Water management in Europe

As India grapples with the challenge of developing water-management strategies to support an expanding population amidst rapid economic growth, it should be of value to learn about water-sustaining experiences from other parts of the world. In this regard, the European water experience is particularly relevant. With an area of 4.3 million sq. km and a population of 490 million (114 people per sq. km), the European Union (EU) is comparable to India in size (3.25 million sq. km, 1.1 billion population, 338 people per sq. km). Europe and India share a rich diversity of physiography, climate, flora and fauna, and continuous human habitation over millennia. While individual nations of Europe have developed their own water laws over the centuries, they are now coming together under the aegis of the EU to formulate laws and policies that will harmonize their collective common interests in conserving and protecting water, the environment, ecosystems, and in general, vital natural resources. The following is a fleeting glimpse into the framework of water laws of France, Germany and Spain, followed by an account of the Water Framework Directive issued in 2000 by the EU.

In the aftermath of the Second World War, problems of public health and water pollution associated with urbanization and industrialization necessitated a modernization of water law in France. An interministerial water commission set up in 1959 recommended unified water legislation. Accordingly, the Water Law of 1964 was promulgated. Amended by enactments in 1992 and later, this Water Law governs water management in France. Scientific management lies at the core of the French water law, and the country is divided into six river basins towards achieving that end. Surface water and groundwater are deemed to constitute a single resource. All water remains in public domain, with limited provisions for private ownership. Regardless of ownership, all users must obtain permits for specific water use. Water management is supported by an infrastructure of technical institutions to monitor, gather, interpret and disseminate scientific data. Water is administered through a hierarchical structure of administrative and financial institutions at national, basin, regional and local levels, supplemented at an international level to constructively collaborate with neighbours with whom France shares riparian interests. The law provides for active participation of citizens and users at all levels of decision-making. Conservation of biological diversity and aquatic environments is an integral part of the water law.

Germany promulgated its Federal Water Code in 1957 to unify water-management practices over the country. Prior to this, there were 19 different water regimes in Germany, substantially differing in attribution of ownership in waterbeds and groundwater, and rights to use water. The objective of the Federal Water Code was to attain sensible distribution of surface water and groundwater in the whole of the Federal Republic. It was perceived that this could be achieved only if free disposition by private ownership is restricted, and if consideration of public weal is the starting point of all action. German water law is guided by ideals of *Öffenliche Sache* (public good) and *sozialpflichtigkeit* (social responsibility). Ownership of land does not entitle a landowner to the use of surface water or groundwater. Except for small quantities of water, all users are required to obtain permits issued within the framework of scientific water management. In 1985, the Act was amended, requiring that water be considered part of an integrated ecosystem. In Germany, the federal government is responsible for water policy framework, while Länder (State) has executive responsibility for management. When a watershed spans more than one Länder, integrated management is facilitated through coordinating committees.

Spain had a tumultuous history during the 20th century, leading to a Constitutional monarchy in 1978. During this period, Spain was governed by water Acts passed in 1866 and 1879, which placed most water in public domain, leaving groundwater, among others, in private domain. During the 1920s, River Boards were initiated to harness rivers through hydraulic structures. Modern Spanish Constitution declares all continental and coastal waters to be in public domain, in order to be rationally managed by public officials. The Water Act 29/1985, amended in later years, is centred around scientific management of river basins. Execution is vested with Autonomous Communities (analogous to States). When a river basin is shared by more than one Autonomous Community, the State is responsible for coordinated management. During the 1990s, Spain drafted a National Hydrological Plan, which conceived the linking of river basins. Under this plan, water would be transferred from the interior Ebro Basin to the arid, coastal Mediterranean Basin. After vigorous and contentious national debate, this water transfer plan was shelved in 2004. Presently, some 40% of Spain's waters is harnessed through hydraulic structures.

During the 1990s, the EU, of which France, Germany and Spain are members, began working on a global approach to water policy towards a wise, unified management of water resources of all its members. After open consultation with all interested parties, the EU issued its Water Framework Directive in 2000, calling upon member nations to enact suitable laws to comply with it. Declaring water to be a common heritage to be protected and defended, the goal of the Directive was to get Europe's water cleaner through water management over river basins, achieve good status for all waters by a set deadline, get citizens involved closely and streamline legislation. France is in an eminent position to comply with the Water Framework Directive because its 1964 Act already has the elements of the Directive in place. Germany and Spain have to make significant organizational changes. For example, both have to shift management philosophy from administrative units (Länder or Autonomous Community) to river basins. However, they are working towards compliance.

It is remarkable that 27 nations of the EU with widely different cultures and traditions are coming together to better manage water. Part of the reason, it turns out, is a common cultural tradition. Fifteen hundred years ago, Roman jurists, commissioned by Emperor Justinian, and inspired by Aristotelian science, recognized that because of Nature's immutable, unchanging laws, certain things such as air and water are common to all mankind. Accordingly, they concluded that such public good should be governed by a law

that is common to all nations or all mankind (*ius gentium*). Over fifteen centuries, this concept has endured throughout Europe as a legacy of Roman law, despite the decline and fall of the Roman Empire. The doctrine of public trust, which asserts public rights in navigable waters, fisheries and tidelands, is but one manifestation of *ius gentium*. Upon reflection, it is not unreasonable to think that the coming together of 27 members of the EU to share their common heritage through a law that is common to 'all nations' is a modern embodiment of *ius gentium*. There is no reason why this philosophical approach of the EU should not be broadened to other parts of the world towards wise use of water, a heritage common to all.

Looking at the Water Framework Directive from India's perspective, it is particularly relevant to note that this philosophy of water management, despite its roots in a society that pre-dates modern society by over fifteen centuries, is based on science and technology. Modern water law and policy cannot exist without active participation from science. Yet, science cannot make judicial and policy decisions. In the larger scheme of democratic governance, science, scientists, and scientific institutions have an obligation to see that the best available scientific knowledge is brought to bear on the creation of water laws and policies, as well as their implementation. Science has to learn to address a different type of knowledge that lies outside its traditional boundaries.

T. N. NARASIMHAN

Materials Science and Engineering,
University of California at Berkeley,
Berkeley,
California 94720-1760, USA
e-mail: tnnarasimhan@LBL.gov

Omega-3 fatty acids: A boon to human beings

Omega-3 fatty acids have drawn considerable attention due to their potential role in human health[1]. Here we mention the benefits of omega-3 fatty acids and conditions which are responsible for better results.

Omega-3 fatty acids are considered a boon to human beings. Body functions are improved by their intake. Brain is a vital organ that keeps the body functions in proper control. These fatty acids increase the volume of grey matter associated with mood and regulation of emotions. The risk of dementia and Alzheimer's disease is also checked. They also boost the cognitive functions in elderly people, and there is improvement in osteoarthritis by prevention of loss of cartilage that acts as a cushion in the joints and checks inflammation. They protect against prostate and breast cancer by stimulating the death of tumour cells. These fatty acids increase HDL cholesterol and reduce triglycerides, a condition that is favourable for the heart. These keep the blood in fluid state by decreasing platelet aggregation. Thickening of the arteries is inhibited and there is an increase in dilation of the arteries. These strengthen our immune system. Dietary intake of omega-3 fatty acids is inversely related to age-related macular degeneration and reduces the risk of blinding disease. Above all, it is reported to prevent sudden death of an individual.

Omega-3 fatty acids are long-chain poly unsaturated fatty acids like eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which increase the fluidity of membranes. Once the membranes function in a normal manner, there is proper cell-to-cell communication. Omega-3 fatty acids are found in flax seeds, walnuts and soybeans, besides fatty fishes like salmon. These are essentially in the *cis*-form. The oils containing omega-3 are not directly taken; instead they are used for cooking. At higher temperature (160°C), the *cis*-form is converted to *trans*-form, which is not healthy for humans as the benefits of omega-3 fatty acids are lost. The same refined oil can however be used uncooked, but spread over salads, etc. for better results. The omega-3 rich edible refined oils and supplements, should be kept in the dark and protected from oxidation. Their intake should not be more than 3 g per day. The use of omega-6 fatty acids (sunflower oil and safflower oil) is also beneficial. However, their consumption is much higher in comparison to omega-3 fatty acids, and therefore they produce deleterious effects. The best way is to reduce the consumption of excess omega-6-rich edible oil, and increase omega-3-rich edible oil, for proper health benefit.

1. Patil, V. and Gislerød, H. R., *Curr. Sci.*, 2006, **90**, 908–909.

P. K. AMBASHT*
KERDALIN KHARKRANG
SHALIMI RAPSANG NONGPIUR

Department of Biochemistry,
School of Life Sciences,
North Eastern Hill University,
Shillong 793 022, India
**e-mail: pravin.ambasht@gmail.com*

From biohazard to bioresource

Zoos are known to harbour hundreds of herbivorous animals[1]. These animals produce enormous amount of dung daily. The collected dung is disposed swiftly since it is considered waste, unhygienic and a potential reservoir for contagious diseases. Due to this repulsive attitude, animal dung as a bioresource with renewable energy potential has seldom been recognized in zoos globally.

Cow dung has been used as fertilizer and fuel in many countries for centuries. Mahatma Gandhi was keen to utilize biogas from dung and it was materialized in the 1930s when the Indian Council of Agriculture Research developed a simple device known as 'gobar gas plant' that produced biogas and manure[2]. However, the concept did not receive public interest for nearly half a century.

Biogas is comprised primarily of methane and carbon dioxide. It is produced by anaerobic digestion or fermentation of organic matter. The biogas technology