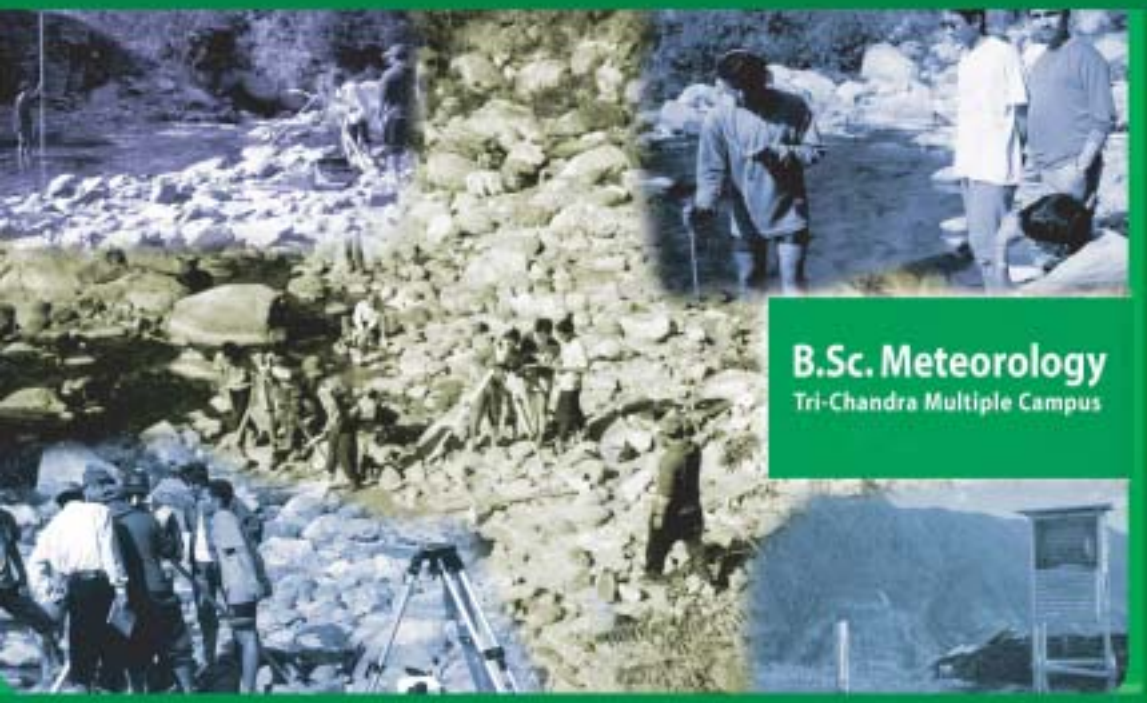
THE SMALL EARTH NEPAL-2001

Green View

Special Issue, January 2005



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Project
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BTK Vs VSBK

Ecologic
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Some new steps
towards
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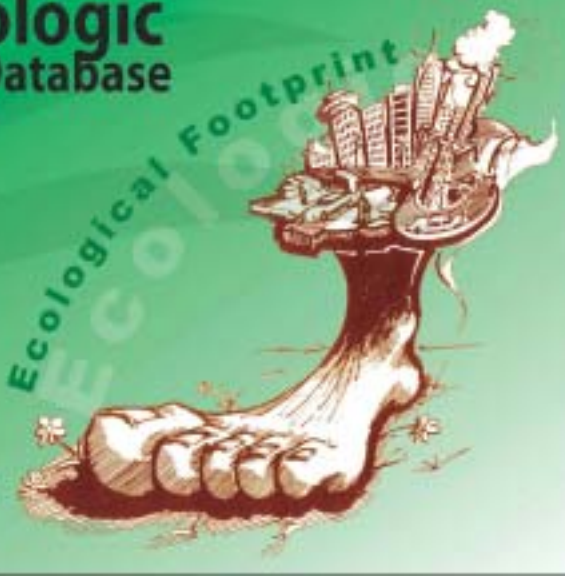


ETHANOL
an alternative FUEL

Behavioral
Development

Cover Page designed by Anup Sthapit
Middle Photo (front page): Students' participation in the one-week long *Environmental Awareness Program* organized by The Small Earth-Nepal (Photo by Sudarshan Rajbhandari)

Price: Rs. 25.00 only

(Rs. 15.00 for students)

Green View is published by:
The Small Earth-Nepal
Naya Baneshwor, Kathmandu

Mailing Address:
P.O. Box 181, Patandhoka
Lalitpur, Nepal

Tel: 977 (1) 4490 834
Email: smallearth@wlink.com.np

Contents

From the Editor

Nine months ago, the executive committee members of the Small Earth-Nepal (SEN) decided in publishing a quaterly magazine with the objective to disseminate information on sustainable lifestyles (including the concept of Global Footprint) to the general public. However, the progress on the magazine from the decision to the publication was made successful due to active involvement of B.Sc. III year students from Tribhuwan University. With added enthusiasm and valuable inputs from the students the scope of the magazine has been extended to encompass all the aspects of environment and meteorology. The magazine has been named "*Green View*" by the students which is indeed a very suitable name reflecting its contents. I am sure that you would find *Green View* knowledgeable, informative and enjoyable. I would like to welcome you to your first issue of the *Green View*!

The *Green View* team would like to acknowledge all who contributed their valuable articles/materials and supports for the special issue of the *Green View*. I would also like to thank Mr. Denesh Amatya and Mr. Bikram Shakya for their added enthusiasm and support for the *Green View*.

Future articles in the *Green View* will include insights to the developments in Ecological Footprint Analysis and more details on Global Footprints and Sustainable Lifestyles. Similarly, we would be updating on the different degrees available in the field of Environment, Science, Engineering and Technology (undergraduate/postgraduate) within Nepal and neighboring areas.

Finally I would like to request your feedback on our first issue so that we would be able to present you a better magazine to meet your requirements and expectations. All feedbacks are welcome regarding all aspects of the magazine (contents, formats, articles etc.). Enjoy your reading! ■

Dhiraj Pradhananga, Chief Editor
smallearth@wlink.com.np

Some new steps towards a sustainable world:

Local Strategies, a Footprint tax and a real Global Deal

Jan Juffermans

The trends of our growing global Footprints, the global warming and the decline of biodiversity are still dramatic. See the Living Planet Report 2002 of the World Wildlife Fund. The number of extreme poor people is only a fraction less than 10 years ago. Yet we might be a bit optimistic; in almost every section of our society the process of thinking in terms of sustainability is growing. For example in schools and universities, the business sector, in agriculture, the building, energy and traffic sector, and many cities and towns. But we need new steps to bring sustainability within reach.

Local Agenda 21 experience

Last ten years have brought us a lot of experience with local processes towards sustainability with the Local Agenda 21. Several countries have been very successful with the model, like Denmark, England, Finland, Norway and Sweden. In Denmark every city and town now has to develop such a program by law. On the basis of the experience with LA 21 the follow up of 'Johannesburg' should be that all cities and towns on earth will develop a Local Strategy for Sustainable Development (LSSD), to implement the National Strategies for Sustainable Developments (NSSD). No longer we can afford a voluntary approach, as unsustainability is linked directly with the violation of human rights many millions of people now and even many more people of future generations.

The Global Footprint tax

One of the most powerful tools we have received last ten years is the model of the Global Ecological Footprint. It has the power to become a common reference for the most crucial aspects of sustainability, for all, from children to UN-officials. The first book about it (Our Ecological Footprint by Rees and Wackernagel) was published only in 1996. Soon after that the stream of other publications, debates and educational activities with the footprint started to grow. The above mentioned Living Planet Report is the most political, compact document that shows the calculated and comparable footprints of 152 countries. But it shows also detailed calculations of the footprint components: arable land, grazing land, CO_2-emissions, forests, fishing grounds and built up land. These calculations can become the basis of a new global tax; the Footprint tax.

Real Global Deal

More than ever we have a clear picture of the big differences in the footprints of the rich and the poor countries. Taking into account the political choice for a sustainable level of use of the limited natural resources, we need a new and fair distribution system. It would be reasonable that the rich will start to pay a footprint tax for that part of their claims of resources that go beyond their fair share. And those people who still have a very small footprint, below their fair share, have the right to claim the revenues of such a footprint tax. With the money they can invest for a sustainable living. In this way we can reach more goals at the same time; lowering the CO_2 emissions, quickening the process to stop the extreme poverty on our earth and it might slow down the growth the world population as well. We know from research that more education and health for woman, leads to a free choice of less children per family.

We could start with this system on the basis of an equal distribution of per capita CO_2 emission rights. A process we need any way to reach an effective approach globally to stop climate change. This collective attempt for rebalancing the North-South gap and climate change would be a real Global Deal. ■

Jan Juffermans is the advisor of De Kleine Aarde/The Small Earth centre in the Netherlands, <www.dekleineaarde.nl>, more about the footprint on <www.ecofoot.net>.

Solid waste management:
a win-win scenario

Yogesh Shakya

In Nepal, population expansion and urbanization has led to the erupting issue of managing the solid wastes. It is rather population explosion in Nepal where urbanization is continuing so haphazardly. The major urban places of Nepal are all the victims to this problem.

Solid waste is the substance at the wrong place and at the wrong time. However, solid waste will remain no longer a problem if its utility is promoted. In our context, the main source of solid wastes are the households, cottage industries, other larger industries, constructional activities, offices, and public services like restaurants, shops, etc. What so ever may be the sources; solid wastes need to be handled properly.

Types of Solid Wastes

Broadly, we can classify solid wastes into two groups, which are,

(I) Biodegradable wastes and
(II) Non-biodegradable wastes.

The biodegradable wastes are those wastes that are decomposed by the microorganisms, the bacteria. This group includes the wastes like kitchen wastes, garden wastes (green parts), and other organic wastes. In the Kathmandu Valley, the biodegradable wastes include over 70% of the total wastes. The group of non-biodegradable wastes includes the wastes like textile, plastic, glass, rubber, etc. It is very important for us to know which waste is biodegradable and which not. The biodegradable wastes can be handled much easily than the non-biodegradable wastes. On the other hand, the idea of recyclable wastes is also very important for the public. Paper, plastic and glass are the major recyclable wastes.

Similarly, it is to be kept in mind that the wastes from the chemical industries and some factories may be toxic to public health. Medical wastes from hospitals and nursing homes are hazardous. Hence, the disposal of such wastes must be done in very secure way, especially because the hospitals are always in or near the residential areas.

Effects from Solid Wastes

The major effects of solid waste are directly reflected in the community health and state of environment. The pathogenic microorganisms present in the decaying solid wastes and the toxic components of solid waste do directly offend the public health. Typhoid, diarrhoea, dysentery, etc may be caused by such pathogens. The degradation of environmental components as land or soil, water, and air due to solid waste is equally troublesome. The dumping of solid wastes over the open land

Agricultural residue at a countryside household, Kathmandu. Photo by Dhiraj Pradhananga

degrades the soil quality. The liquid product from such dumps may penetrate deep into the soil and reach the underground water reservoir. This will pollute the water sources as rivers, well, etc. So, we must highly discourage the dumping of solid wastes near the water sources. The spreading of unpleasant odor from the decaying solid wastes not only reduces the aesthetic value of our environment, but also causes air pollution. The gases emitted in such conditions are Methane (*Biogas*) and Hydrogen Sulfide. Hydrogen Sulfide has the smell of rotten egg.

Can we make Waste Resource?

Never should one let the above points make him or her think that solid wastes are useless. There is an ample opportunity that solid waste provides us benefit from it. We, who produce the solid wastes, can ourselves find several solutions, not only to reduce the adverse effects of solid wastes, but also to benefit economically from the solid wastes.

In household level, the solid wastes can be converted into compost. It can be used as good organic manure in the agricultural production and in kitchen gardening. The formation of compost takes about 2 to 3 months, but the use of *Effective Microorganisms* (EM) can trigger the rate of formation of manure from the organic wastes, giving the manure in less time. It also helps to reduce the odor that comes from the decaying substances. This EM can be easily bought from the market. These so produced compost can be used or can be marketed, as it has a good market.

Role of Government

In Nepal, the Government is playing a significant role in managing the solid wastes in Municipal level. The Government is trying to promote landfills, rather sanitary landfill sites. A sanitary landfill is under the way of construction at Sisdol, ward number 4 of Okharpauwa VDC, Nuwakot District. The Municipalities, along with the Solid Waste Management and Resource Mobilization Center (SWMRMC), Ministry of Local Development, provide legal frameworks for solid waste management.

At present, SWMRMC is in its preparation to develop the National Environmental Impact Assessment (NEIA) Guideline for Solid Waste Management in Municipalities of Nepal. Recently, the center collected data about solid waste from all the 58 municipalities of Nepal, and has published the summary report of the collected data. On the other training programs, composting programs, collection of dead animals, school children programs, etc are conducted by the Municipalities.

Role of NGOs

The role of NGOs is also very significant in the field of solid waste management. They have been active in collection of solid wastes, construction of community level compost plants and other activities. Some organizations as Women Environment Protection Committee (WEPCO) and SILT Consultants (P) Ltd are active in this field.

The international agencies and organizations are also keen to work for the betterment of solid waste management in Nepal. At present JICA (Japanese International Cooperation Agency) has involved through a team of Japanese experts, the CKV (Clean Kathmandu Valley) Study Team, so as to develop a 15 year Action Plan for solid waste management in the valley. The CKV Study Team is conducting various pilot surveys and pilot projects about solid waste management at the municipalities of the Kathmandu Valley.

What we can do?

The use of products that give higher amount of solid wastes, the overuse of papers and plastics are some practices which must be highly discouraged. On the other hand, plastic reduces productivity of agricultural lands, causes clogging in the sanitary pipes, and may kill the cattle or domesticated animals, which by mistake eat them. Using stronger plastic bags or bags made of cottton or jute for shopping can reduce the use of plastic bags, especially the Polyethylene (polythene) bags. The polythene bags which are thinner than 20 micron must not be used because they are not recyclable.

We can adopt the habit of reusing the plastic bags that have been used once. The containers of glass and metals can be reused after the products have been consumed. For example, plastic bottles can be used for *Solar Disinfection* (SODIS) of drinking water. In this method water is aerated in bottle and exposed to sun for about 7 hours, resulting into almost over 95% disinfection of water.

Plastics, tins and cans can be used for making decorative articles. The use of bones for making buttons and decorative articles has an attractive market. Similarly, the value of recycled paper is also well appreciable in Nepalese market.

The creation of market for solid wastes is an effective way of handling the issue of solid waste. For example, if we create market for plastic bottles and medicine-bottles, they will no longer remain wasted in the streets. Yes, simply because they can be sold. At managerial level, the dumping or land filling of all the wastes is the major way of disposing the solid wastes, but it is not the only way out.

On the other hand, it must be realised that the fanatic concept of *Zero Waste* in present urban context of Nepal is not so practicable, especially when the urban scenario and life style of people are changing so quickly under limiting technology.

Therefore the problem of solid waste must be tackled by using an integrated approach. Everything possible to reduce the solid wastes must be done and anything done to handle the present wastes must not only protect the environment, but at same time, must benefit the people from wastes.

Identification of sources, choice of appropriate technology and creation of market for solid wastes remain the bigger jobs in hand for the Government, as well as private sectors involved in this field.

Nevertheless, the most significant role that can ever be played by, in solid waste management, is the communities themselves. We, the people who generate solid wastes, are obliged to solve the solid waste problem. The change in attitude is very essential at this point. We must understand that 'Solid waste is a gift full resource, not problem'. The concept of '3-R Rule' is very important to tackle this issue. It includes Reducing the sources of solid waste, Recycling the wastes and if not possible Reusing the wastes. Drawing the bottom line, it is our obligation that we take active initiation in this "win-win and win'' job. There is no losing, not at all. The Government, the NGOs and the Public, all can have wonderful success if all go hand in hand. We have to adopt the 'do or DO' motive to solve this issue, there is no other way out.

It always feels so good to look at the mirror and say, "I am part of the solution, not the problem". Why not feel good in mirror as well? I know you do, or at least want it so. ■

Do you know ?

Collected by: Pravin Tandan

1) Nepal, with only 0.003% of the world's land, is the 25th rich country in biodiversity.

2) Of the 34 landlocked countries in the world, Nepal is the country with the highest population.

And lastly, When a man cannot say what he is doing!

Ans:*sleeping*

About Climate Change

Indira Kandel

The global climate has undergone significant changes on a wide variety of time scales. The climate generally refers to the aggregation of all components of weather precipitation, temperature, cloudiness etc. These climate systems are closely connected to biogeochemical cycles.

Many important features of biogeochemical cycles can have significant impacts on earth system functioning without any direct change in the climate system. Some of its examples are: The direct effects of changing atmospheric CO_2 concentration and hence on calcification rates in the ocean and also the sharp depletion of stratospheric ozone from the injection of chlorofluorocarbons in the atmosphere.

Similarly, many interactions between biology and chemistry can have profound impacts on ecological systems. The impact of nitrogen deposition on the biological diversity of terrestrial ecosystem and the effect of non climate driven change in terrestrial and marine biospheric emission of trace gases to the chemistry of the atmosphere though have profound impacts on ecological systems do not directly change the climate system.

After millions of years there have been changes in the shapes of the oceans and the distribution of the continents. There have also been changes in the local modifications

by constructing cities and destroying forests. Although human societies and their activities are not considered to be a direct part of climate system they have profound impact on important processes of climate system. Broadly speaking, the climatic variation on earth is a continuous process that has occurred in past and will occur in future.

Plants, animals, human beings all change with climate and can survive only in limited and definite conditions of various climate systems. Under the conditions of transient drought the seeds cannot germinate and the tender seedlings will die. There are also losses of cattles and various crops due to flood, soil erosion and landslides.
The effect of climate change to insects in Sweden is surprising. The tick species, which carries encephalitis normally, requires two seasons to complete its lifecycle, but with a warming climate it can complete its life cycle in one season causing an unpredicted outbreak of tick population.

The climatic instability influences a lot on man's social and economic conditions. Moreover, we cannot deny the fact that man mismanaged his land and is facing several problems like drought, soil erosion, flood and land slide.

Lastly, the short period changes in climate are relatively easy to explain but for long period change study of various mechanisms are required. In some cases the analysis made through long term data are also not reliable. So it's our major responsibility to act now and beware of the dangerous consequences that can be led by the climatic changes. ■

Sources:

Lock Wood, JG, *1979, Causes of climate. Edward Arnold Publishers, London.*

Staffen, et. al. 2004, *Global change and the Earth System: A planet Under Pressure.* Springer, Berlin.

Whyte, RD, *The Significance of climatic change for natural regetation and agriculture.*

Project Proposal Writing and Report Writing (PWRW) Training

The PWRW training organized by 'The Small Earth-Nepal' was successfully completed on 11th September 2004 at Bhojan Griha, Dillibazar with the special remarks from Mr. Dhiraj Pradhananga, President of The Small Earth-Nepal (SEN). Mr. Pradhananga thanked the volunteers of SEN for their excellent effort to manage the training despite many constraints. The main trouble they faced was the curfew in the Kathmandu Valley during the scheduled days for the training. He also explored some of the opportunities for the participants' proposals submission. He concluded the training program with the announcement of the publication of the periodical eco-magazine "Green View" soon. During the closing ceremony, three participants and Mr. Ramesh Man Shakya also emphasized the importance of the training.

The organizing team, the resource person and the participants of the first PWRW training.
Photo by Prasamsa Singh

The training was of 15 hours conducted in various days starting from 28 August. There were all together 22 participants from various fields, mainly students of environmental science. The resource persons for the training were Mr. Ramesh Man Shakya and Ms. Akim Shrestha. The next Project Proposal Writing Training will be organized for 20 hours in the future. ■

Ethanol:

An alternative fuel source for vehicles in Nepal

Bhupendra Das

Regarding pollution, air pollution is the most serious environmental issue all over the world. In the context of Nepal, the Kathmandu Valley is facing a serious problem of air pollution. Major sources of air pollution in the Valley includes: combustion of fossil fuels mainly vehicular exhaust, industrial effluents, dust particles, smoke emission from the combustion of biomass, solid waste and sewerage.

New Road, Kathmandu. Photo by Dhiraj Pradhananga

Due to the lack of proper traffic management more than 60% of air pollution is from vehicular emission. Incomplete combustion of fossil fuel such as petrol, diesel, kerosene & coal produce large amounts of carbon monoxide (CO), sulphur-dioxide (SO_2), Oxides of Nitrogen (NO_x), unburned hydrocarbons (CH) and tar droplets. It is also found that high lead content petrol emits lead (Pb) in the atmosphere. The worsening condition due to air pollution is causing serious heath problem among the residence of the Valley.

Reducing the use of fossil fuel and promoting the use of alternative resources will effectively minimize the environmental issues related to air pollution. Among alternative resources, the use of ethanol is a good example.

Ethanol is being used as a vehicle fuel in many countries for a long time. In Nepal, Thapathali Campus has performed few experiments on ethanol and its blends with gasoline in motor bike and car. Alcohol blended fuel has a good future in Nepal, however the detail study of technical, environmental and economical impacts are yet to be done. In order to achieve success, most engines need some modifications to run on pure ethanol while 20% level requires no engine modifications.

Pollution Test

For the pollution test, MARUTI-800 car was used. Before starting

Before tuning the engine

Fuel	*CO % by volume*
Gasoline	2.01
Ethanol blend fuel	1.27

After tuning the engine and cleaning the filter

Fuel	*CO % by volume*
Gasoline	1.53
Ethanol blend fuel	1.08

the operation of the car, ambient temperature, tire pressure and atmospheric pressure were checked and measured. Test sites were chosen for less traffic network Ring Road in the Kathmandu Valley at morning time.

Pollution tests were carried out for carbon monoxide (which is established as 3% by volume as Nepal standard) with the help of highly calibrated analyzing machine. The results are presented in the above table.

From the result, it is clear that the timely maintenance may reduce the pollutants like Carbon monoxide (CO), upto 29.40% by volume, whereas just using 20% of ethanol in the gasoline as ethanol blend fuel in place of conventional gasoline reduce upto 36.81% of CO in the vehicle.

Therefore, the users of vehicles are encouraged to use ethanol blend fuel in their vehicles without any engine modification so as to minimize the environmental impacts. ■

Reference:

Tamrakar, RK; Shrestha, OB; Sharma, B; Dangol, DM; Pradhan, S; 1998, *Proceedings of international conference on Role of Renewable Energy Technology for Rural Development , 12-14 oct, Pp. 134-139.*

Termites as Detrivore

Ramdevi Tachamo

Termites (Isoptera) are dominant soil animals in the trophics. They feed on a range of organic materials in the decomposition process. They are divided into two large groups: the lower termites (six families) and the higher termites (one family Termitidae). "The lower termites, which harbor associated protozoa in their gut, mainly consume wood, whereas the higher termites that lack protozoa and constitute 75% of all species, consume various kinds of dead organic material including wood, dry grass, bark, lichens, fallen leaves and soil". The symbiosis phenomenon of termites with microorganisms have shown remarkable developments in adaptive radiation of their feeding habit.

Fungus growing termites of sub-family macro termitinae are cultivated symbiotic fungi in the nest. They feed on the fungus garden (comb), these are considered as successful group especially in dry areas of Africa and Asia. Soil feeding is also widely represented with 51% of all genera of the Isopetra and 62% of the termitidae occurring in three sub families:

(I) Apicotermitinae
(II) Termitanae
(III) Nasutitermitinae

The majority of soil feeding species belong to two sub-famalies. They are:

(I) Apicotermitinae
(II) Termitinae

Soil feeding represents a major trophic habit within the Isopetra. There is a conspicuous variation among soil feeding species in gut morphology and pH regimes.

Methane is produced by termites, which are an important source of methane in the global budget, but the absolute contribution is difficult to quantify. It is pointed out that acetogenesis occurrs in wood feeders whereas methanogenesis is favoured in fungus growers and soil feeders.

The variation in emission rates in lower termites is extremely large, ranging from the detectable limit to a very high level. In higher termites, there are two types of symbiosis; wood feeding and soil feeding have different efficiencies of interspecies transfer of H_2. Anaerobic acetogenesis is occurred in the gut of lower termites, which are fermented, from CO_2 and H_2.

In the gut of termites, cellulose is decomposed into glucose and then fermented into CO_2, H_2 and acetate. Thus produced CO_2 and H_2 are converted into CH_2 and acetate by bacteria in hindgut. The acetate is absorbed and utilized by the host termite as source of energy. Then, the produced CH_2 leaves within termite body.

Therefore, the emission rates of CO_2, CH_4 and H_2 are related with several trends corresponding to the kinds of symbiotic microbes and feeding habit. ■

Source:

Tayasor, I, 1998. Use of Carbon and Nitrogen Isotope ratios in termite research. *Ecological Research,* Vol 13, Pp 377-387.

Australia's excessive use of plastic bags

Victor Wong
Melbourne, Australia

Be it convenience, complacency or just downright ignorance, Australians use more than seven billion plastic check out bags each year. And to continue to meet the demands of our ever-growing country, the amounts are continually increasing. There are alternatives like the recycling bin and the shopper's handy bag, however, there are still very little amounts used to promote them to the public.

With plastic bags, a lot that is currently being circulated are not bio degradable, and even if it is, the material lasts for a very long time. The litter of plastic bags into our society not only says a lot about our concerns, it influences the lives of creatures we share the environment with. Plastic bags get caught in wire fences, drains, the ocean and sometimes are even seen floating on the roadside or in a paddock. It can trap birds and other small creatures and could even be mistaken for food. The results are nevertheless disastrous.

What can we do about this?

OK, you do not need to be smart here, just considerate. Think about using your previous plastic bags whenever you go shopping or better still, do not use it at all, instead opting for your own personal paper box (for fruits and vegetables), or carry the items by hand. Recycled paper bags, are also another option. Keep all the remaining plastic bags you do not need and recycle them at your nearest recycling centre/ or the next rubbish collection. Make a constant reminder to yourself that you should always carry a cotton bag ready in case you do go shopping.

Will the use of plastic bags ever stop?

Unfortunately, this would take some considerable amounts of time as people are wired to think only about convenience for themselves. Currently, it is this thought in our society that comes first, not the protection of the environment. As plastic is seen as a cheap and relatively strong material for storage and protection, it willl be used much more than any recycling materials (at the moment, recycle materials costs more than plastics because of the process that is involved).

Where do we go from here?

Teach the children about plastic wastage and the problems it can cause for other wildlife and the environment. There needs to be a lot of work to make people aware that this is no longer a small problem.

In all the developed countries of the world, plastic bags are one of the most used and abused items by consumers. It is light yet strong substance spells doom for creatures and the fact that there are very little advertisements and campaigns to highlight this point makes it even more important to highlight the situation to future generations.

It is a problem that would not just go away eventually and requires the careful attention from consumers like us. Some countries are now charging for plastic bags but still do not highlight other alternatives that could be used. If more awareness is given to this, then the benefit could be seen whenever anyone steps outside their front door. ■

Ecological Footprint:

A measure of sustainability

Dhiraj Pradhananga

There are continuous developments in measurements for sustainability. Ecological Footprinting is one of the measuring tools for the sustainability, and is now considered the most comprehensive expression of environmental impacts produced by any technology or lifestyles.

What is Ecological Footprint?

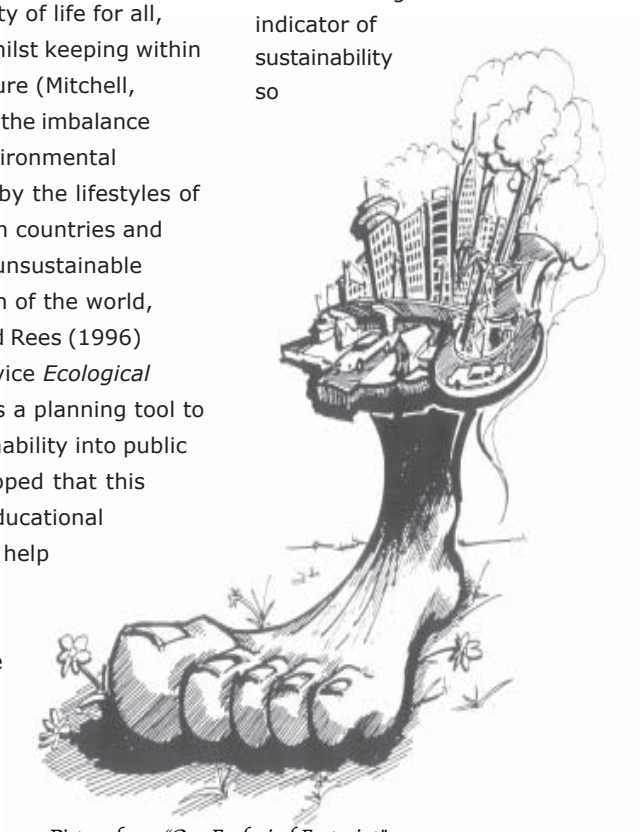
A number of methods have been developed to measure and evaluate the sustainability and environmental impacts of human activities. For instance, Life Cycle Analysis (LCA), Energy and Material Flow Analyses (EMFA) or Mass Balance Analysis (MBA) and Material Intensity per Unit Service (MIPS), and the most recent Ecological Footprint Analysis (EFA). Chambers and Lewis (2001) compared these approaches to assess the environmental impact of the products and services of a business. They found that EFA was the most comprehensive analysis which drew all these approaches. Chambers et al (2000) argued that EFA followed the same principles as LCA but did not use subjective weightings. In addition, EFA encompassed the carrying capacity of the earth and therefore sustainability. They claimed that EFA was one step on from LCA.

Sustainable development needs to ensure the quality of life for all, rich and poor, whilst keeping within the limits of nature (Mitchell, 1997). Realizing the imbalance between the environmental impacts caused by the lifestyles of the poor and rich countries and considering the unsustainable economic growth of the world, Wackernagel and Rees (1996) introduced a device *Ecological Footprint* (EF) as a planning tool to translate sustainability into public actions. They hoped that this analytical and educational technique would help to make the sustainability strategies of the world more effective and liveable. They also hoped that it would be effective in building public awareness and assisting decision-making processes.

Wackernagel & Rees (1996) defined *Ecological Footprint* as:

Ecological Footprint is an accounting tool for estimating resource consumption and waste disposal of any population (from a single individual to a whole city or a country) in ecologically productive land area equivalent (ha/capita).

Thus, the EF method assumes that every category of energy and resource consumption and waste production requires the bio-productive capacity of a finite area of land or sea. The method uses area as a single indicator of sustainability so that comparison can easily be made among various technologies or lifestyles. Vuuren et al. (1999, p. 54) reported: 'The EF aggregates data on the consumption of different resources into one single indicator.'



Picture from "Our Ecological Footprint"

EFA allows us to estimate the human pressures on the Earth and to make comparisons between humanity's demands on nature and the capacity of the Earth to supply resources and assimilate waste as well (WWF 2000). According to Wackernagel and Silverstein (2000), neither any government nor UN agencies operated a

systematic accounting system to find out to what extent human consumption of natural resource fitted within the renewable capacity of the existing ecosystems. They, therefore, argued that the EF is the new tool that attempted to account such an integrated resource management. With EFA, Chambers et al (2000) stated that human consumption is most likely exceeding the rate that nature can regenerate – *'We are in overshoot, with footprint larger than the carrying capacity of our planet'.*

Overview on Global Sustainability

The significant outcome of EFA is that EF describes a minimum condition for ecological sustainability (Wackernagel and Silverstein 2000). EFA was applied to answer the basic ecological question for sustainability: 'How much natural resource do we have compared to how much natural resource we use?' (Chambers et al. 2000, p. 29). The web site of RIO+5 (www.ecouncil.ac.cr/rio) comprised a report of Wackernagel et al. (1997), which presented EF of 52 nations in a rank with corresponding footprinting values.

Similarly, WWF (2000) presented EFs and ecological capacities of 152 nations. One of the significant expressions of the world's ecological situation applying the global EF concept was presented in the Living Planet Report (LPR) 2000 for the first time and it was re-emphasized in the LPR 2002. The global EF has been expressed by adding up six footprint components: cropland, grazing land, forest, fishing ground, built-up land, and energy footprints (see Figure 1).

The LPR 2002 summarises that the Earth has about 11.4 billion hectares of productive land and sea space and, when divided by the global population of six billion people, the availability area becomes 1.9 hectares per person. While the EF of the average African or Asian consumer was less than 1.4 hectares per person in 1999, the average Western European's footprint was about 5.0 hectares, and the average North American's was about 9.6 hectares (see Figure 2). The EF of the world average consumer in 1999 was 2.3 hectares per person, or 20% above the earth's biological capacity of 1.9 hectares per person. This clearly indicates that consumption practices of humanity have exceeded the planet's capacity to sustain its renewable resources. At the current consumption rate, the EF of all humankind is expected to reach twice the regenerative capacity of the Earth by 2050 (Martin 2002).

Moreover, the share of available resources is not in equitable (Chambers et al. 2000; Juffermans 1998). Juffermans (1995, p. 17) argued that the level of energy, commodity and land consumption by the developed countries made impossible to live all inhabitants of the earth. Whereas, the poor people were forced to degrade the environment in order to survive.

It is clear from the EFA that current lifestyles and practices are causing irreversible ecological damage. Jennings (2001) stated that the ecological damage could hamper development programs and ultimately affect the survival of human society. According to him, the models and approaches to sustainable development need to address all aspects of human activity, including energy production and use. He recommended that sustainable development required the world to move towards a new approach to energy production and use.

Energy Footprint

As mentioned in the previous section, the humanity's EF has six footprint components and energy footprint is one of them.

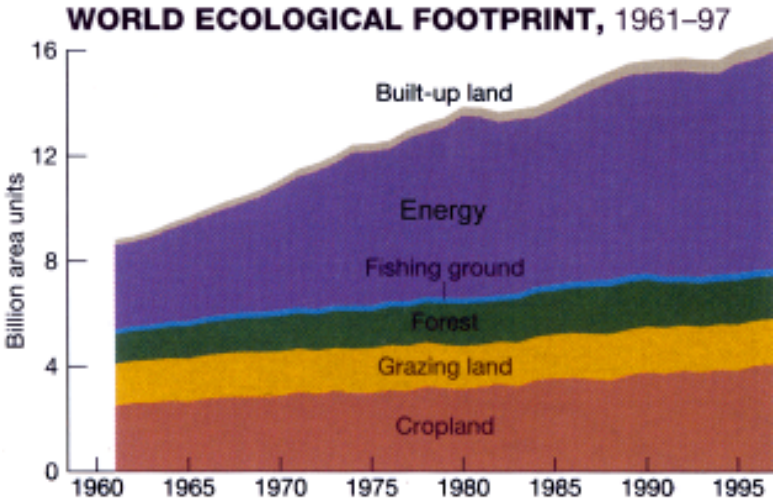


Figure 1: *Source: WWF 2000*

A country's energy footprint represents the area required to sustain its energy consumption. It encompasses four types of energy: fossil fuels, biomass, nuclear, and hydro. The footprint of fossil fuel combustion is calculated as the area of forest that would be required to absorb the resulting carbon dioxide (CO2) emissions, excluding the proportion that is absorbed by the oceans. The footprint of biomass fuel is calculated as the area of forest needed to grow the biomass, and the footprint of hydropower is the area occupied by hydroelectric dams and reservoirs.

The energy production and consumption practices may be one of the biggest environmental problems and the carbon based energy practice is the single biggest contributor to this problem. Energy costs accounted for over 50% of the EF. The growth rate of the global EF indicates that the energy footprint was also the fastest increasing component of the global EF in the period 1961-99 (see Figure 1).

Our technology is shaped by, and addicted to the intensive use of fossil fuels (Miner & Stomberg 1998). However energy supplies can be made sustainable, and one of the solutions to change this threat into challenge is by developing and using clean technology. There are many alternatives available for the solution; some of them are wind, solar and hydropower, as they have lower footprints (Table 1). Renewable energy sources such as solar, wind and hydrological cycle can have a much lower footprint, approaching zero comparative to fossil fuels. Chambers et al. (2000) stated that a switch to renewable energy sources is essential if we were to avoid unacceptable climate change, undesirable effects on health, and manage the continued depletion of the earth's fossil fuel reserves.

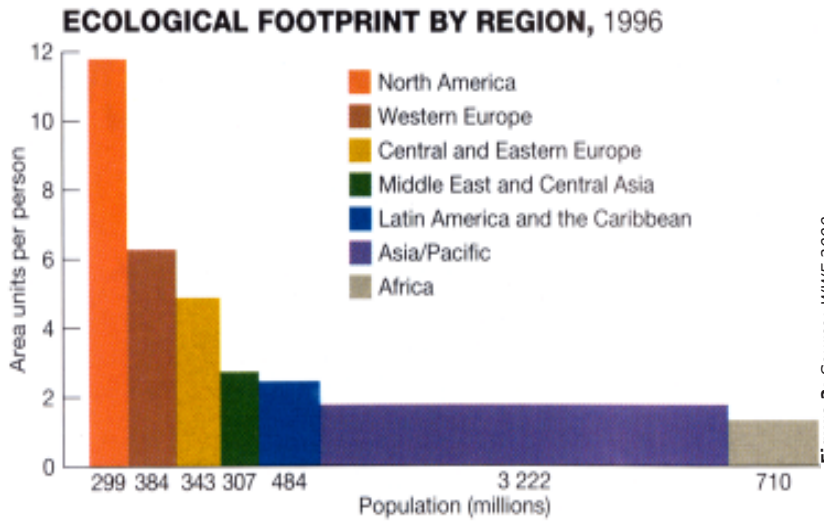


Figure 2: *Source: WWF 2000*

Therefore the analyses of energy footprint clearly indicate that the world, both developed and developing countries need to reform their energy generation technology from fossil fuels to the clean technology.

Table 1: Delivered electricity footprint factors for a number of renewable and non-renewable sources (Chambers et al, 2000**)**

Energy: electricity generation	Footprint (hectare years per GWh)
Electricity produced using hard coal condensing power stations	161
Electricity produced using coal	198
Electricity produced using oil	150
Electricity produced using natural gas	94
Wind	6
Photovoltaic	24
Biomass-woody	27 to 46
Hydroelectricity	10 to 75

The Other Applications of Ecological Footprint

According to Juffermans (1998) the EF is an accounting tool for ecological resources and a measure for sustainability of our lifestyles. Wackernagel (2001) stated: '….the ecological footprint becomes a tool for weighing the merits of potential policies and developing effective strategies and scenarios for a sustainable future.' As described above in the LPRs, EFA has been extensively applied for the comparison of different nation's lifestyles and their energy and material consumption and also available bio-productive areas in the respective areas. Thus, it will also allow us to envisage and

evaluate whether a particular country or region is in the ecological deficit. In the words of Vuuren et al. (1999), 'EF is a macro-indicator, which is generally more useful as indicator of an unsustainable situation rather than a sustainable.' Wackernagel and Silverstein (2000) believed that the EF was a robust model for quantifying human use of the nature. The UNFPA (2001) applied EF indicator to compare the resource consumption by different regions or group of countries and the continents in the report - The State of World Population 2001.

In addition to its global and regional level application, EF may be applied at the corporate level and may have a significant role in education on sustainability, both for individuals and organizations. Chamber and Lewis (2001) presented a practical account of EFA for businesses. They believed that EFA could be used as a sustainability indicator for business and that might have a crucial role in influencing the modern business community to move their organizations in more environment friendly directions.

Similarly, EF method has been applied for the environmental assessment for industrial products. For example, Frey et al., (2000) applied the EF method to electronic products. They used a bottom-up approach based on LCA for estimating the bio-productive area needed to appropriate the resources and emissions of a personal computer and compared with the EF of world-average citizen.

Frey et al. (2000, p.1) mentioned the work by Buitenkamp and Spapens (1999) in EF for products – a detergent and a photocopier. But, according to Buitenkamp and Spapens (2001), they rather used *Ecospace Audit* – indicators of *environmental space* (The term environmental space has been introduced in Europe in the early 1990s) to measure sustainability of companies that produce the products and services.

Nevertheless, the approach also uses *ecological space* for the evaluation similar to EF. The *Ecospace Audit* focuses on the amount of resources that enter the product or service in its entire life cycle rather than focussing on outputs (pollution, waste). It also combines land use and social aspects. They have tested the method on the two companies: Xerox Europe (production of a photocopier) and Ecover (production of a detergent). This approach is rather limited to LCA, though LCA focuses more on emissions. Similarly the recent work on the EF of dairy production was conducted by Beynon et al. (2002).

The EF may be considered as an excellent method of educating people by quantifying and illustrating the impacts on the environment from the various lifestyles. The most extensive studies of EF concept has been done for the calculation of a personal lifestyle. Many institutes and even individuals worked on the concept to develop an easy and quick methodology to calculate the EF of a person or a household.

A number of websites (or links) are developed with the tool to measure the EF of lifestyle of a person. This facilitates a person to compare his lifestyle with others. It is therefore believed that this has become an effective program to make people aware of their own lifestyles and motivates them to reduce their consumption which would ultimately reduce their environmental impact.

During the Oslo workshop on

De Kleine Aarde

Ecological Footprint, Juffermans (advisor, De Kleine Aarde/The Small Earth, Boxtel, The Netherlands; see the photo in the previous page) presented the experiences of using the EF actively towards the public, trying to promote conditions for positive change. Some of the applications were - a couple of pilot projects in the Netherlands to calculate footprints of the municipalities, awareness programs using campaign materials like folders, posters, articles including the national website (ProSus c. 2001).

The related articles in many websites have globally warned on the imbalance between human impact on the earth and the carrying capacity of the earth using the EFA. They have also presented some solutions to reduce EF of the individuals.

Summary

A number of approaches are available to evaluate the environmental performance of technology advancement, and evaluation is important for the social and environmental dimensions of sustainable development.

Among them, EFA is considered the most comprehensive approach expressing the environmental impacts created by technology and lifestyles. However, the application of EFA to date has mainly focused on the global and regional scale.

Nevertheless, the quantifiable assessment of the environmental impacts is the significant feature of EF. The discussion of EFA indicates the need in shift of energy production and consumption paradigm from fossil fuel to alternative energy technology. Also there is another option to lessen the consumption by improving technologies and increasing their efficiency and thus lowering the energy wastage.

If we could be aware of these consequences, it might certainly be helpful to aware the public and make polices to minimize the unnecessary consumption of natural resources - or in other words, to conserve the resources with meeting human need - the sustainability.

Therefore, the EFA can be applied as an effective tool for educating people by quantifying and illustrating the impacts on the environment from the various lifestyles and technologies. Moreover, there is a need for further research into the methodology and practical application of EFA for the complete expression of sustainability of any technology/lifestyle. ■

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Chimney Bhatta:
What is the alternative?

Deep Narayan Shah

The mud-bricks have been used in ancient cloisters, temples, durbars, including other cultural monuments of archeological importance located in the Kathmandu Valley. This is evident from intricate bricks of all shapes and sizes found at *Changu-Narayan* (464 A.D.) built during *Lichhavi* period (Photo 1) and the ancient constructions in Kathmandu, Lalitpur and Bhaktapur cities within the Valley (Photo 2) built during the *Malla* period.

These intricately figured bricks used as exposed walling materials have shown no signs of ageing or degradation even after 1500 years. This is an ample evidence of the technology and artistic mastery prevalent and practiced since the ancient times. It also aptly demonstrates that although we have progressed technologically through leaps and bounds over the years, we have failed even to understand our own roots creating a vacuum on replicating; leave alone improving, on our ancestors.

It seems that Bricks will be continued to use in construction even in the future since no alternate construction material is significantly available. It is natural to increase the number of kilns (*Chimney Bhatta*) due to high demand of bricks.

The availability of sufficient sticky soil in the Valley, which is essential to produce bricks, may be another reason of extension of kilns. The extension of the kilns developed along with the

Photo 1. Changu Narayan, Photo Courtesy: Bijesh Charan Raya

'*Awale*' expert artesians involved in agriculture in *Awal* (*Thado Bhatta*). 530 thousand bricks could be burnt in such kilns at once by putting the raw bricks along with the fuel enclosed inside for one week in *Awal*.

Ashalal Maharjan (*Awale*) of *Awal* community started Chimney *Bhatta* at Khumaltar in Lalitpur district for the first time, keeping in mind the rapid construction of modern buildings in the Valley after 2020 BS because quality bricks could not be produced by the traditional technology and the burning of the fuel could not be controlled in such technology. From Chimney *Bhatta*, bricks could be produced regularly than from Awal and if the fuel used in such Chimney *Bhatta* could be managed properly, the quantity of bricks would be introduced; so, Ashalal brought the expert artesians from Darbhanga of India for the purpose.

Other 30 Chimney *Bhattas* were established in the Valley within 10-12 years after Maharjan had established the Chimney *Bhatta* in 2024 B.S., a modern type Chimney Bhatta of Harisiddhi Itta Tayal Karkhana, was established in assistant of the government of our neighboring country China. By 2040 B.S. the total number of *Bhattas* was 105 among which only one modern type of Brick Industry (Bhaktapur Bricks Industry) was added and the rest all were Thado *Bhatta*. The total number

Photo 2. Nyatopola Temple at Bhaktapur, Photo by Denesh Amatya

of *Bhattas* was 132 up to 2041, 254 up to 2044 and 305 by 2050 B.S. Now such *Bhattas* are being run in dense residential areas, which could once be seen far from those areas.

Photo 3. VSBK verse BTK, Photo courtesy: VSBK Program, SDC

The laws for controlling the pollution emitted and will be emitted in future by chimneys were forwarded by the government in 2049 B.S. According to those laws, *Bhattas* should be at least 1 km away from the settlement area, permission should be taken from the government for digging the soil before the running of industry, and establishment of industry should be at least 3 km away from the forest.

Later on, some more rules were added such as the height of chimney should be 36 feet, industries should not be disturbing the neighbours, the waste materials generating from the industries should be managed properly. Before the establishment of industry environment screening should be done and lastly without disturbing any local *Pati Pauwa*. But in the Valley large number of industries has been established without registrations and they even ignore the rules of the government.

Beside dust particles, chimneys also emit SOx, NOx which affect not only the local people but also the whole Valley people. Even such industries are established nearby schools, which cause negative impacts to the school children. Due to the geographical structure of the Valley (bowl shaped), pollution emitted by the chimneys of one place effects other places within the Valley.

VSBK technology transfer to Nepal

In May 2002, the Government of Nepal (HMG Nepal) announced the discontinuation of production licenses for Bull's Trench Kilns (BTK) with movable chimneys. This decision along with environmental concerns from neighboring communities has placed brick makers under strong pressure to find a viable alternative to the BTK. In an initial stage of the programme preparation, HMG Nepal analyzed the technical, environmental and commercial viability of VSBK (Vertical Shaft Brick Klins) technology, and concluded that it responds to the needs of the brick industry and at the same time achieves to conserve energy and benefit the environment. Environmental reforms in the brick and other energy intensive sectors are largely in response to the Rio Conference Agenda 21.

VBSK programme, a holistic approach to modernize the brick industry in Nepal

Photo 4. Fixed chimney, Photo courtesy: VSBK Program, SDC

Anchoring the technology in Nepal

Nepal has considerable regional variations across the brick industry in terms of raw materials, brick making processes, climatic conditions, firing technologies and final product qualities. In response to these variations and to overcome uncertainty of successful adaptation of new technology among different stakeholders, the SDC (Swedish Development Centre) financed programme decided to pilot test two demo VSBKs in Lalitpur district under close technical and managerial supervision to prove it's appropriateness in Nepal.

Since the technical viability and energy conservation potential of the technology have been demonstrated under Nepalese conditions, the technology will be made available to local support service providers with provision of technical backup supports.

The Programme components

1. Improving social equity

Technology shift will be used as an agent of change in the social structure of the brick industry thereby aiming to share benefits of the technology transfer to workers in addition to entrepreneurs and neighborhoods. The programme comprises of "techno-socio integration" component in order to improve social equity. The major target group of the techno-socio integration is the brick workers followed by the entrepreneurs and neighborhoods.

The purpose of the techno-socio integration is empowered labour force to maintain improved living conditions with self-dignity. The programme will design short, medium and long-term strategies and processes. The programme will work in close collaboration with entrepreneurs to sustain the efforts made towards better living and working conditions of the workers.

2. Improving environmental and energy conditions

Emissions from brick kilns constitute a major source of pollution in the Kathmandu Valley. To achieve a sustainable healthy air quality, both stack and fugitive emissions from these kilns have to be immediately reduced by using cleaner fuels or alternative technology. The VSBK technology introduced in the Valley is one step ahead in this direction. It will considerably reduce the emissions by using less fuel and efficient burning process.

Therefore, working conditions on the kiln will be improved drastically while the kiln neighborhoods will be benefited from the reduced air pollution leading to an improved health situation. The programme regularly monitors the pollution level and energy consumptions in the pilot VSBKs.

Initial operation of the pilot VSBKs

The construction of the two pilot VSBK kilns has been completed and the initial firing was done on 5 May 2003. Encouraging results have been achieved both in terms of product quality as well as energy efficiency. Stack and fugitive emissions have been considerably reduced as evident from the small amount of smoke escaping from the chimneys in the kilns.

Finally

VSBK has two specific features, which make the technology so interesting for the brick entrepreneurs, as well as for the public. First, the specific energy consumption is much lower compared to BTK, fixed or movable chimneys. Reduction on energy consumption of up to 35% has already been achieved, resulting in high savings for entrepreneurs (see the table). Secondly, the pollution is even more drastically reduced. SPM or dust goes down by a factor 12 compared to BTK with movable chimney. Moreover sulfur emissions are significantly reduced. All these aspects make brick production a much more acceptable industry than the old fashioned BTK technology, permitting brick making and other land usages to stay in peaceful environment. ■

Economics

V.S.B.K	Cost (NRs.)	Annual production (piece)
1 shaft chimney	4,60,000	17,00,000
2 shaft chimney	10,70,000	34,00,000
3 shaft chimney	17,80,000	68,00,000

***Source**: The VSBK Program, SDC*

Preparing Ecological Database of Nepal Churiya

Dr Dinesh Bhuju

Nepal (area: 147,181 km^2) contains five major physiographic zones: Terai, Siwaliks, Midhills, High Mountain, and the Himalaya. These physiographic zones run parallel from east to west across the country's 885 km length and are spread over varying elevations. The Siwaliks, known as Churiya in Nepal, constitute an integral part of the Himalaya in the south. The zone consists of Tertiary unconsolidated and highly erodible fluviatile sediments. Geologically the Churiya is very rugged and unstable, and its river system exceedingly flashy. The region is regularly affected by soil erosion due to floods and landslides. It is estimated that the erosion rate in the Churiya ranges between 780 and 20,000 tones/km^2/yr depending upon land use type.

The Importance

The Churiya rocks are rich in vertebrate fossil contents. Its unearthed fossils of later Tertiary have provided basis for much of our present knowledge of the evolution of Asian flora and fauna. Major fossil fauna includes primates, carnivores, ungulates, elephants, rodents, birds, reptiles and fish. The primate collection from the Churiya includes a number of genera of Anthropoids. Study indicates that the animals of that period were the immediate ancestors of the present-day species. Recently, fossil parts of prehistoric elephant were unearthed from the Churiya of central Nepal.

The Churiya belt covers an area of 12.7% of Nepal's total land. Land Resources Mapping Project (LRMP 1978) estimated that 76% of the Churiya was covered by forests, mainly *Shorea*, mixed hardwoods and *Pinus*. This coverage is the highest percentage of land under forest of any physiographic zone in the country. Primeval forests used to cover in wild, and the doons were practically uninhabited. That is no longer true now, however. After the eradication of malaria and the opening of east-west highway in 1960s, people from inner valleys of the high mountains migrated to the lowland Terai. This migration also opened encroachments in the Churiya. Today, the Terai along with Churiya, supports 46.7% of the total population of Nepal. The increased human encroachment and their associated disturbances such as livestock grazing have made the fragile landscape of Churiya at risk.

The Churiya, however, is a neglected area. Ecological information on Churiya is almost non-existence. For instance, out of 637 site specific botanical studies carried out so far since 1922, only 3.1% have touched the Churiya. This figure is the lowest of all the physiographic zones. Our scientific endeavors have concentrated more on middle hills and high mountains which comprise over 85% of the total studies till recently. More interestingly, Nepali experts have paid more attention on middle hills while the foreigners on high mountains. Out of 348 studies covering midhill, 58% were conducted by Nepali researchers. On the other hand, out of 186 studies covering high mountains, 63% were done by the foreigners.

The Initiative

The study of Churiya in Nepal Himalaya was initiated by Resources Himalaya, a research organization, with support fund of Nature Conservation Society of Japan (NCSJ) in 1999. The study is the first of its kind that aims at preparing ecological baseline data for Churiya range of Nepal Himalaya. Later, keeping view the importance of Churiya in connecting the protected areas distributed in Nepal and India of Terai Arc Landscape, the World Wildlife Fund also took interest in the study.

Till date, the study carried out by the team of Resources Himalaya has investigated over 60% of Churiya hills (total area: 188,6000 ha) covering eastern part (Mechi-Koshi, length: 105 km), central part (Bagmati-Kanchan river, Butwal, length: 235 km), western part (Butwal-Mahadevpuri, length: 200 km) and far-western part (Karnali-Mahakali, length: 125 km). The study covered five different areas viz.: (i) Land use change based on three temporal maps of 1958, 1978 and 1991, (ii) Forest structure and regeneration pattern, (iii) Tree species association at different altitudes, (iv) Local knowledge on

plant use, and (v) Distribution of birds and other fauna.

Preliminary Results

The preliminary results of the study have shown that the forests of Churiya have discretely been fragmented. For example, in the eastern Churiya, the forest area has decreased by 11.7% while agricultural land has increased by 10.7% indicating the extent of human interference. In 1957, the forest coverage was 81%, in 1978 it decreased to 73%, and in 1992 it further decreased to 61%. The agriculture land, on the other hand, was merely 13% in 1957, it increased to 18% in 1978 and reached 29% in 1992.

Haphazard human settlements were found even near to the "non-accessible" forests. Nonetheless, several species of biological interest such as Tree Fern (*Cyatheae* sp.) *Cycas pectinata*, and *Rauvolfia serpentina* listed in CITES, and protected birds Giant hornbill (*Buceros bicornis*) and Black stork (*Ciconia nigra*) were recorded during the study. Some other scarce bird species noted in Churiya were Black stork, Blue-eared barbet, Brown fish owl, Jack snipe, Black baza, Slender-billed oriole, Ibis bill.

Local inhabitants of the Churiya included varied of ethnic groups including Chepang, an indigenous community living in remote hills. The inhabitants were found to use over 200 kinds of plant species for medicinal and other purposes such food, fodder, timber, and cultural values. The plants have been used to cure more than 65 different diseases including fever, diarrhea and dysentery, diabetes, fractured bones, cough and cold, cuts and menstrual disorder. The most and frequently used medicinal plants were: *Terminalia bellirica*, *T. chebula*, Sikari lahara (Local name), *Azadirachta indica*, *Pogostemon benghalensis*, *Phyllanthus emblica*, *Woodfordia fruticosa*, *Viscum album*, *Cuscuta reflexa* and *Asparagus racemosus*.

Study of the Churiya revealed that they contain major ecological elements of both Terai and Middle-Hills signifying its importance as a key landscape component of the Himalaya. The major tree species comprised of *Shorea robusta*, *Terminalia alata*, *Lagerstroemia parviflora*, *Adina cordifolia*, *Acacia catechu*, and *Semecarpus anacardium*. *S. robusta* and *A. catechu* are *protected species by the government. At least two rare or vulnerable species Dalbergia latifolia, and Alstonia sp. were also recorded during the study. In the understory, the most* common species were *Woodfordia fruticosa*, *Mallotus philippensis*, *Murraya koenigii*, *Phoenix sylvestris*, and *Clerodendron voscosum*. The ground coverage was very poor in most of the sites.

Some interesting aspects of tree species association were noted during the field survey *Pinus roxburghii*, reportedly a species above 900m asl, were seen growing naturally below 500m near Amlekhgunj and Hetauda. Similarly, patches of *Acacia catechu*, a typical riverine species, were also found on the hill-top of 800m asl in the central Churiya. *Acacia* made scrub type of forests in the Deukhuri, which is visible even from the East-West Highway. Species of mid-hill characters such as *Castanopsis indica*, *Schima wallichii* were also found at some sites of Churiya. In eastern part, Schima was recored up to 300m asl, the lowest altitude record for the species. In the far west Churiya across Karnali river, temperate species *Quercus* in association with *Shorea*, a typical tropical species was recorded.

Longitudinal variation of species association were also noted, such as in the eastern side of the study area *Lagerstroemia parviflora* were associated with dominant species, mostly *Shorea robusta* while in the western part *Anogeissus latifolia* were mostly associated in the forests.

Conclusion

Now, there is a growing concern for the conservation of Churiya in Nepal. Such concern is mainly because for three robust reasons:

1) once, contiguous the lowland Terai forests have fragmented beyond restoration;
2) protected areas and their buffer zones have been inadequate in large-scale conservation; and
3) rapid deterioration of the Churiya needs to be addressed properly as they are the only land bridge for biodiversity conservation at landscape level. ■

Dr. Bhuju is Chief Investigator of Churiya Ecology Project, initiated by Resources Himalaya.

He can be contacted at:
Royal Nepal Academy of Science and Technology
GPO Box 3323, Kathmandu, Nepal
e-mail: dineshb@mail.com.np

Behavioral development in human being

Indradev Sahu & Siddhi Bir Karmacharya

Human being is different from other animals by his imaginative gifts. He can combine his talents in more complex and intimate ways. Biology rests on the firm Darwinian foundations of shared evolutionary history of living organisms, common ancestry, adaptation and natural selection. Man alone has been able to shape his environment; his survival in hospitable surroundings determined more by his inventive abilities, rather than the slow and seemingly limited process of biological adaptation by natural selection. Man is not the most majestic of creatures… . But he has what no other animal possesses, a jig – saw of faculties which alone, over three thousand million years of life, make him creative (Balaram, 2001).

The fertilized egg from which each person develops is barely visible to the eye. The adult human body consists of million upon million of cells dong different things. Yet it is obvious that experience, education and culture make a big difference to how people behave whatever their genetic inheritance. The behavioral and psychological development is explained in terms of the exclusive importance of one set of factor either genetic or environmental. When somebody has conducted a clever experiment demonstrating an important long-term influence on behavior, they have good reason to feel pleased. Debates about behavioral and psychological development often degenerate into sweeping assertion about the over-riding importance of genes or crucial significance of environment.

Behavioral development means understanding the biological and psychological processes that build a unique adult from a fertilized egg. The rise of sociobiology and evolutionary psychology led to a temporary eclipse of developmental approaches to behavior.

1. Genetic materials

Long before genes and DNA were discovered, breeders took this as a beautiful fact of life, even though they had no idea how inheritance of human behavior has been greatly helped by comparing genetically identical twins with non-identical twins. Identical (or monozygotic) twins are genetically identical because they are derived from the splitting of a single fertilized egg. Non-identical (dizygotic) twins are developed from two fertilized eggs. So they are genetically as dissimilar as two siblings born at different times.

If identical twins are no more alike than non-identical twins in a given behavioral characteristic, then this suggests that the genetic influence on those characteristics is weak. Conversely, the mechanism of inheritance is to be through the nuclear genes.

Another way of exploring genetic influence on the behaviour is to compare the twins who have been reared apart with the twins who have been reared together. The appearance, behavior and personality of identical twins who have been reared apart are startlingly similar.

Some well-conducted statistical surveys have revealed that on a range of measures of personality, the identical twins who have been reared apart are more like each other than the non identical twins who also been reared apart. The inescapable conclusion is that some observable aspects of individuals' behavior are influenced by inherited factors (Bateson, 2001).

Further evidence for genetic influences comes from observing patterns of behavioral Growth development. Mental growth spurts are found in children's capacities for complex through and reasoning, and individual children differ in the chronological ages at these developmental spurts occur.

2. Experience Matters

There is the astonishing variation among humans in language, dietary habits, marriage customs, childcare practices, clothing, religion, architecture, art and much else besides. Nobody could doubt remarkable the human capacity for learning from personal experience and learning from others.

Early intervention can benefit the disadvantage child, but in ways

that had not been fully anticipated.

A large Headstart government program was designed to boost children's intelligence by giving them educational experience before starting school. The children's who had received the Headstart experience displayed an initial, modest boost in their IQ scores, but these differences soon diminished after a few years (Bateson, 2001). Striking differences were found between the children as they grew up.

3. Developmental Processes

The genes might be linked to a blueprint of a building of at least as far as behaviour is concerned. In blueprint, the mapping works both ways. Starting from a finished home, the room can be found on the blueprint just as the room's position is determined by the blueprint, which is not true for genes and behaviour in either direction.

The genetic difference between two groups is associated with a difference in behaviour. Even in compact environmental conditions, the developmental outcome depends on whole gene team. Particular combination of genes has particular effects, in the same way as a particular collection of ingredients may be used in cooking particular disc; a gene that fits into one combination may not fit into another.

The adult human brain has around one hundred thousand million (10^{11}) neurons each with hundreds or thousands of connections to other neurons. Since the behaviour of the whole animal is dependent on the whole brain, it is not sensible to ascribe single aspect of behaviour to a single neuron.

Nothing happens in isolation, the products of genes and the activities of neurons are all embedded in elaborate networks. Each behaviour patterns of psychological characteristics is affected by many different genes, each of which contributes to the variations between individuals. The effect of any one gene also depends on the actions of many other genes. Modern technology allows particular genes to be knocked out of action.

Genes store information coding for the amino acid sequences of proteins. They do not code for the parts of the nervous system and they certainly do not code for particular behavioral pattern. Any one aspect of behaviour is influenced by many genes, each of which may have a big or a small effect. Conversely, any one of the many genes, can have a major disruptive effect on a particular aspect of behaviour.

The main behavioral consequence of genetic defect is a lack of sexual interest in member of the opposite sex. Cells that are specialized to produce a chemical messenger called gonadotropin – releasing hormone (GnRH) are formed initially in the nose region of the foetus. Normally the hormone producing cells would migrate in to the brain. As a result of genetic defect, the surface properties are changed and the cells remain dammed at the nose. The pathway from gene to behaviour is long, complicated and indirect.

Learning is the most obvious way in which individual interact with, and are changed by their environment. Learning entwined in the process of human behavioral development, adapting individuals' behaviour to local conditions, enabling them to copy the behaviour of more experienced people, and fine tuning preference and action that were inherited from previous generations. A single development ingredient, such as a gene or a particular form of experience, might produce an effect on behaviour, but this recently does not mean that it is the only thing that matters. ■

Indradev Sahu
Assistant Lecturer of
Central Department of
Environmental Science
Tribhuvan University

&

SiddhiBir Karmacharya, Ph.D.
Professor and Head of
Central Department of
Environmental Science
Tribhuvan University

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B. Sc. Meteorology:
An Overview

The Bachelor Degree of Science (B.Sc.) in Meteorology was introduced in 1973 at Tri Chandra Multiple Campus (formerly Tri-Chandra College), Tribhuvan University (TU). This is the only institute in Nepal where B.Sc. Meteorology programme is available for intellectual pursuit and career development.

Discharge measurement. Students at fieldwork

Although in the beginning it was two years course, three years B. Sc. Meteorology was introduced in 1996 to meet the following objectives.

1. To upgrade the quality of the B.Sc. programme so that TU science graduates could compete academically with the graduates from other Asian universities

2. To broaden the intellectual horizon of the students

3. To make the B.Sc. programme more practical and relevant to the professional needs of national development and,

4. To provide the students with in-depth knowledge in the area of specialization

How to use theodolite? Students at fieldwork.

B.Sc. meteorology is designed in such a way that it is a platform for acquiring a basic ground for scientific research and further pursuing higher studies as well as research career. The course of the degree contains theory and practical

papers with field-works and project reports.

The students are exposed from basic to advanced knowledge in various fields of meteorology including agro-meteorology, hydro-meteorology, hydrology, surveying, computer programming skills (FORTRAN) and introductory on remote sensing technology.

The Master degree (M.Sc.) in meteorology is also available at Tribhuvan University, Kirtipur since 1988.

Students' visit to Meteorological Forecasting Division at Kathmandu Airport

Significance of Meteorology

Meteorology, the science of atmosphere, which deals with weather, climate and water has its importance in different fields from agriculture to aviation, and from tourism to trade and therefore it influences virtually all human activities.

Agriculture production can be increased if the climate and weather of the region are well understood in advance. Meteorology has a very close relation with water induced disaster management. Every year recurring impact of natural disasters such as flash floods, landslides and severe storms can be alleviated through weather forecasting and warning. Besides, meteorology has a significant role in water resources management, food security and pollution control.

Atmospheric phenomena have vast influences on people whether they are driving across the country or flying 12 Km above the land or over ocean. Meteorology is important for aviation not only for making flights safe but also to help in the efficiency, punctuality and economy of the flight, which in terms of money cost a great deal.

Similarly, weather forecasting is vastly used for public safety, controlling diseases, health problems, controlling fire, conducting various researches and expeditions. Moreover, climate change is a burning issue in the present context. The climate related studies are very important for adaptation and to reduce the vulnerability to climate change.

Group photo after a talk program at the Department. Photo by Prasamsa Singh

People are interested to know not only tomorrow's weather today for their daily life but also keen on how weather and climate have shaped human culture throughout history including direct influence of weather on literature, music, folklore, art and religion etc.

In summary, meteorology plays a vital role directly and indirectly in nation's socio-economic development and protection of the environment.

Scope of Degree in Meteorology

Many countries around the world are taking advantage of knowledge and advanced products of meteorology for socio-economic upliftment through vigorous research. However in Nepal's context, the awareness on the significance of Meteorology is lacking. This is mainly because of the research gap in meteorology in Nepal. Therefore the country needs human resources with expertise in the field to fill this gap and thus graduates in meteorology

have greater scope.

Moreover, graduates with this degree can work in other disciplines like water resources management, climate change studies, environmental science, energy and agriculture sectors.

The Alumni's of this department are either working in the same discipline or other related fields at different organizations/institutions as meteorologist/hydrologist/weather forecaster/ teacher/research scholar/consultant etc. in Nepal and abroad. Some of them are studying higher degrees abroad. The followings are the organizations/institutions where the products from Department of Meteorology are employed.

1. Department of Hydrology and Meteorology, His Majesty's Government of Nepal

2. Academic Institutions/Universities in Nepal and abroad

3. Civil Aviation Services

4. NGOs and INGOs

5. Consultancy services in Nepal and abroad

Future Plans

1. Adopt modern technologies and methodology for teaching

2. Develop joint proposals with national and international institutions/organizations for collaborative researches thus by engaging the students on research works

3. Invite expertise from different organizations to give lectures on a regular basis ■

Contact Details

Dhiraj Pradhananga
Head
Department of Meteorology
Tri-Chandra Multiple Campus
Ghantaghar, Kathmandu, Nepal

E-mail: tcmet@enet.com.np
Phone: 977-1- 4269 080

Sustainability

Prakash Tandan

Having a chance to live
Let's try to be a live
We have an earth, the small earth
Let's try to decorate it

First I then only we
What can be done by myself
See the around in view ecological
Recycle the product like plastic

Destroy the thing that decompose
For the organic, there's compost
Use the thing just in necessitys
This is the voice of sustainability ■

Gandhi, in course of his freedom fight, was in a village of India. He repeated his morning job, but the landlord of the house noticed one thing, which surprised him. Gandhi used to brush his teeth with a same '*nim* stick' for about a week. Seeing this, the landlord, curiously asked Gandhi, "Respective, we have many *nim* trees here, why are you using the same *nim* stick repeatedly? Gandhi in turn smilingly replied, *"Is it better to use more than necessity, even if it is abundant?"* ■

Together we stand for *Sustainable Lifestyles*

A sustainable transport

Mr. Joel Meyer from New Hope Lifestyle Program presenting students for healthier lifestyle in a program organized by The Small Earth-Nepal

A sustainable energy technolgy: Traditional water mill in a rural area of Nepal needs attention for recognition and improvement!