vitamins. Some brown seaweeds afford scope for the production of algin, mannitol and iodine. Iodine is present in varied quantities in Sargassum and other seaweeds.

The Chilika Lake harbours over 150 migratory and resident species of birds and 225 species of fish, including Irrawady dolphin (*Coryphaena* sp.) and sea cow (*Dugong dugong*). The grassy expanse of Nalabana Island having an area of around 37 sq. km which has been declared a bird sanctuary, is the major refuge of millions of migratory birds. This scenario has been changing day by day. The avain grandeur and fish population are observed to be dwindling rapidly. The Chilika is an attractive lake with splendid avifauna. At the same time it also attracts thousands of people who are eager to exploit it for commercial purposes, such as prawn farming or fishing and thereby cutting and shredding of the waters into small sections. Swathes from Chilika's main body are lost every year from the shores. Unregulated tourism is another factor endangering the Chilika's fragile ecosystem. While birds face problems of poaching, the dolphin is injured and threatened due to the increasing number of motor launches. At present natural resources such as forest and freshwater resources are exploited by the local communities and the lake is therefore under tremendous pressure.

A new artificial mouth was dredged in the year 2000 by the Chilika Development Authority at Magarmukh to reduce the length of the inlet channel by 18 km for salinity restoration and this has brought a new lease of life to the lagoon. After its opening, there is a marked improvement in the exchange of water between the sea and the lagoon, facilitating auto-recruitment and free breeding migration of fish, prawn and juvenile crab into the lagoon, leading to a significant improvement of the fishery resources. The other components of the restoration plan include integrated watershed management with community participation, monitoring and assessment, improvement of socio-economic conditions of the local communities, shared decision making, improvement of communication network, fish stock enhancement, development of a visitor centre, wetland research and training centre, etc.

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Manual drawing of groundwater from borewell/tubewell

Abstraction of groundwater from borewells and tubewells is generally done through pump sets. Many a time, the cost of pump sets with pipes and overhead tank exceeds that of construction of a borewell. During a recent hydrogeological investigation in and around Chelakkara area, Trichur District, Kerala, a unique method of drawing water from a borewell was observed. On enquiry, it was found that the people have been using this system over the last two years, and it was providing trouble-free service. Similar to the bucket and rope method used to draw water, there was no maintenance cost and this system could be operated by anybody without technical know-how. This technique is used to draw water from borewells, where the depth to water level is up to 15 m below ground level (m bgl). Since it is cost-effective, simple and unique, the technique can be practised in rural and urban areas for drawing water from borewells/tubewells. This method can be used as an alternative to pumps/hand pumps.

The device is similar to bucket and rope method used to draw water from open wells. It is lowered through a pulley hung on the wall/roof exactly above and at the centre of the borewell. A piece of PVC pipe has been modified to draw water in place of the bucket. The borewell, where this method has been adopted has a diameter of 6.5″ and the water level varies between 9 and 14 m bgl. A PVC pipe of 4.5″ dia and 1.3 m length has been used for drawing water. It is sealed at the top with a small hole and a hook to tie the rope. Along the bottom, a reducer is fixed and a small foot valve of 1.5–2″ dia is attached. A special provision is made in the foot valve bottom with a long bolt, which protrudes out of the foot valve (Figure 1 *a* and *b*). When this bolt is pushed inside, it opens the valve inside the foot valve (Figure 1 *c*).

This modified PVC pipe is lowered into the borewell using a rope and pulley (Figure 2). When it touches the water level, the foot valve opens and water enters into the pipe. Then the entire system is immersed into the water column and the PVC pipe is filled up with water. When it is lifted up using the rope and pulley, the valve inside the foot valve

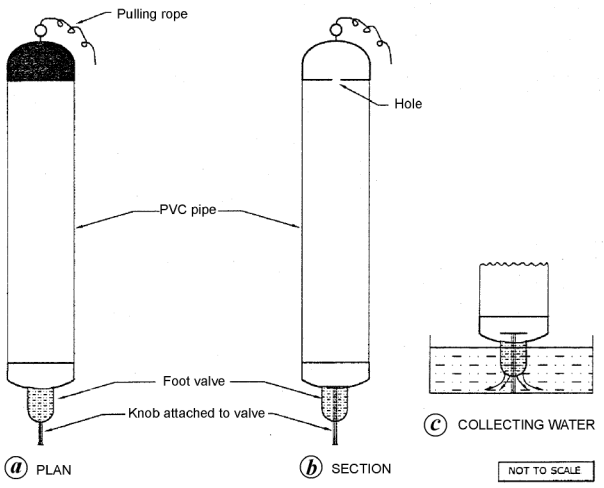

Figure 1. Schematic diagram of manual abstraction method.

Figure 2. Pulling out the system from the borewell.

unit closes due to the weight of water inside the PVC pipe. The next step is to remove water from the PVC pipe. The system is kept inside a bucket/vessel and the bolt projecting out of the foot valve is pressed, resulting in the valve being opened. Water from inside the PVC pipe flows out and is collected in a vessel. The system at Chelakkara is capable of drawing 5.5 litres of water at a time.

Since the system is lowered and pulled up using the pulley, its operation is simple and more comfortable than a hand pump. There are no mechanical parts for periodical replacement due to wear and tear like in a hand pump. Hence, maintenance cost is more or less zero. A further advantage is that the mechanism and the components used are simple and can be repaired by a layman, which makes it attractive. If the diameter of the borewell is larger, a proportionally larger diameter PVC pipe can be used, which may draw larger quantity of water.

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Kawwal Wildlife Sanctuary needs the status of Tiger Reserve

The tiger, our national animal, has always occupied a position of awe and respect in our minds due to its royal splendour and elusive nature. Unfortunately, as an animal of national significance it has not received due treatment that it deserves. Owing to this perilous position, the Government of India launched the 'Project Tiger' in 1973, with an objective 'to ensure maintenance of viable population of tigers in India for scientific, economic, aesthetic, cultural and ecological values and to preserve for all times, areas of biological importance as a national heritage for the benefit, education and enjoyment of the people'.

At present[1], there are 28 Tiger Reserves under Project Tiger in India located in 17 states, covering an area of 37,761 sq. km.

Kawwal Wildlife Sanctuary is situated in the Adilabad District, Andhra Pradesh. It is located 260 km from Hyderabad, between 19°05′N–19°20′N long. and 78°32′E–79°12′E lat., it occupies an area of 892.23 sq. km. Declared as a Wildlife Sanctuary in 1965, it is one of the oldest sanctuaries of the state. It is a perfect tiger habitat with dense bamboo undergrowth and adequate prey population. It harbours endangered fauna like the Indian gaur, four-horned antelope and grey jungle fowl[2]. It is known for herds of spotted deer, sambar, blackbuck, nilgai and gaur which are important tiger prey. Vegetation in the sanctuary exhibits a classic example of southern tropical dry deciduous forests with predominantly *Tectona grandis* and its associates like *Anogeissus latifolia, Terminalia alata, T. arjuna, Boswellia serrata, Cleistanthus collinus, Lannea coromandelica, Hardwickia binata, Adina cordifolia, Mitragyna parviflora, Strychnos nux-vomica, Chloroxylon swietenia, Bombax ceiba* and *Diospyros melanoxylon*[3]. It protects the catchment of numerous perennial streams that ultimately drain into the River Godavari. It has enormous potential for research in conservation of biodiversity and endangered flora and fauna. According to the 2006 census, 13 tigers were reported[4]. In recent years, the glory of the sanctuary is rapidly diminishing due to increasing anthropogenic pressure, heavy felling of trees by smugglers and ethnic natives who inhabit the sanctuary for their livelihood and also for making of agricultural equipment and firewood. This ultimately leads to habitat destruction of herbivores, which in turn has an adverse effect on the availability of prey for the tigers. Worldwide the number of big cats and other predators is plummeting. The tiger too is coming under increasing threat from intensification of agriculture and an upsurge in human population and livestock in the environs of the protected areas[5]. As Project Tiger is undisputedly the custodian of the major gene pool of the country and a repository for some of the most valuable ecosystems and habitats for wildlife; the Kawwal Sanctuary needs immediate attention for the conservation of tigers. There has been no further declaration in the state after inclusion of the Nagarjunasagar–Srisailam Sanctuary under the Project Tiger. The Kawwal Sanctuary needs the status of a Tiger Reserve without any delay for better management of tiger habitat.

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