Western countries - where water is most needed.

Prof. Asano says, I learned one thing from visiting these countries that, a lot of well educated and trained people work in the fields of hydrology, engineering and public health. We always need to get valuable advice from these knowledgeable people.

Prof. Asano soon recognized that developing countries in the semi-arid or arid regions of the world with their rapidly growing populations and limited economic resources needed special attention and contributed significantly to the problems and solutions of developing countries in this regard. Many local, regional, national and international agencies benefited from Prof. Asano's knowledge and advice.

Although, there is no other well-known name in the field of wastewater recovery and recycling, Prof. Asano equally values and respect others. In fact, he credits his Stockholm Water Awards with the combined efforts of colleagues and mentors from the United States, the Mediterranean, North Africa, the Middle East, South America, Japan, and elsewhere.

Since 2001, Prof. Asano has focused on writing a textbook on water recycling along with his two expert colleagues. The main focus of this textbook is on the use of integrated water resources management

as a sustainable alternative to water recycling treatments. Prof. Asano is developing a blueprint for how wastewater recycling will be integrated with water resources in an integrated manner using public health care for public health purposes.

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12
Prof. Ignacio Rodríguez-Iturbe, USA

The intense desire to understand "how nature works" became a major professional inspiration for Professor Ignacio Rodriguez-Iturbe. It was this passion that helped Professor Rodriguez-Iturbe to reach the pinnacle of his chosen hydrology. Born in Venezuela, Rodriguez-Iturbe became the first South American to receive the Stockholm Water Prize.

The scientific contribution of Professor Rodriguez-Iturbe has significant theoretical and practical importance for the development of hydrology as a planetary science. He added that knowledge about the planet's meteorological system, in which water circulation plays a crucial role. His research has shed more light on climate and hydrological events - such as floods and droughts, which can lead to environmental and economic damage. In the 1970s, Professor Rodriguez-Iturbe developed a mathematical model for such long-term environmental phenomena. Its formulas are widely used around the world, for example - to predict changes in river flows and water levels.

In addition, Professor Rodriguez-Iturbe contributed greatly to the development of methods for determining the accuracy and value of hydrologic data. This concept is now accepted in hydrology and meteorology services. It has been used in the US, Canada and England to evaluate the usefulness of data collection systems.

In the mid-1970s, Professor Rodriguez-Iturbe first implemented the "Bayesian approach" to improve various models for river flow and to predict the probability of hydrological phenomena. (This is a mathematical tool for gathering information from many different sources) This type of approach is now accepted in many planetary sciences. For example - it acts as a way of integrating output from different climates or weather models or as a way of integrating models and opinions for environmental risk assessment.

In the 1980's and 1990's, Professor Rodriguez-Iturbe and his colleagues refined the theory of river basin formation from a geographical point of view (Geology is the science of the Earth's surface). Nature carries water and silt out of the watershed with maximum efficiency, he was able to establish an equation that, once resolved, the nature would create a drainage system that would form different climatic and geographical conditions.

Professor Rodriguez-Iturbe's mathematical representation of precipitation in an active point method makes it possible to predict precipitation over many years from different periods, create sequences that mimic how nature will behave in the future, and it is possible to use the results in engineering design or analysis.

Recently, Professor Rodriguez-Iturbe defined the concept of natural hydrology to explain the interaction of climate and hydrology with vegetation and soil. In-depth study of this new field now forms a new scientific front in hydrology and ecology, and the results of research in this field will be important for understanding the differences between the global carbon cycle and climate.

Professor Rodriguez-Iturbe's passion for teaching is well-known, as it provides him with dynamic answers to problems. He is a well-known lecturer and author of many scientific articles and books.

In all of his work, the strongest motivation for him is to understand "How nature works".

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13

Prof. Peter A. Wilderer, Germany

The winner of the World Water Prize-2003 was Prof. Peter A. Wilderer from Germany. Wilderer set out to become an architect in his youth. But in real life things turned out very differently. Instead of designing buildings, prof. Wilderer spent his life in water management and for his outstanding work in this field he became the recipient of the Stockholm Water Prize-2003.

Professor Wilder, in his long-term study, firmly believes that water management can only be successful if the interrelationships between its ecological components, ecological and microbiological systems, and human activities are understood in detail. Professor Wilderer repeatedly demonstrated his ability to solve and define scientific problems in a variety of disciplines and developed a comprehensive and holistic approach to sustainable and integrated water management as well as wastewater management.

Peter A. Wilderer is a professor at the Technical University of Munich and also serves as director of the Institute for Advanced Studies on Sustainability. Professor Wilderer, a civil engineer, recognized the need to understand the various effects of human activity on the water cycle in the early 1970's. He brought together scientists working in various disciplines to solve the problems that have arisen and also with due interaction with society, industry, business and public bodies he showed that sustainable water management is possible only if the decision-making process is based on sound scientific foundations and appropriate technology.

An example of this is an international training program "Safe Blue Danube" on water-related risk management. The aim is to detect, prevent and develop appropriate measures to prevent catastrophic flood and accidental pollution in the River Danube, its tributaries, and the delta of Black Sea.

Professor Wilder's research is characterized by a rare combination of in-depth development of technology and in-depth study of the environment and the quality of human life. With the introduction of basic research into modern bio-film kilns, their contributions have made it possible to treat and dispose of wastewater from civic and industrial plants around the world safely and in everyday use.

He was one of the first researchers to question how sustainable it would be to exchange Western sanitary concepts with the rest of the world, focusing on large-scale centralized measures used in traditional methods in large cities. Thus, they quickly recognized the importance of decentralized small-scale efficient wastewater treatment and water reuse and encouraged it everywhere; as 95 percent of urban population growth will be in the fastest growing cities in developing countries.

Professor Wilder humbly states, "I am not a philosopher; but I think that in order to be able to survive, human societies must adapt to the adoption of new ideas. Also applies to all technical concepts, where it is necessary to adapt to local cultural requirements. For me, sustainability does not mean that we have enough oil for the next generation, but I mean that the next generation should be able to adapt to any future energy source."

Professor Wilder's earlier ambition to become an architect is still reflected in his work. Creativity and curiosity are two essentials in any way of life. "Even if you don't have the technical equipment or the expensive kits for analysis, you still have

them fully in your mind," says Professor Wilder." There is so much more to learn through the internet. However, the solution lies in the combination of individual creativity and ability. "

In the end, he says, such creativity is already there everywhere. For example, it would be helpful in finding out solutions to specific water problems that are faced by the developing countries.

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14

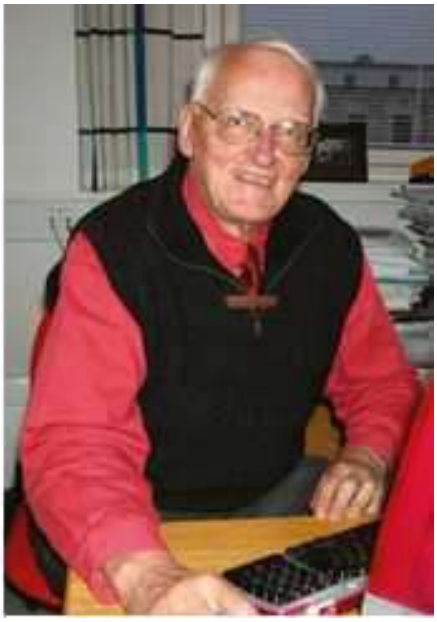
Prof. Sven Erik Jørgensen, Denmark and
William J. Mitsch, USA

Prof. Sven Eric Jorgensen of Denmark and Prof. William J. Mitsch of the United States had been the joint winner of Stockholm Water Prize-2004. Their work on how lakes and wetlands work has added to the world's knowledge. Prof. Jorgensen and Mitsch have made significant contributions to understanding as to how to better protect and nurture lakes and wetlands in the future and how to use them more efficiently for human use. Their work has been at the forefront of the development of environmental models of lakes and wetlands and has been recognized as an effective tool widely used globally in sustainable water resources management.

Sven Erik Jørgensen is a professor of environmental chemistry at the Danish University of Pharmaceutical Sciences in Copenhagen, and William J. Mitsch is a professor of natural resources and environmental science and director of the Olentangy River Wetland Research Park at The Ohio State University in Columbus.

Their theoretical research on ecosystems, lakes and groundwater quality management in lakes and wetlands, as well as protection, rehabilitation and use of lakes, rivers and wetlands has been accepted and practiced in both developing and developed countries.

The lakes have become a source of drinking water, hydropower, food, irrigation as well as recreation. But they are at risk of pollution and excess water uptake. Wetlands are important breeding grounds for biodiversity, providing water and primary productivity and on which numerous species of plants and animals depend for survival. Conservation of lakes and wetlands is a major need of life for people in many parts of the world, given their cultural, environmental and socio-economic value.



The concept of how work in lakes and wetlands should be sustainable is fine on paper, but it remains only a concept unless it is divided into activities managed by the right tools. Professor Jorgensen's unique ecosystem models provide an in-depth look at the entire lake and wetland system and the physical, biological and chemical interactions that occur between them.

Models of these types of systems provide concrete tools for managers and planners to solve problems and implement solutions. To this end, he and his colleagues developed modelling software for the United Nations Environment Program, which helps in planning and decision making for the management of lakes and wetlands in developing countries.

Today, more and more freshwater reservoirs are polluted by wastewater from domestic and industrial sources, which makes them eutrophic, where excessive algal growth results in severe changes of water quality and the ecology and overgrowth of algal there causes serious changes in water quality and the environment.

Software developed by Professor Jorgensen is an easy-to-use tool that helps to better understand the origins and effects of the eutrophication process, as well as preventive and curative measures.

Prof. Jorgensen and Mitsch, who are proponents of an environmental approach, have often collaborated with each other. The approach to the ecosystem recommended by them is a great strategy for integrated management of living resources on land as well as in water.

From their theoretical developments and practical applications in environmental engineering to "The creation of a sustainable ecosystem for the benefit of human society and its natural environment and both", they combined various existing ecological fields such as classical ecology, restoration ecology and agriculture.

Skills in this area are used to develop low-impact systems for waste processing, food and energy production, housing restoration and other benefits. As eminent writers, orators and pioneers in the field, Prof. Jorgensen and Prof. William Mitsch have directly or indirectly influenced and inspired many scientists and environmental engineers involved in the conservation of lakes and wetlands in all parts of the world.

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15

Centre for Science and Environment, New Delhi, India
(Under the Directorship of Sunita Narain)

The 2005 Stockholm Water Prize was awarded to Centre for Science and Environment, New Delhi, headed by Sunita Narayan. It highlights the growing challenges of water management in many regions of South Asia and the need for new approaches to provide local food and water security to diverse communities. The CSE, through its publications and the traditional systems of water management, advocates a new idea as to how it could become a starting point for eradicating rural poverty in many parts of the world, once it is revived.

Sunita Narayan says that improving the productivity of rain-fed and marginalized lands is a serious challenge facing the world. In this challenge, water can transform a large portion of the country's currently dry land into productive land, reducing poverty and increasing incomes where it is needed most. CSE has demonstrated through its work that local water management is a cost-effective business. More importantly, harvesting the rain water where it actually falls and local water management is important and can only be done through community participation.

CSE's work has highlighted that water cannot become the concern of everyone until there is a fundamental change in the way water is handled. While making the policy, one has to bear in mind that water management involving communities and families, must become the world's largest cooperative enterprise. For this, the organization has strongly argued that the prevailing mindset that 'water management is the sole responsibility of the government', should now be changed. This powerful concept is now gaining ground in policy and implementation in many areas of the world.

It is clear that in many parts of the world 'water scarcity' is not the problem but 'water management' is the real problem. CSE's work on rainwater harvesting has shown many innovative ways, through

which people have learned to live with water scarcity. That water is being used to recharge ground for irrigation and drinking water needs in millions of storage systems like tanks, ponds, step-wells and even roofs implemented in different regions in different ways.

The 2005 award recognized CSE's contribution to creating a water-literate society which values every drop of rain to create a water-wise world and inspires society to learn from the frugal habits of our ancestors. This movement has the potential to change the future of the world's water. Two books, published by CSE viz: “Dying Wisdom : Rise, Fall and Potential of India's Water Harvesting System” (1997) and “Making Water Everybody's Business” (2001), were eye-openers in the field of water management. They helped reinvent practical, traditional and cheap techniques in water management, helping to ease pressure on India's inefficient, centralized water systems.

But the work of CSE is not limited to water only. The organization has tackled issues ranging from global climate change to scrutiny of various Indian industries. It has always been their mission to check something on hard facts before announcing it. This philosophy has given the center great social standing and support for policy change in civil society, politics and the media. CSE uses media effectively to disseminate and support their information. CSE Center produces and publishes fortnightly and other effective educational materials like 'Down to Earth' along with several fortnightly and magazines. Their journals have become an important voice for scholars seeking hope and change.

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16

Prof. Asit K. Biswas - Mexico

Indian-origin Mexican Professor Asit K. Biswas was awarded the 2006 Stockholm Water Prize. While many hydrologists have contributed highly effective methods for rational use and management of water resources, Professor Asit K. Biswas created a socio-economic and political environment, which enabled effective conversion of scientific (both natural and social) and technological advances into meaningful solutions. His role as a global facilitator on an international platform where any organization or individual can take concrete action on water has been multifaceted.

While serving as Chief Scientific Adviser to the Secretary-General of the United Nations Water Council held in Mar-del-Plata, Argentina in 1977, Professor Biswas was instrumental in designing and promoting the campaign for the International Decade on Water Supply and Sanitation. After the UN General Assembly endorsed the initiative, Professor Biswas guided international and national organizations on what the Decade should look like. During this decade, visions of affordable technologies to serve those without access to improved water and sanitation services and how to engage them were developed. Professor Biswas, along with former UN Under-Secretary-General Dr. Peter Hansen, reviewed the work of all UN agencies for the Mar-del-Plata Conference and provided guidance on how to maximize the impact of all their water-related activities.

"My ultimate dream is that in my lifetime every citizen of the world will live in a water-safe world". He goes on to say that "This dream is not impossible but achievable. If we fail, as Shakespeare says in Julius Caesar, 'The fault, dear Brutus, is not in our planet, but in ourselves; because we are failing to work".

Believing that water is not a source of conflict but of cooperation, Professor Biswas chaired the Middle East Water

Commission from 1993 to 1997 in collaboration with the Sasakawa Peace Foundation. He brought together high-level personalities from most of the countries in the region for a face-to-face review and assessment of water issues. Many of the Commission's recommendations were based on existing agreements on water issues between these countries. Finally, Professor Biswas was inspired by the concern that the next generation of aspiring hydrologists were not being properly recognized at major international forums and initiated a new 3-year program in collaboration with the Nippon Foundation to select emerging hydrologists under the age of 40 to mentor and promote water development work.

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17
Prof. Perry L. McCarty, USA

The recipient of the 2007 Stockholm Water Prize was Prof. Perry L. McCarty of the USA. Sir Perry L. McCarty likes to think outside the box. But even so, he is always polite. Not only does he has a keen interest in septic tank activities, but he also has an unbridled passion for research and endless enthusiasm for constantly sticking behind the microscope to discover new things in the sustainable and healthy reuse of water resources.

Accepting the Stockholm Water Prize in 2007 from the King Carl Gustaf (XVI) of Sweden, he told the audience in his mild humorous style that the passions like his are not common among ordinary people. It should be taken rightly. Because, the pioneering work, that he is known for, in the design and operation of water and wastewater systems, is considered extraordinary.

His journey began at Stanford University nearly half a century ago, in 1962, when he entered the Ivy League that was working to develop environmental engineering and science programs. However, he did not confine his work only to the department of an educational institution, but extended it widely outside. Since starting his work at Stanford, Prof. McCarty's work has helped define the entire field of environmental biotechnology, which has become the basis for small-scale and large-scale pollution control and safe drinking water systems.

Prof. McCarty says of septic tank microbes “It's a community of organisms all working together that we need to study and learn more about. We certainly have a lot to learn about how to live together with each other's co-operation; maybe they can help us learn this better. We also have to adapt to the impending climate change and I am sure we will be able to do that successfully. If we all work together, I'm sure we can achieve it, just as the microbes in the septic tank have learned to do this together."

Author of over 300 publications and textbooks on biological processes used to control and eliminate environmental contaminants such as nitrogen and hazardous chemicals, Prof. McCarty's research has provided key insights into the movement and control of contaminants in groundwater and has opened new opportunities for water recycling and advanced wastewater treatment.

As an icon and active member of the academic and professional community, Prof. McCarty has held many positions in addition to his roles as a teacher and researcher. He has held various past and present positions, including chair of Stanford's Department of Civil and Environmental Engineering, director of the Western Region Hazardous Materials Research Centre, and stints at the National Academy of Engineering and the American Academy of Arts and Sciences. Before receiving the Stockholm Water Prize, he has been honoured with several other awards. These include the 'John and Alice Tyler' Prize for Environmental Achievement in 1992 and the 'Ashleigh Richardson Irwin Clarke' Award in 1997 for excellence in hydrology and technology.

His entire decorated career in engineering solutions is dedicated to the better use and protection of people and water resources, and it should be a lesson to all that we can't afford to waste water the way we do. Therefore, for this to change we must change our attitude towards these resources of ours which is very necessary.

What we call so-called 'wastewater' is not waste at all, but has great value to society, which we waste on a large scale. Achievements such as reduced pollution of groundwater resources and better application of scientific and natural process understanding, to which

Professor McCarthy's work has contributed greatly, provide countries with the ability to clean up and efficiently reuse these precious water resources.

Prof. McCarthy, while in Stockholm to receive the award, offered an advice to nations and scientists seeking sustainable solutions for generations to come. Never straying from his passionate love for the microscopic worlds that reside in sewage and the endless innovations discovered in microscopic organisms, he aspired for all to learn from this tiniest of sources.

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18
Prof. John Anthony Allen, England

Professor John Anthony Allen of King's College London and School of Oriental and African Studies was honoured with the Stockholm Water Prize-2008. Prof. Allen has taken a leading role in developing key concepts in understanding and explaining water issues and how they relate to agriculture, climate change, economics and politics.

People use water not only when they drink or bathe. In 1993, Prof. Allen, 71, introduced the new groundbreaking concept of "Virtual Water" and showed that there is an embedded water use in food and consumer products, in its commercial transport, that is measurable. For your morning cup of coffee, 140 litres of water is used to grow, pack and transport the coffee beans to market. This is roughly the amount of water an average person in England uses every day for drinking and domestic purposes. Americans use about 6,800 litres of virtual water per capita per day, which is three times the water consumption of a Chinese person.

Virtual waters continue to have a major impact on global trade policy and research. This, in particular, has redefined water policy and water management in water-scarce regions. It explains how and why nations like the US, Argentina and Brazil 'export' billions of litres of water every year, and others like Japan, Egypt and Italy import billions. From this, the concept of virtual water has opened doors to various opportunities for more productive water use. National, regional and global water and food security can be enhanced using this concept. For example, taking the production of water-intensive goods to regions where it is economically viable and trading them in regions where it is not. While studying water scarcity in the Middle-East, Professor Allen developed the theory of importing virtual water through food, as an alternative water "source", to reduce pressure on scarce domestic

water resources there and in other water-scarce regions.

The international nominating committee for the award wrote in its citation that "Prof. Tony Allen has been honoured with the Stockholm Water Prize for his unique, pioneering and long-standing work in academia and for raising international awareness of the interdisciplinary links between agricultural production, water use, economy and political processes." He introduced important new concepts such as “virtual water”, as well as the concept of “problematic” to emphasize that the most critical problems in the water sector are solved outside the water sector; energy is a major issue and, above all, understanding the political landscape of water science is the most important factor in the policy relationship that has led to innovative new research and action by both individuals, large organizations and social organizations. An improved understanding of trade and water management issues at the local, regional and global levels is most relevant to the successful and sustainable use of water resources".

As a scientist, educator and consultant, Prof. Allen has developed the knowledge and communication tools necessary for sustainable and efficient water resources management and policy. His research aims to provide a broad range of insights into environmental, economic, social and political theories of global water resources and how they can be made

sufficient to meet future population needs. Through their work, policymakers, scientists, water professionals and the general public are more aware of the role of water in the production of a wide variety of products and its impact on global trade and the economy. Virtual water has been a central and active component of scientific research and policy making, and has empowered individual consumers to influence water management on a global scale.

Thinkers who look beyond the box

Prof. Allen has developed the concept and terminology of "hydro-hegemony" and "problematic". This work has led to a better understanding of the different capacities and real conflicts in border regions such as the Nile River Basin, where water resources are shared between nations, as well as providing perspective on the economic and political processes that can enable food and water security for all such nations. He is an expert consultant on sustainable water development as well as countering population growth in developing countries, increasing food demand, institutional reform, valuing water, and balancing conflict resolution in the Middle East and North Africa region.

Prof. Alan has written or edited seven books and published more than 100 research papers in political science, natural resource management and interdisciplinary water journals. He has also educated over 1100 current and future water professionals. He has worked in the Middle East for over 35 years, working as a consultant on joint management of shared water resources in each of its basins. He has also edited the scientific journal 'Water Policy' and worked as a consultant for several nations, the World Bank and the European Union. His keen perception and scientific analysis have inspired new thinking on a wide range of water challenges. He has been described by many as one of the most influential thinkers in global waters today. In the year 2021 Prof. Tony Allen has passed away.

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19

Dr. Bindeshwar Pathak, India

As the founder of Sulabh International Social Service Organization, Dr. Bindeshwar Pathak is recognised worldwide for his extensive work in the field of sanitation in promoting public health, social progress, and human rights in India and other countries. His work in healthcare, education, sanitation technology, and social initiatives has been a boon to millions of people in India and is seen as a model for social organisations in public health initiatives worldwide.

Dr. Pathak has stated numerous times that providing clean toilets for the common man is one of civilization's most significant advances. Since founding the "Sulabh Swachhta Movement" in 1970, Dr. Pathak has been instrumental in changing the social attitudes towards unsanitary toilets in poor communities across India, in slums, rural areas, and densely populated cities. Through those efforts, he developed a cost-effective toilet system to improve the daily lives and health of millions of people. This also created an economic opportunity for the ex-sweepers and their families. He worked tirelessly to end the traditional practise of sanitation workers in India cleaning toilets by hand and carrying filth from the head with a bucket, all while ensuring the right to a decent standard of living and social dignity. Dr. Pathak's tireless effort is one of the most amazing examples of how one person's efforts can make a positive impact on the health of millions. Dr. Pathak's world leadership in achieving socio-environmental outcomes has been universally recognized.

The "Sulabh toilet" systems, like the twin pit and pour-flush systems he has developed, are now in use in more than 1.2 million households and buildings in India. This technology has been declared by the United Nations Habitat and the Centre for Human Settlements as the best technology in global use and recommended for use by more than 2.6 billion people worldwide.

Based on this public system providing accessible toilets and bathing facilities, 7500 such facilities have been constructed as of 2009, benefiting more than 10 million people every day. These pay-and-use public facilities provide economically sustainable, environmentally sound, and culturally acceptable solutions to sanitation problems in congested public spaces or slum communities.

Accessible toilet systems have introduced technology that minimises water consumption. A traditional toilet uses at least 10 litres of water. But a simple toilet requires only 1.5 litres of water to flush. This has significant additional benefits for health and quality of life in rural water-poor regions. Ecosystem-based and ecologically balanced businesses, such as aquaculture, that provide economic opportunities to rural poor communities are emerging from wastewater treatment programs. Technology is being used to convert the air produced from toilet faeces into biogas, which is used for cooking and generating electricity.

A self-described "action sociologist," Dr. Pathak has been at the forefront of social initiatives for decades. He has combined business best practises and principled activism to advance their work towards better sanitation, social change, and quality of life. In 1970, he founded the Sulabh International Social Service Organization, an NGO promoting sanitation and social change across India. As of 2009, more than 50,000 associate members were providing their voluntary services through Sulabh. The organisation has recently started operations in Bhutan and Afghanistan. In collaboration with UN Habitat, Sulabh has trained engineers, architects, planners, and administrators from 14 countries in Africa. Sulabh is now planning to start operations in Ethiopia, Cambodia, Laos, Angola, Madagascar, the Dominican Republic, Tajikistan, and other countries.

Through Sulabh, Dr. Pathak has done away with the decades-old practise of scooping human excreta by hand from simple toilets and carrying the filth on one's head, prevalent in most parts of India. The simple toilet concept was developed out of his concern for the plight of the untouchable scavengers and his eagerness to change this situation. Over the years, he has spearheaded several initiatives for social dignity, economic justice, and freedom from the caste-based system for the untouchable scavengers and their families. The Sulabh International Institute of Health and Hygiene, established by Dr. Pathak, has developed an effective health model by creating sanitation and health educators for urban slums and rural villages and leading them through NGOs and the government sector. In collaboration with other organizations, it has developed hygiene courses for young schoolchildren and their teachers, provided hygiene and health training for volunteer teachers in the slums, and opened basic health care centres for the urban poor in accessible community toilet complexes.

While working with the Indian Ministry of Environment and Forests, Dr. Pathak has established an accessible Environmental Information System Center for collecting and disseminating environmental information related to sanitation and wastewater processes for researchers, academicians, policy makers, and students.

Dr. Pathak first became aware of the plight of the scavengers in 1968, when he joined the Bhangi-Mukti Cell of the Bihar Gandhi Centennial Celebration Committee. During that time, he travelled across India as part of his Ph.D. research, living with the families of Bhangi workers, and decided to take social action based on that experience. Not only out of sympathy for the scavengers but also because of the inhumane practise of carrying manual excrement on the head, which would have a devastating effect on modern Indian society, he founded Sulabh International Social Service Organization in 1970, combining technological innovation with humanitarian principles and starting a unique movement from it.

Born in 1943 into a Brahmin family and brought up in the Indian state of Bihar, Dr. Bindeshwar Pathak studied at Patna University, where he did an MA in Sociology, an MA in English, and obtained a Ph.D. in the topic of "Liberation of Scavengers through Low-Cost Sanitation." He holds a Doctorate of Literature on "Sanitation and Environmental Sanitation Eradication in India: A Sociological Study." He lives on the "Sulabh campus" in New Delhi.

A great speaker Dr. Pathak has written extensively, and there are many books in his name. The most famous of them is "The Road to Freedom." He regularly and actively participates in global conferences on sanitation, health, and social progress around the world.

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20

Dr. Rita Colwell, America, USA

Dr. Rita Colwell, 76, is recognised as one of the most influential figures in water and health science and technology of this century. She has made an exceptional contribution to controlling the spread of cholera, a waterborne disease that infects 3 to 5 million people and causes about 1,20,000 deaths every year. Through her groundbreaking research, innovation, and decades of scientific pioneering work, she has defined our current understanding of the ecology of infectious diseases and developed the use of advanced technologies to prevent their spread. Their work has established the basis for environmental and infectious disease risk assessment that is widely used worldwide.

The Stockholm Water Prize Nomination Committee has mentioned in its citation that Dr. Rita Colwell's seminal contributions to solving water and water-related public health problems, particularly the work to prevent the spread of cholera, are of great global importance. Through research on physiology, ecology, and metabolism, Dr. Colwell further advanced the fields of mathematics, genetics, and remote sensing technology and is concerned not only with these bacteria but also with the prevention of other diseases in many developing countries.

In the 1960s, Dr. Colwell's research found that Vibrio cholerae, the causative agent of cholera, can survive in association with zooplankton. This led to the surprising discovery that some bacteria, including Vibrio species, can enter a dormant state and return to an infectious state when the nutrient conditions are favorable. This means that even when there is no disease outbreak, rivers, lakes and oceans can serve as breeding grounds for these bacteria. These findings overturned conventional wisdom and belief that cholera could only be transmitted from person to person, through the mixing of sewage with food or drinking water. As a result of their work, scientists are now able

to examine whether there is an underlying relationship between changes in the natural environment and the spread of disease.

Defining the new climate of disease prevention:

Dr. Colwell has shown how climate change, extreme weather events, changes in ocean circulation, and other environmental processes can create conditions conducive to the spread of infectious diseases, and in doing so, she has created the potential for early strategies to reduce outbreaks. Her research in the Bay of Bengal, Bangladesh, demonstrated that warmer sea surface temperatures promote the growth of cholera-infected zooplankton and thus increase the number of cholera cases. She was the first to lead research experiments in the US on the effects of El Nino on human health and the aquatic environment. In the 1990s, Dr. Colwell was the first scientist to research the spread of infectious diseases and the effects of climate change. She also serves as a senior government health advisor to the World Health Organization and dozens of other international organizations, as well as developing policies on climate change adaptation.

Saving lives with low-cost and high-tech innovations:

Throughout her career, Dr. Colwell has worked at the forefront of science and technology, dedicating her life to creating practical solutions to provide clean drinking water and protect human and environmental health. She has been instrumental in developing and leading the curriculum in bioinformatics, which combines biology, computer science, and information technology. This has led to rapid

advances in the understanding, diagnosis, treatment, and prevention of many genetic diseases. She has also pioneered the adoption of remote sensing technology to track the spread of diseases globally. Dr. Colwell developed the first remote satellite imaging model to track and predict cholera outbreaks before they occur. This model has become a model for infectious disease surveillance and prevention used worldwide.

Lifelong Scientific Leadership :

Dr. Colwell was born in 1934 in Beverly, Massachusetts, USA. She has authored 17 books and covered 700 scientific topics. Dr. Colwell has worked extensively for many years in communities across South Asia and Africa, promoting community-based water security education and the dissemination of viable and cost-effective technological innovations. In the 1990s, during the cholera epidemic in Latin and South America, Dr. Colwell served as a national advisor to several countries. Her research into Vibrio cholera in hospitals and the shrimp industry in Ecuador saved countless lives. She was honoured by the national government of Peru for her work in developing drinking water standards and helping to formulate guidelines to prevent the spread of disease.

Dr. Colwell has held a number of advisory positions at US non-profit science-policy organizations, private organizations, and international scientific research communities. From 1998 to 2004, she was appointed by President Bill Clinton as the first woman to serve as director of the National Science Institute. She was inducted into the United States National Academy of Sciences in the year 2000. A passionate teacher, Dr. Colwell has special interests in elementary and high school science, mathematics, graduate science, and engineering education, as well as increasing the participation of women and minorities in science and engineering.

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21

Prof. Stephen R. Carpenter, USA

Prof. Stephen Carpenter of the USA was awarded the 2011 Stockholm Water Prize for his groundbreaking research on how lake ecosystems are affected by the surrounding terrain and human activities and what concrete measures should be implemented in managing lakes.

Prof. Carpenter, 59, is recognized as one of the world's most influential environmental scientists in the field of environment. He has reshaped our understanding of how humans and the surrounding landscape affect freshwater lake ecosystems by combining experiments and theoretical models from extensive research on lakes.

Stockholm Water Awards Nomination Committee, led by Prof. Carpenter, has placed more emphasis on the importance of Carpenter's contribution, which helps us understand how the discharge of nutrients from wastewater, fishing, and alien species affect these lakes. The Stockholm Water Awards Nomination Committee further states that Prof. Carpenter has demonstrated outstanding leadership in guiding environmental research, integrating it from a socio-ecological perspective, and providing guidance in aquatic resource management work.

Establishing the relationship between lake and land:

Prof. Carpenter is best known for his research on 'tropic cascades' in lakes, a concept that explains how impacts on any species in an ecosystem cascade down or up the food chain. For example, overfishing of large fish in a lake may result in the growth of smaller fish, thus reducing the abundance of immature animals (zooplankton) further down the food chain. This expansion increases the growth of algae and the effect of the decomposition process.

Those findings have influenced concrete policies to deal with the erosion process and have provided a practical framework for the

management of freshwater resources. It is pointed out that to overcome the resulting problems, it is necessary to understand that reducing the nutrient discharge to the lake is not enough and may also require changing the composition of the fish community. Apart from this, Prof. Carpenter's research has shown it to be broadly applicable to ecosystems other than lakes.

Learning by doing, leading by example:

Known among his peers in the scientific community for his creativity and enthusiasm, Prof. Carpenter's work combines various scientific disciplines and approaches. He has succeeded in bridging research with both policy and practice by collaborating with institutions outside his academy. Prof. Carpenter is an inspiration to people in his field and beyond. He has mentored numerous students over the years and helped many develop research experiments in innovative areas.

After hearing the news of the award, Prof. Carpenter said, he was thrilled to hear that, and he further says, that this award would increase his determination and sense of duty to work on emerging freshwater issues, such as the intrinsic link between climate change and food and water security.

Born in 1952, Prof. Carpenter lives in Madison, Wisconsin. He holds a Ph.D. in Botany / Oceanography, and Limnology from the University of Wisconsin-Madison. Prof. Carpenter serves as director of the Limnology Center and Stephen Alfred Forbes Professor of Zoology at the University of Wisconsin-Madison. He is a member of the National Academy of Sciences and a fellow of the American Academy of Arts and Sciences. He has played a leading role in the Millennium Assessment.

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22
International Water Management Institute, Sri Lanka

The International Water Management Institute (IWMI), a leading organization working on water, is headquartered in Colombo, Sri Lanka. The 2012 Stockholm Water Prize was awarded to this organisation for its significant research work in developing countries to improve agricultural water management, increase food security, protect environmental health, and alleviate poverty.

Seventy percent of the worlds freshwater is used for agriculture. As global food demand is projected to double by the middle of this century, more and more food will need to be grown with less water. IWMI is a driving force in promoting policies and technologies that help farmers achieve 'more yield per drop' and implement measures that enable agriculture to grow enough food for a growing world population with limited water resources.

The Stockholm Water Prize Nomination Committee said in its citation that the International Water Management Organization is a leading organization in agricultural water management. Its work has led to new policies and investments in agriculture. This has not only made water use more productive and efficient but has also improved food security, economic development, and environmental soundness around the world.

After receiving the Stockholm Water Prize, Dr. Colin Chartres, who is the Director General of the IWMI, said it was an incredible honour for his organisation. The real winners, of course, are the dedicated staff of IWMI, which has consistently provided the highest quality research space for just over half a century. This work has had a profound impact on water management policy worldwide, with real benefits for the poor.

Over the past quarter century, IWMI has established itself as a trusted source for comprehensive resources and knowledge on global

water resources. From 2002–2007, IWMI led a team of 700 scientists for a global programme of cutting-edge research in water management. The subsequent publications 'Water for Food' and 'Water for Life: A Comprehensive Assessment of Water Management in Agriculture' established an unprecedented knowledge base on the state of global water and land resources and were one of the most influential studies on water and agricultural policy ever produced. By providing clear evidence of where and how water scarcity has increased and its impact on all sectors of the economy, the report's findings have positioned sustainable water resource management as a priority issue for governments, industry, and international organisations around the world.

The organization's extensive work with irrigation sector reforms has paved the way for new and improved design, operation and maintenance of irrigation systems throughout Asia and Africa. IWMI has helped create the current international guidelines on how to safely use wastewater in agriculture. This method is used by millions of farmers worldwide. IWMI is leading innovations in developing ideal business systems to attract investment in wastewater recycling systems that can benefit rural communities in developing regions.

Mapping the World's Water Resources:

IWMI's advances in the application of remote sensing and analysis in geographic information systems have significantly improved the ability to measure water availability and efficiency, directly enabling farmers around the world to better manage agricultural water resources. IWMI's Water Data Portal and global mapping of water scarcity, irrigation use, environmental flows and drought patterns are among the most important sources of information in the field of hydrology. More than one lakh publications are downloaded from the IWMI website every month and are widely read in leading electronic media worldwide.

This work has also led to the creation of a water accounting system that can determine the amount of potentially usable water in a basin, assess where the water is going, and determine the actual cost of water per cubic metre. This tool is widely used by planners to determine where water can be saved and how it can be used most effectively.

A 2011 publication, 'An Ecosystem Services Approach to Water and Food Security' led by IWMI and the United Nations Environment Program, outlined how 'ecosystem-based' natural systems for agriculture could potentially double agricultural production. Sustained work in this area can lead to a radical change in agriculture in the future to ensure food security for a global population that will reach 9 billion by 2050.

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23

Dr. Peter Morgan, Zimbabwe

Zimbabwe's Dr. Peter Morgan was fortunate enough to receive the 2013 Stockholm Water Prize. In the last four decades, Dr. Morgan's work has led to the discovery of cost-effective, practical, and advanced solutions for making the water used by millions of people around the world cleaner and safer. As a result, countless global communities now experience safer water, a cleaner environment, and an improved quality of life as a result of his pioneering work in developing practical water and sanitation technologies for those most in need.

The Stockholm Water Prize Committee states in its citation that “many existing solutions to providing clean water and sanitation are unaffordable, impractical, and beyond the reach of the world's poorest people.

Today, more than 7.8 billion people lack access to safe water, and 2.5 billion lack adequate sanitation facilities. More than 5,000 people die every day due to unsafe water, unsanitary conditions, and the diseases they cause.

Dr. Morgan is admired as a world-class researcher on clean and safe water and also for health-related sanitation issues. He has invented a wide range of simple, smart, and low-cost water and sanitation technologies. Several of his major innovations, including the "B" type bush pump and the Blair Ventilated Improved Pit (VIP) latrine, have been adopted as national standards by the Zimbabwean government. There have been a large number of Blair toilets built for both families and schools, and millions of people in Zimbabwe alone have received this service. Many more such toilets have also been built around the world. Dr. Morgan also introduced the concept of the 'improved family well', whereby families could support themselves on their own. The concept now helps half a million people improve the quality of water they get from conventional wells.

Dr. Morgan is strongly committed to empowering local communities to develop their own solutions to their problems and to sustainably run them to become self-sufficient communities. He has developed extensive training and educational materials for each type of technology they produce, enabling local professionals to install, maintain, and, if necessary, modify those systems. E.g., the Blair VIP toilet has been redesigned so that it can be upgraded in stages as the need or opportunity arises. Today in Zimbabwe, various forms of Blair VIP, "B" type bush pumps, and community awards for improved wells have become the backbone of rural water and sanitation programmes.

Dr. Morgan is also known as a leading developer and proponent of environmental sanitation solutions that enable the safe recycling of human excreta and waste to increase soil quality and crop yields. Its 'Eco-San' toilets are now in use in many countries around the world, with the focus now on turning a sanitation problem into a productive resource. A lot of work has been done by schools in this regard.

Dr. Morgan says, "Great strides have been made in providing safe water and sanitation to people around the world. Yet millions of people still lack access to these facilities. This prestigious award recognises my role in protecting and improving the supply and conservation of water, which is our most precious resource, and encourages me to be more prompt in implementing and making these sanitation services reach more people".

Dr. Morgan currently serves as the Director of 'Aquamore', a non-profit company working in the rural water supply and sanitation sector in Zimbabwe. He has previously served as Chief Research Officer and Acting Director of the Blair Research Laboratory and as a consultant to the Ministry of Health in Zimbabwe. Throughout his career, Dr. Morgan freely shares the designs and innovations he creates and makes

sure that the local communities in which they are used can implement and improve them themselves.

A great and highly respected scientist Dr. Morgan is the author of over 100 published research papers. He previously served as president of the Zimbabwe Scientific Association and editor of Zimbabwe Science News. He works as a consultant on rural water supply and sanitation programmes in countries across Africa, such as Botswana, Ethiopia, Kenya, Malawi, Mozambique, Namibia, Tanzania, South Africa, Sudan, Uganda, and Zambia. Dr. Morgan has received numerous awards and honours, including several international research awards like the Amkav AfrikaSan' award for technological innovation in sanitation and the "Rural Water Supply Network Award' for lifetime service to rural water supply.

Born in 1943 in Wellingborough, United Kingdom, Dr. Morgan is a naturalised citizen of Zimbabwe. He holds a Ph.D. in marine biology from the University of Hull and was awarded a Member of the Most Excellent Order of the British Empire in 1991.

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24

Prof. John Briscoe, South Africa

South African-born Professor John Briscoe, driven by an unwavering commitment to improving people's lives, was honoured with the 2014 Stockholm Water Prize for his outstanding contributions to global and local water management. Prof. John Briscoe currently lives in the US and is a Distinguished Professor at Harvard University.

The Stockholm Water Prize Committee said in its citation that Prof. John Briscoe combines world-class research and policy implementation approaches with an integrated approach to water resources development and management, as well as improving access to safe drinking water and sanitation.

Today's world is beset by daunting water challenges, threatening human water security and biodiversity. At the same time, the global demand for water is increasing, and droughts and floods are causing deadly disasters. These challenges cannot be met alone. Prof. Briscoe's keen intelligence is reflected in his fusion of science, policy, and implementation practises, which has given him unparalleled insight into how water should be managed to improve the lives of people around the world.

In the mid-1970s, Prof. Briscoe moved to a small village in Bangladesh and learned how infrastructure to protect against floods and droughts can transform the lives of the poor. He keenly realised that you can only be a credible policymaker if you can help solve the fundamental problems of building infrastructure and running it, and later in the late 1970s, Prof. Briscoe took up a specialist role as an engineer in the government of the newly independent Mozambique.

Commenting on the honour, Prof. John Briscoe says, "Practitioners of their ideologies are delighted to be recognised by this award. Ultimately, what actually happens on the ground is more important. It should be rigorously tested to see if the policies are

actually making a difference. I believe it is because of the years I spent working at the micro level that I was able to become an effective policy maker".

Prof. Briscoe's many achievements include the 2003 water policy designed for the World Bank. This water policy has set a new creative and sustainable standard for global understanding of the need for both good infrastructure and developed institutions. The policy has had far-reaching implications beyond the watershed, ensuring that developing and emerging countries have a strong voice in global governance.

Prof. Briscoe brought his high-level policy experience to Brazil in 2005 as Country Director to the World Bank. Brazil was one of the largest creditors of the World Bank. Prof. John Briscoe's contribution to bridging the gap between good environmental management and the economic goals of development in the Amazon and other rapidly developing nations has been commendable.

Professor Briscoe is known for his passionate commitment to sustainable economic development, his outspoken stance on building walls of inequality, and his insistence on raising the voices of those affected, from poor farmers to the private sector to the political sphere.

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25

Dr. Rajendra Singh, India

India's Dr. Rajendra Singh was honored with the 2015 Stockholm Water Prize for his innovative efforts in water conservation and extraordinary determination to ensure water security and improve the livelihoods of people in rural areas.

Born in 1959, Mr. Rajendra Singh lives in the predominantly arid state of Rajasthan, India. He dedicated his life to the task of overcoming drought and empowering the local community for decades. With tireless work and the cooperation of local residents, he and his organization revived many rivers. Those efforts restored water and life to a thousand villages, giving countless people a new lease of life. Using the Indian traditional wisdom of water recharge, helpless, neglected, and poor villages have been revived.

The Stockholm Water Prize Committee, in its citation, states that "Today's water problems cannot be solved by science or technology alone. They are actually human problems and shortcomings in governance, policy, leadership, and social resilience. Shri Rajendra Singh has dedicated his life to solving local water problems and building the necessary social capacity for them through participatory action, empowerment of women, integration of indigenous knowledge with modern scientific and technological approaches, and judicious use of resources following development traditions and social norms."

Mr. Singh always tells the locals that, whenever we see the demand for fresh water multiplying many folds, if we don't learn how to take better care of our water, we will face a severe water crisis within decades. He has become a ray of hope there. He literally brought hundreds of villages to life. If we want to create water sustainability, we need to take lessons from Mr. Singh and act accordingly, says Mr. Torgani Holmgren, Executive Director, SIWI.

Dr. Rajendra Singh's work shows that he is a true humanitarian and a firm believer in empowerment. After studying Ayurvedic medicine and surgery, he moved to the largely impoverished rural areas of Rajasthan in the mid-1980s with the aim of actually setting up clinics to provide health care. But the villagers reminded him that the biggest need there is not healthcare but water. Its wells had dried up, crops withered, and rivers and forests were disappearing. Their villages were covered with sand and dust. Many young villagers had left for the cities in search of work, leaving behind women, children, and the elderly.

After that, Rajendra Singh did not insist on setting up a hospital there. Instead, he undertook an extensive program of construction of Johad, or traditional mud dams, through labor with the help of villagers. Within two decades of his arrival, 8,600 johads and other reservoirs were built for water. A thousand villages across the state got water through these efforts. Thanks to the efforts of Mr. Singh and his colleagues in 'Tarun Bharat Sangh', which he founded, many rivers in Rajasthan were revived through this organization. As forest cover began to grow over the region, animals like deer and leopards began to return to the area. Dr.Singh modernized the thousands of years-old traditional Indian practices of rainwater harvesting and storage. These practices were thrown out of use during British colonial rule. But this man, who is regarded as India's water man, and his colleagues have managed to bring water back to the most arid regions of the world's most populous region, like Rajasthan.

Dr. Rajendrasinh says, "When we started our work, we were only looking at the drinking water crisis and how to solve it. Today, our mission has expanded. This is the 21st century, and it is considered the century of exploitation, pollution, and encroachment. To put an end to all this, to transform the shadow of war on water into peace, has now become the mission of my life". He adds that now, due to rainwater harvesting and groundwater recharge, our area is no longer prone to drought or floods. Our work is a way to solve both floods and droughts globally. So the impact of this work is local, national, international, and beyond. We think it will be more important at the village level."

Climate change is changing weather patterns around the world and causing more frequent extreme droughts or floods. Learning how to harvest rainwater and use snow-capped mountain peaks to fill valleys would be a key skill in most parts of the world. Some of the world's leading scientists are currently focusing on how to manage rainfall and how to develop an information base for it. To reduce the risk of drought and floods, it is necessary to learn more about rainfall management and recharge.

Dr. Rajendra Singh was presented with the Stockholm Water Prize during World Water Week on August 26, 2015, by King Carl Gustaf XVI of Sweden in a special ceremony for his great work.

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26
Prof. Joan Rose, USA

Prof. Joan Rose of the US was awarded the 2016 Stockholm Water Prize for her tireless contributions to global public health. She has been heavily involved in assessing water-related human health issues and developing guidelines and tools for decision-makers and communities involved in improving global health.

Prof. Joan Rose is the head of the 'Homer Nolin Chair' for Water Research at Michigan State University. She has dedicated her professional life to water quality and public health safety. She is regarded as a world-class authority on aquatic microbiology.

In its citation, the Stockholm Water Prize Nomination Committee stated, "The interrelationship of water microbiology, water quality, and public health, theoretically and practically, is fraught with uncertainty. The world is blessed with a few individuals who can meet the growing and changing challenges of clean water and health. Starting from cutting-edge science through dedicated and original research, then moving to professional dissemination, effectively reaching the legislatures, influencing practitioners, and raising social awareness, their work has made great progress. Mrs. Joan Rose is a shining example of a very rare talent in this field.

Prof. Joan Rose says that the prize has drawn attention to the most important issues related to water and water quality in the 21st century. She was always inspired by the principles of public health and how to prevent diseases. A key weak link is that our water infrastructure is crumbling or nonexistent in many parts of the world. The global population without access to wastewater treatment facilities is estimated to be in the billions.

It is estimated that about 1000 children under the age of five die every day from diarrheal diseases, which are a leading cause of child mortality. However, it is only one of the diseases caused by poor water

quality. There are more than two billion people in the world who lack adequate sanitation, and over one billion do not have access to safe drinking water. The World Health Organization says that 8.42 lakh deaths from diarrheal diseases every year could be prevented with access to clean and safe water, sanitation, and hygiene facilities. We need to develop a global water curriculum to educate the next generation of problem solvers, said Prof. Joan Rose.

Prof. Joan Rose has since long begun her quest to secure the health of the entire human community, and she has not stopped there. She expanded that work to ensure that water also supports health in aquatic ecosystems. Prof. Rose has provided dedicated leadership to make this world a better place for humans and other species to share.

Cryptosporidium is a parasitic microorganism that lives in the intestines and exists in both humans and animals. Prof. Rose is a keen scholar of this microorganism and is recognized as the world's foremost authority on the subject. These microorganisms cannot be killed by chlorine and can survive in the host's body for several months, even becoming fatal in severe cases. Prof. Rose and her team, whom she calls ''water-spies,'' investigate outbreaks of waterborne diseases globally to determine how they can be prevented or stopped. In 1988, she was the first to identify the widespread occurrence of Cryptosporidium in water

supplies.

In the drinking water standards established by the World Health Organization in 2004, Prof. Rose's work was important, having a positive impact on countries around the world. She also worked in Malawi and Kenya to help translate this standard into local regulations. She was requested to take the lead in assisting Member States in meeting the goals of resource management and capacity building under UNESCO's International Hydrology Programme. She chaired a specialist group on international water cooperation, through which it was ensured that countries around the world understood the latest engineering standards at the state and national level and incorporated those principles into their country's implementation.

Her expertise in identifying and prioritizing water quality issues facilitated the legal implementation of the Great Lakes Water Quality Agreement. She chairs the Singapore Water Audit Panel of the influential Public Utilities Board and is also a consultant to government water departments in both Canada and Korea. She also established the Global Aquatic Pathogens Project, which has the online participation of 140 water-related scientists.

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27
Prof. Stephen McCaffrey, USA

Prof. Stephen McCaffrey of the USA was awarded the 2017 Stockholm Water Prize for his outstanding contribution to the development of international water law. Prof. Stephen McCaffrey is an Adjunct Professor of Law at the McGeorge School of Law at the University of the Pacific in Sacramento, California. He is considered to be the only and most respected authority figure in this field who is globally recognized. His work has had a major impact on scholars, jurists, and policymakers and has greatly contributed to the sustainable and peaceful management of shared waters across countries.

In its citation, the Stockholm Water Prize Nominating Committee described Professor McCaffrey as "a strong directional leader and scholarly figure in international maritime law". He has made unique contributions in three specific areas, including his seminal work on treaty negotiations in two countries. His many scholarly works, including his book on International Watercourses Law, profound leadership, being a wise expert legal advisor, and training in complex negotiations with various stakeholders are included.

Prof. McCaffrey serves as legal counsel in negotiations related to interstate shared water resources. He has acted as counsel in interstate disputes between several countries over shared water resources. For example, Argentina and Uruguay, India and Pakistan, Slovakia, and Hungary have been heard by international courts and tribunals.

He has provided legal guidance in many protracted inter-country negotiation processes regarding transboundary reservoirs or rivers. For example, the Nile and Mekong rivers flow through many countries. Despite first-hand experience of potential conflict over freshwater resources, he remains optimistic and often points to studies showing that freshwater is more of a catalyst for cooperation than conflict.

Prof. McCaffrey has worked as a special correspondent of the United Nations for the International Law Commission. As a result of McCaffrey's effective diplomacy, the 1997 United Nations Conference on Bilateral Agreements on the Non-Traffic Use of International Watercourses led to the adoption of his draft, whose principles are today the basis for adjudicating international water disputes and planning long-term management in countries sharing international waters.

For studies, research, or professionals in the field of maritime law or diplomacy, no one today can be unaware of McCaffrey's contribution to the conceptual and practical elaboration of many legal concepts and principles.

Earlier, Professor McCaffrey's prolific writings presented important views on the human right to water, which was later recognized by the United Nations General Assembly in 2010 as a fundamental human right. In addition, he has provided important insights from his work over the years in the areas of policy coherence of water laws, conflict resolution, benefit sharing, and environmental protection.

Prof. McCaffrey says one of the most pressing challenges facing the international community in the 21st century is implementing this right in both developing and developed countries. Prof. McCaffrey adds, "Nearly 40 percent of the world's population lives in river basins shared by many countries. Alleviating this increasing stress on water

resources globally requires fair and equitable use of trans-boundary waters, with good management of these waters reducing the potential for conflict, promoting socio-economic development, promoting shared benefits, and supporting healthy ecosystems and services."

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28

Prof. Bruce Rittmann, USA and
Mark Van Loosdrecht, Netherlands

Prof. Bruce Rittman, USA and Marc van Loosdrecht, Netherlands were awarded the 2018 Stockholm Water Prize for revolutionizing water and wastewater processes. Their pioneering microbiology-based technology has led to a new class of energy-efficient water treatment technologies that are being implemented worldwide.

Their innovative microbiological water treatment not only removes harmful contaminants from wastewater, it also reduces treatment costs and energy consumption, while also recovering its chemicals and nutrients for reuse.

Mark van Loosdrecht is Professor of Environmental Biotechnology at Delft University of Technology, The Netherlands. Bruce Rittman is Regents Professor of Environmental Engineering and Director of the Biodesign Sweat Center for Environmental Biotechnology at the Biodesign Institute, Arizona State University, USA.

In their citation, the Stockholm Water Awards Nomination Committee Prof. Rittman and van Loosdrecht have been honored for "pioneering the development of environmental biotechnology-based processes for water and wastewater treatment. They have revolutionized the safe treatment of drinking water and developed minimal electricity consumption techniques for treatment processes that involve the release or reuse of polluted water".

Prof. Loosdrecht says the award recognizes not only his work but also the contribution of microbiological engineering to the water sector. He adds that he actually only thought of doing something to get rid of the pollutants. But now they are looking at them as potential resources, which are misplaced.

Prof. Rittman has an intensive study of how microorganisms can transform organic pollutants into valuable products for humans and the

environment, and is increasingly focusing on how microbial systems can be used to generate resources.

Prof. Van Loosdrecht's work is responsive and consistent with Prof. Rittman's studies. His research has led to the widespread adoption of wastewater treatment processes that are less expensive and more energy efficient than traditional methods. "There is an overall trend towards energy neutrality with current technology. There is a lot of research on how to be energy positive. It is important to note that especially in developing countries where electricity supply is unstable and funding availability is limited. If we want to be self-sufficient with energy generation, if we can build sewage plants, it will be possible to start such sewage plants in many places", says Prof. Loosdrecht.

Together Professor Rittman and van Loosdrecht are leading work on the path to providing clean and safe water for humans, industry and ecosystems, bringing to light important aspects of one of the most challenging human activities on Earth.

Prof. Bruce Rittman and Mark van Loosdrecht say that we are currently in the middle of all these changes and are increasingly focusing on how to generate resources using microbial water treatment systems.

Prof. Rittman has written over 650 rigorously peer-reviewed scientific research papers. He has also co-authored textbooks on Environmental Biotechnology with Stockholm Water Prize winner Prof. Perry McCarty. He is the inventor of the membrane biofilm reactor, a

commercially available technology that uses naturally occurring microorganisms to remove contaminants such as perchlorate and trichloroethene from water.

Prof. Rittman has received many awards during his career. These include being elected as a Fellow of the International Water Association, the National Academy of Inventors, and the American Association for the Advancement of Science. He is a distinguished member of the National Academy of Engineering and the American Society of Civil Engineers.

Prof. van Loosdrecht's research has been instrumental in developing the Anammox and Nereda technologies for wastewater treatment. The anammox process is a resource-efficient way to remove nitrogen from wastewater, leading to an energy-generating process.

Nereda technology is based on bacterial granulation, thereby providing a cheap and simple urban wastewater treatment. The Nereda plant is significantly smaller and energy efficient (up to 50%) than conventional plants. In addition, the recovery of high-performance biopolymers from sewage sludge can further contribute to the circular economy.

Prof. van Loosdrecht has received several awards including the 2014 Spinoza Prize and the 2012 Lee Kuan Yew Award. He is the Editor-in-Chief of the scientific journal 'Water Research' and a member of the Royal Netherlands Academy of Arts and Sciences and the Dutch and USA National Academies of Sciences.

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Prof. Dr.Jackie King, South Africa

Dr. Jackie King of South Africa was awarded the 2019 Stockholm Water Prize for her global contributions that have radically changed river-management. She has developed a more precise scientific understanding of river flows by providing decision-makers with the tools and methods necessary to make a thorough assessment of the costs and benefits of managing or developing river systems.

Dr. King began her method development work as a researcher at the University of Cape Town, funded by the South African Water Research Commission. Later, she and her colleague Dr. Kate Brown and Dr. Alison Joubert further developed those methods to create ecosystem models to demonstrate the ecological and social consequences of damming rivers and the consequent reduction of water in rivers. This has enabled an objective assessment of the negative impacts and associated costs on aspects of water-resource development such as hydropower schemes and irrigated crops.

Humble and energetic, Dr. Jackie King has never sought high-profile jobs. She was more interested in working as a scientist and was free to tell the world what she felt needed to be said about river degradation. She was more than happy to hear clearly the silent voices of the river-system and the people who depended on it. If we pursue ill-informed development and management, the rivers will deteriorate rapidly and we will all lose out, she says.

Dr. King's commitment, to raise awareness about the value and importance of rivers to millions of people, has earned her a highly respected position among academics and water managers globally. Her scientific rigour, selfless dedication and effective enlightenment have transformed the whole way of thinking, talking and working about the flow of life and water.

Dr. King's early work greatly influenced South Africa's 1998 National Water Act. She is now guiding governments and organizations around the world more. First as a researcher and later as a consultant, she has worked in more than 20 countries and administrations of the Mekong, Zambezi, Indus and Okavango river basins among others.

Dr. King explains that every government has the right to determine its own path of development. It convinces administrators in decision making that healthy river ecosystems are not a luxury but a basis for sustainable development. She helps in effectively evaluating various options by providing them with transparent and useful information.

Dr Jackie King says, "Governments involved in water resource development realize the potential benefits, but do not realize the costs involved in improving degraded rivers. Now we can show all these environmental and social costs in the same way as the benefits planners show. There is a new type of information, which was not available until a few years ago, that helps the rulers to understand the many good and bad aspects involved in development in making future planning decisions".

Dr. King was the co-founder and principal researcher of the Department of Freshwater Research at the University of Cape Town for nearly four decades. She now works independently as an Emeritus

Professor and Consultant at the Institute for Water Studies, University of the Western Cape. Her achievements as an aquatic ecologist have been impressive in the recently established field of environmental flows.

Dr. King has been awarded gold and silver medals by the South African Society of Aquatic Scientists for her work. She has also been honoured with South Africa's “Women in Water” award for her research work. She is also the recipient of South Africa's “Living Planet Award” in 2016. She participated in the educational programs of preparing several textbooks. She has published more than 100 research articles in international journals and conferences.

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30
Dr. John Cherry, Canada

Dr. John Cherry of Canada was awarded the 2020 Stockholm Water Prize for his research into groundwater vulnerability, which has revolutionized our understanding of groundwater. His research has raised awareness of how groundwater pollution is increasing around the world and has led to new and more efficient ways to combat the problem.

The Stockholm International Water Prize Nominating Committee said in its citation: “The Stockholm Water Prize is awarded to Dr. John Cherry for his contributions to science, education, implementation and his passionate and highly effective advocacy for groundwater. Science forums that inform current and future policies, legislation and public deliberation should be established by every government to protect this most essential and yet most threatened resource, water".

Dr. John Cherry is a world-renowned hydro-geologist and is considered an authority on the dangers of groundwater contamination. As the creator of the academic discipline of Contaminant Geologist, he changed the scientific paradigm in groundwater research by showing how chemicals and wastes mix with groundwater.

Dr. Cherry has pioneered thorough his systematic research by providing measurement tools and insight into groundwater flow processes. Through their comprehensive field experiments, they have developed new ways to monitor, control and clean up contaminated groundwater.

Dr Cherry says "Groundwater is also becoming more and more important for humans. Although more attention is being paid to the global water crisis today, it is often forgotten that 99 % of the liquid fresh water on Earth is in the form of groundwater. Many people still think of it as pure, but, in fact, it is threatened by human activities. Today, nearly half of the world's population consumes groundwater. In the next few years, when our planet will have an additional two or three

billion inhabitant, most of them will depend on groundwater. We urgently need to raise awareness about the importance of groundwater which is essential for ecological balance, which sustains everything like rivers, lakes, wetlands, etc".

Dr. John Cherry's 1979 textbook on groundwater, co-authored with RA Freeze, provided many students with a better understanding of groundwater. Making groundwater knowledge freely available to students and practitioners has always been close to his heart. For this he started an innovative ground water project in 2020. Dr. Cherry, along with other leading groundwater scientists, was instrumental in creating a comprehensive resource forum, in which all materials are freely available.

Dr. Cherry has made us aware of how dependent we are on groundwater and how it is at risk of extreme contamination. He has made invaluable contributions to our understanding of how we can protect this groundwater from threats.

Dr. Cherry is an Adjunct Professor at the University of Guelph, Canada. He is director of the University's Consortium for Area-Based Groundwater Research and Associate Director of G360, an organization for groundwater research. He is also Emeritus Professor of the University of Waterloo.

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31
Mrs.Sandra Postel, USA

Mrs. Sandra Postel of America was awarded the Stockholm Water Prize-2021 for her groundbreaking work in the water sector, which has changed the point of view of many people towards water. She was the first to warn of the impending global water crisis and call for the conservation of water-based ecosystems. Today, her work inspires those involved in the decision-making process to find innovative solutions to stop water scarcity, climate change and biodiversity loss.

Sandra Postel is considered a leading authority on international water issues. In 1992, she published the book 'Last Oasis: Facing Water Scarcity' on the global water crisis. Its revolutionary message sparked new discussions and debates about threats to freshwater resources. The book was published in eight languages and later turned into a television documentary. Postel has written extensively, publishing more than 100 articles and research papers for scientific and popular publications.

Mrs. Sandra Postel is recognized as a global authority on water scarcity. It is rare to find individuals with such commitment, ability, courage and tenacity in solving far-reaching and critical water problems affecting human and natural ecosystems. She is a pioneer in water communication and knowledge sharing. She worked tirelessly to raise awareness of global water issues and draw attention to the human impact on the water cycle. Her work has been instrumental in changing public and professional awareness of the water crisis.

Many of the warnings she gave about 30 years ago are unfortunately being faced today; water scarcity is spreading, food security is increasingly threatened, freshwater fauna is disappearing, and water-related disasters are increasing in number and severity. However, as this happens there is a growing public understanding of how these issues are interconnected. Sandra Postel has played an

important role in bringing about these changes in society.

One of her main ideas is to expand the "Community of care" around freshwater. This has led her to constantly explore new forms of communication. Between 2009 and 2015 Mrs. Postel served as a "Freshwater Fellow" of the National Geographic Society and attending numerous conferences, she advocates for a more water-secure world, advocating for the belief that by working with nature, not just against it, we can develop more effective climate solutions and improve water management to restore degraded ecosystems. These ideas are attracting a large number of people. In her most recent book "Replenish: The Virtuous Cycle of Water and Prosperity", she provides many inspiring examples.

Sandra Postel is an American water conservation activist and a recognized expert on international water issues. She began to adopt a multidisciplinary approach to water soon after studying geology, political science, and environmental management during her tenure at the Worldwatch Institute in Washington DC. In 1994, Sandra Postel founded the World Water Policy Project. Between 2009 and 2015, she served as a Freshwater Fellow of the National Geographic Society.

She is also a prolific writer and a sought-after speaker. Sandra Postel became a household name in 1992 after she published her book Last Oasis: Facing Water Scarcity, a forewarning of the impending water crisis. She has since written extensively in both popular and scientific journals, including Science, Natural History, Foreign Policy, and Ecological Applications. Her most recent book Replenish: The Virtuous Cycle of Water and Prosperity suggests several new solutions for freshwater conservation and management.

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32
Prof. Wilfried Brutsaert, USA

The 2022 Stockholm Water Prize was awarded to Professor Wilfred Brutsart of the US for his outstanding research in measuring environmental evapotranspiration through integrated studies of land and atmosphere. Prof. Brutsart is an eminent hydrologist and also a pioneering researcher. His innovative concepts in evapotranspiration and hydrology have been of lasting theoretical and practical importance, particularly in terms of climate change. He pioneered innovative approaches to understanding changes in groundwater storage and made major contributions in developing tools to assess climate water availability.

Prof. Wilfred Brutsart is an Emeritus Professor of Engineering at Cornell University, USA. He is a renowned expert professor in Hydrology and his work has earned him the respectful title of Mr. Evaporation.

Terrestrial evaporation is a fundamental aspect of the water cycle. But it is very difficult to measure. So when Prof Brutsart found new ways to predict evaporation and its effect on the Earth's energy balance, it was a breakthrough. Their theoretical approach opened the door to further developments in the technology for measuring both remote sensing and terrestrial observations to assess evapotranspiration. It is also important for climate modelling and understanding the impact of climate change on the water cycle.

Prof. Brutsart's work has helped improve local predictions of whether an area will experience more or less evaporation, or indirectly less or more precipitation. Brutsart's research, more than anyone else's has contributed more to improving the understanding of spatial geospatial information. Scientists have always found it more difficult to make predictions at the local level than at the global level, because local geospatial information is so difficult to make predictions about. Due to the contribution of Prof. Brutsart, significant progress has been made in

this field. This is particularly important for local communities, enabling them to anticipate the various impacts of climate change on their local water supplies and water resources.

Prof. Wilfried Brutsart has developed creative new methods for understanding changes in groundwater reserves, another central aspect of the water cycle. He has been instrumental in bringing new knowledge to the world about how global warming affects the water cycle, including research on how it affects groundwater as the permafrost melts. Wilfried Brutsart's work has greatly enhanced the scientific understanding of the water cycle, and is also fundamentally important in practical water management.

Prof. Wilfried Brutsart was born in 1934 in Ghent, Belgium. He went to University of California, Davis, USA for research and studies. In 1962 Wilfred Brutsart joined the faculty of the Department of Civil and Environmental Engineering at Cornell University, where he served for over 50 years. He has also done research in Japan, Netherlands, Belgium, Switzerland and China. His significant work includes extensive research in environmental hydrology and fluid mechanics. However, they are best known for their important role in evapotranspiration and groundwater storage. He has authored and co-authored more than 200 refereed articles in several scientific journals. Also, author of two important books, "Evaporation into the Atmosphere" (Springer) and "Broader Hydrology: An Introduction" (Cambridge).

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33
Prof. Andrea Rinaldo, Italy

Dr. Andrea Rinaldo of Italy was awarded the Stockholm Water Prize-2023 for his groundbreaking work in hydrology, hydrogeomorphology and epidemiology, which has had a major impact on several academic fields. His research is used to protect biodiversity and prevent the spread of disease.

Dr. Andrea Rinaldo is a leading thinker in hydrology, whose conceptual and quantitative ideals have led to profound understanding in the fields of hydrogeomorphology and ecohydrology. In his research, he has highlighted the important interrelationships between river networks and the distribution of dissolved substances, aquatic species and diseases.

In his long career, Dr. Rinaldo has advanced the overall understanding of the complex interactions between the hydrological cycle, ecological processes, and the evolution of the natural structure of the region. At a time when hydrology was mainly concerned with fluid mechanics and fluid hydrology (hydraulic) engineering, he used his creativity to explore alternative approaches and ultimately developed new conceptual and quantitative models to explain how water shapes the Earth's surface and ecosystems. In 2008, Dr. Rinaldo established the world's first laboratory of environmental hydrology at Ecole Polytechnique Fédérale de Lausanne.

Dr. Rinaldo and his lab's pioneering research have demonstrated how river systems organize themselves into optimal conditions and provide "ecological corridors" for populations and pathogens. This new understanding of hydrological processes has revolutionized many academic fields and has made it possible to model the distribution of solutions, aquatic species, and diseases.

Its importance is difficult to explain, as it has many real-life applications. Understanding water pollution and why water becomes

contaminated first requires an understanding of how solutes and pathogens diffuse through the surface. In order to protect biodiversity, it is important to prevent invasive species, which requires knowledge about how they travel and settle. At the same time, decision makers in the field of combating waterborne diseases need to understand how pathogens survive, how they spread in aquatic ecosystems, and how human mobility affects disease rates over space and time.

Dr. Andrea Rinaldo's research team has studied cholera, schistosomiasis and proliferative kidney diseases in fish, providing new and improved tools for the future. After his team developed the first spatially accurate model of epidemic cholera, it has been successfully applied to outbreaks in Kwa-Zulu Natal, Haiti, South Sudan, Lake Kivu, and Senegal. This will only increase its importance in the coming years as climate change intensifies hydrology and the spread of waterborne diseases is feared.

Dr. Andrea Rinaldo is known as an innovative and rigorously working scientist. His work has had a major impact on many academic fields, including hydrology, hydrogeomorphology, and epidemiology. He has co-authored more than 320 peer-reviewed articles for prestigious academic journals in hydrology, ecology and physics, as well as interdisciplinary journals such as Science and Nature.

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आमच्या प्रकाशनातर्फे प्रकाशित केली गेलेली व भविष्यात प्रकाशित होणारी इ पुस्तके :

१. मी एक जलप्रेमी : डॉ दत्ता देशकर

२. जाणून घ्या आपले पाणी : डॉ. दत्ता देशकर

३. जल सुसंस्कृतीच्या दिशेने : श्री. गजानन देशपांडे

४. उद्योजकता : आपले यश आपल्या हाती : डॉ. दत्ता देशकर

५. जलक्षेत्रातील यशोगाथा : डॉ.दत्ता देशकर

६. जलक्षेत्रात कार्य करणाऱ्या संस्थांचा परिचय : श्री. विनोद हांडे

७. पाण्या तुझा रंग कसा : श्री. विनोद हांडे

८. स्टॉकहोम पुरस्काराचे मानकरी : श्री. गजानन देशपांडे

९. Towards Excellence in Water and Culture : Shri Gajanan Deshpande

१०. Recepients of Stckholm Water Prize : Shri Gajanan Deshpande

११. मी एक जलप्रेमी (भाग २) : डॉ. दत्ता देशकर

१२. गोष्ट पाण्याची : डॉ. दत्ता देशकर

Brief Introduction of Shri Gajanan Dinkarrao Deshpande

Shri Gajanan Dinkarrao Deshpande is a retired Engineer from Water Resources Department of Government of Maharashtra. He has gained 36 years of experience in construction, management and administration activities of irrigation projects during his tenure of service. He is the recipient of the prestigious “Outstanding Engineer Award-2002" by the Government of Maharashtra. He has also been actively involved in social work related to water development for the past 25 years. He has been associated with “Indian Council for Water And Culture” a leading social organization in the field of water development for the past 20 years. He has been working as the Honorary Secretary of this organization for the past few years. He is constantly writing on various water related issues through magazines like Jalsamwad as well as other dedicated to water. Some of his books on water have also been released recently. He has actively anticipated in many national and international water conferences and workshops in countries like China, Australia, Sri Lanka, Nepal. His experience in other fields is also rich with interest in tourism in-country and abroad, classical music and varied reading. After retirement he has settled in Pune.