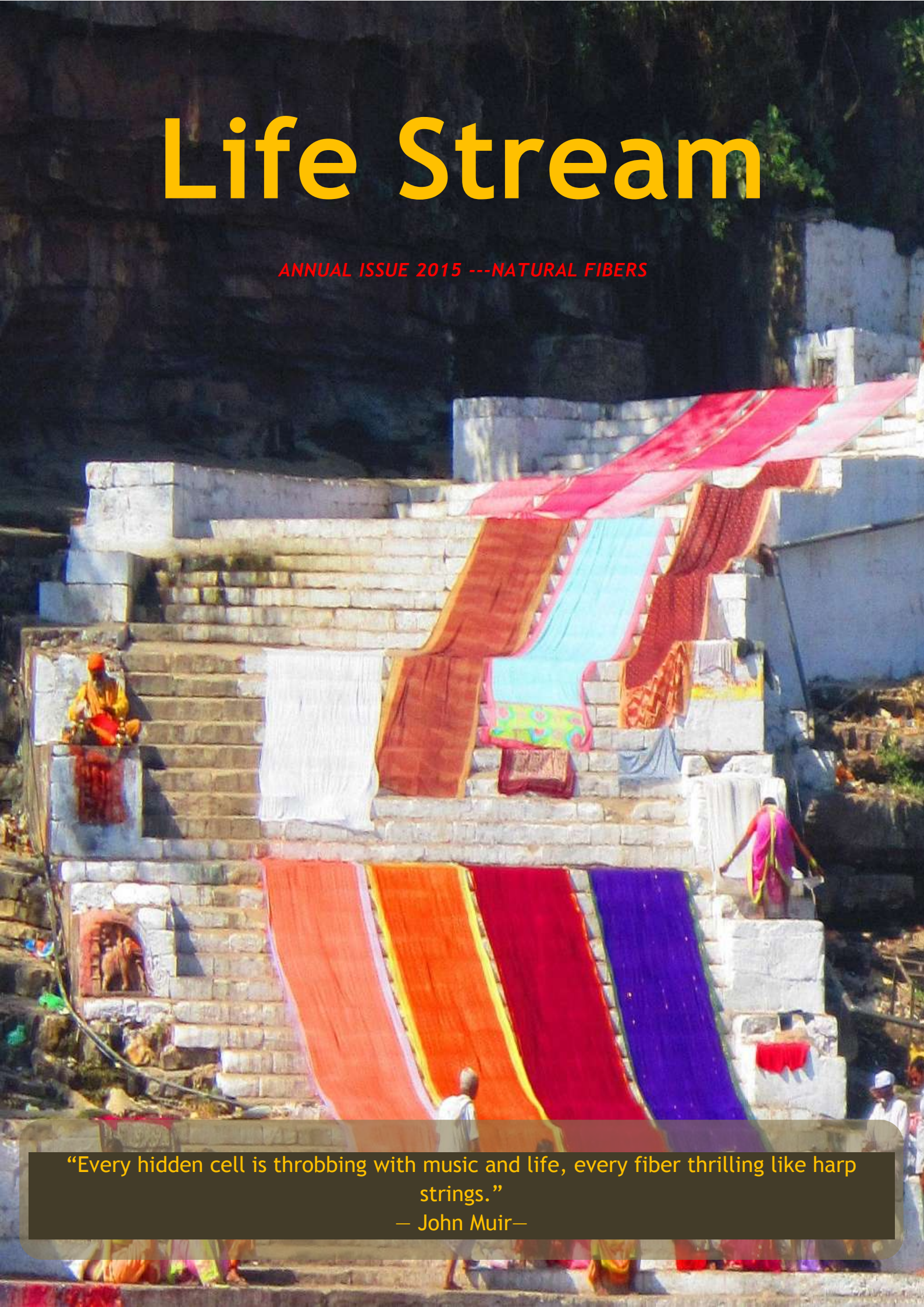


Life Stream

ANNUAL ISSUE 2015 --- NATURAL FIBERS



“Every hidden cell is throbbing with music and life, every fiber thrilling like harp strings.”

— John Muir—

THEME : NATURAL FIBERS**CONTENTS**

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WE PRESENT

Natural fibers have been inter-woven into our culture from the very beginning of our civilization. Although natural fibers are primarily used in making clothes, they are also used for a variety of other purposes. Seeds of some of these plants (coconut, flax) are used as food; coconut, flax and cotton seeds are also used for extracting oil; yet others are used as fodder (cotton seed); the fibers are used for making bags, mats and a host of other useful household goods. Those derived from animals like fibers, wool and fleece provide us with natural warmth.

Today the onward march of synthetic products are rendering the lives. Markets are flushed with cheap and convenient to that these new products are not bio-supports them is not sustainable.



technology and stiff competition from use of natural fibers redundant in our daily synthetic products which are mass produced, handle/maintain. However, it should be noted degradable, and, that the economy which Millions of people who are dependent on natural fibers for their livelihood will be thrown out of employment, once we completely switch over to synthetic products.

Spinning and weaving have held communities together. A humble Charkha was the icon of a nation's struggle to secure its freedom only a century ago. Spinning and weaving also provide the rural communities with supplementary income. We may also ask ourselves whether the gentle creatures which gift us wool and fibers and who have been with us after centuries of domestication and rearing should disappear from our daily lives altogether. Thus for ethical, ecological and economic reasons we ought to support revival of natural fibers in our daily life.

*Luckily for us innovations are helping a comeback for natural fibers, which include scientific cultivation of plants and rearing of animals/efficient extraction of produces /more end uses/sustainable use of waste products / development of composite products, other new technological applications, etc. However, we have to go a long way in this direction. We are happy to note that the year 2009 was celebrated as the **International Year of Natural Fibers** with the objective of drawing world attention to the protection and promotion of natural fibers.*

*As usual our team has collected and collated information from various sources, including the internet, print as well as electronic media and added our own experience and knowledge to it to make this issue informative and entertaining . We present here the Annual Issue of **Life Stream 2014** on the theme of **Natural Fibers**.*

LIFE STREAM TEAM

“So powerful, in fact, is simple string in taming the world to human will and ingenuity that I suspect it to be the unseen weapon that allowed the human race to conquer the earth, that enabled us to move out into every econiche on the globe during the Upper Paleolithic. We could call it the String Revolution.”

— Elizabeth Wayland Barber,

NATURE: FIBERS FROM NATURE

Natural fibers are Nature's gifts to mankind. They have been used innovatively by man to meet a variety of human needs, over centuries. Today they have been mostly displaced by the cheaper, easy to handle synthetic fibers. In today's world are synthetic fibers the only option before us? We need to think deeply on this question.

WHAT ARE NATURAL FIBERS?

Natural fibers are hair like raw materials of animal, vegetable or mineral origin and can be made into non-woven fabrics such as felt or after spinning into yarns or woven cloth. They can also be used as components of composite materials.

Natural fibers have been a part of our life since ancient times. Fibers such as jute and coir have been cultivated since antiquity. According to wikipedia, fragments of cotton articles dated from 5000 BC have been excavated in Mexico and Pakistan and that the use of silk began in China in the 7th century BC. The oldest wool textile, found in Denmark, dates from 1500 BC, and the oldest wool carpet, from Siberia, from 500 BC.

According to www.naturalfibres.com, each year, farmers around the world harvest about 35 million tons of natural fibers from a wide range of plants and animals and that those fibers form fabrics, ropes and twines that have been fundamental to society, since the dawn of

civilization.

TYPES OF FIBERS

Category	Description
Seed fiber	Fibers collected from seeds or seed cases. e.g. cotton and kapok
Leaf fiber	Fibers collected from leaves. e.g., sansevieria, fique, sisal, banana and agave.
Bast fiber	Fibers are collected from the skin or bast surrounding the stem of their respective plant. These fibers have higher tensile strength than other fibers. Therefore, these fibers are used for durable yarn, fabric, packaging, and paper. Some examples are flax, jute, kenaf, industrial hemp, ramie, rattan, and vine fibers.
Fruit fiber	Fibers are collected from the fruit of the plant, e.g. coconut (coir) fiber.
Stalk fiber	Fibers are actually the stalks of the plant. E.g. straws of wheat, rice, barley, and other crops including bamboo and grass. Tree wood is also such a fiber.



Plant fibres



Abaca -Once a favored source of rope, abaca shows promise as an energy-saving replacement for glass fibers in automobiles



Coir -A coarse, short fiber extracted from the outer shell of coconuts, coir is found in ropes, mattresses, brushes, geo-textiles and automobile seats



Cotton - Pure cellulose, cotton is the world's most widely used natural fiber and still the undisputed "king" of the global textiles industry



Flax -One of nature's strongest vegetable fibers, flax was also one of the first to be harvested, spun and woven into textiles



Hemp -Recent advances in the "cottonization" of hemp fiber could open the door to the high quality clothing market



Jute -The strong threads made from jute fiber are used worldwide in sackcloth - and help sustain the livelihoods of millions of small farmers



Ramie - Ramie fiber is white, with a silky luster, and is one of the strongest natural fibers, similar to flax in absorbency and density



Sisal - Too coarse for clothing, sisal is replacing glass fibers in composite materials used to make cars and furniture

Animal fibres



Alpaca wool -Alpaca is used to make high-end luxury fabrics, with world production estimated at around 5 000 tones a year



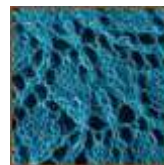
Angora wool -The silky white wool of the Angora rabbit is very fine and soft, and used in high quality knitwear



Camel hair -The best fiber is found on the Bactrian camels of Mongolia and Inner Mongolia, and baby camel hair is the finest and softest



Cashmere -Cashmere is exceptionally soft to the touch owing to the structure of its fibers and has great insulation properties without being bulky



Mohair -White, very fine and silky, mohair is noted for its softness, brightness and receptiveness to rich dyes



Silk Developed in ancient China, where its use was reserved for royalty, silk remains the "queen of fabrics"



Wool - Limited supply and exceptional characteristics have made wool the world's premier textile fiber

(Courtesy: FAO)

We cannot live only for ourselves.
A thousand fibers connect us with
our fellow men---Herman Meville

CLASSIFICATION

Fibers are classified into three types: natural fibers, which consist of plant and animal fibers, and man made fibers, which consists of synthetic fibers and regenerate fibers. Plant fibers include seed hairs, such as cotton; stem (or bast) fibres, such as flax and hemp; leaf fibres, such as sisal; and husk fibres, such as coconut as noted above.

Animal fibers generally comprise fiber or wool taken from animals or hairy mammals ; silk fiber secreted by glands of insects during the preparation of cocoons and avian fiber fibers from birds, e.g. feathers and feather fiber.

COMPOSITION

Plant fibers are essentially made of three structural polymers-- cellulose, hemicelluloses and lignin. Animal fibers are made of proteins such as collagen, keratin and fibroin. Wool is keratin and silk from silk worms is fibroin and sericin.

IMPORTANT PLANT FIBERS

COTTON

Cotton is a soft fiber that grows around the seeds of the cotton plant. It is presently the world's most used fiber. **Every part of the cotton plant is useful, and we see its application in industries such as apparel, home furnishings, medical and surgical, automobile, etc**



Cotton (en.wikipedia.org)

The plant is a shrub native to tropical and subtropical regions around the world, including the Americas, Africa, and India. The greatest diversity of wild cotton species is found in Mexico, followed by Australia and Africa. Cotton was independently domesticated in the Old and New Worlds.

The invention of the cotton gin lowered the cost of production that led to its widespread use, and it is the most widely used natural fiber cloth in clothing today. Current estimates for world production of cotton are about 25 million tonnes or 110 million bales annually, accounting for 2.5% of the world's arable land. China is the world's largest producer of cotton, but most of this is used domestically.

ORGANIC COTTON

Organic cotton is cotton that is grown

" I think natural fibers look better over time. The more you wear them, they look even better.

John Rocha

using methods and materials that have a low



impact on the environment.

JUTE

Jute is a long, soft, natural fiber that can be spun into coarse, strong threads. Jute is commonly used in the production of bags, sacks, canvas, rope, jute yarn, twine and backings for carpet. It is one of the most important natural fibers after cotton in terms of cultivation and usage. **Jute is also one of the most affordable natural fibers**. Cultivation of Jute is dependent on the climate, season, and soil. Almost 85% of the world's jute cultivation is concentrated in the Ganges Delta. India currently is the largest producer of jute in the world.



"Collecting jute"; a painting (artist unknown), 1950s-60 (en.wikipedia.org)

Bangladesh is the second largest producer of jute fiber now, and China the third largest in terms of jute cultivation. The world production of jute reported for the year 2009 was 3,583,235 tonnes, out of which 1,924,326 tonnes were produced in India, and, 1,523,315 tonnes by Bangladesh.

HEMP



Credit: phys.org

According to wikipedia Hemp is a commonly used term for high growing varieties of the Cannabis plant and its products, which include fiber, oil, and seed. Hemp is a fiber plant similar to other bast (stem) fibers like flax, kenaf, jute and ramie and it possesses properties similar to them. **A number of products such as hemp seed foods, hemp oil, wax, resin, rope, cloth, pulp, paper, and fuel are obtained from Hemp. Marijuana, a commonly used drug, is obtained from other variants**

"Nature uses only the longest threads to weave her patterns, so that each small piece of her fabric reveals the organization of the entire tapestry----

Richard Feynman

of the herb *Cannabis sativa*.

France remains the largest hemp fiber producer in Europe with 50,000 tons yearly . China and Russia are also important producers.

FLAX



Flax tissues, Tacuinum sanitatis, 14th century.en.wikipedia.org

Flax (also known as linseed), with the binomial name: *Linum usitatissimum*, is a member of the genus *Linum* in the family *Linaceae*. It is a food and fiber crop that is grown in cooler regions of the world. Today, Canada is the world's leader in the production and export of flax.



World production of flax reported in 2011 was 1,602,047 metric tonnes, with Canada producing 368,300 metric tonnes and China 350,000 metric tonnes.

Dressing is an agricultural act, if we want to wear natural fibers rather than plastic fibers----**Jane Milburn**

OTHER IMPORTANT FIBERS



Sisal Plant (en.wikipedia.org)

Sisal fibres are obtained from *Agave sisalana*, a native of Mexico. The hardy plant grows well all year round in hot climate and arid regions, which are often unsuitable for other crops. A coarse and strong fibre, Sisal is being increasingly used in composite materials for cars, furniture and construction as well as in plastics and paper products.

Abaca, called Manila hemp, is mainly used for the production of speciality papers. **It is extracted from the leaf sheath around the trunk of the abaca plant (*Musa textilis*), a close relative of the banana, native to the Philippines,** and, widely distributed in the humid tropics.



Coir (en.wikipedia.org)

Coconut palm (*Cocos nucifera*), is grown on 10 million ha of land throughout the tropics. Coir is a coarse, short fiber extracted from the husk of coconuts. It is considered to be the thickest and most resistant of all commercial natural fibers, and has a low decomposition rate. Coir is a material which is widely

used to overcome the problem of erosion. When woven into geo-textiles and placed on areas in need of erosion control, it promotes new vegetation by absorbing water, and, preventing top soil from drying out.



Coir products (coirboard.govt.in)

Linen is a plant fiber made from the stalk of the flax plant.

Ramie, also known as China grass, is one of the oldest and strongest natural plant fibers principally used in fabric production.

Rayon: While rayon is man-made, it is not considered a synthetic but a manufactured regenerated cellulosic fiber. **Made from cellulose, rayon is a very versatile fiber and exhibits the same properties as other natural fibers.** It can imitate the feel and texture of silk, wool cotton and linen. The fibers are easily dyed in a wide range of colors.

Properties of natural fibres depend mainly on the nature of the plant, locality in which it is grown, age of the plant, and the extraction method used. These natural products can be used as interior decorated fabrics such as bed linen, kitchen and table linen, curtains, aprons and bags.



ANIMAL FIBERS

The animal fibers used most commonly both in manufacturing as well as in hand spinning are wool from domestic sheep and silk. Also very popular are alpaca fiber and mohair from Angora goats.

SILK

Silk is a natural protein fibre, some forms of which can be woven into textiles. A variety of wild silks, produced by caterpillars other than the Mulberry silkworm, have been known and used in China, South Asia, and Europe since ancient times.

According to wikipedia silk fabric was first developed in ancient China, with some of the earliest examples found as early as 3500 BC. India has a long history of using silk. Recent archaeological discoveries in Harappa and Chanhu-daro suggest that sericulture, employing wild silk threads from native silkworm species, existed in South Asia during the time of the Indus Valley Civilization dating between 2450 BC and 2000 BC.

Silk is used in making upholstery, wall coverings, window treatments, rugs, bedding and wall hangings. Silk has had many industrial and commercial uses, such as in parachutes, bicycle tires, comforter filling etc. However, due to the arrival of synthetic fibers its commercial use has declined.



“Keep flax from fire, youth from gaming”

- Benjamin Franklin

*A traditional Banarasi sari with gold brocade
(en.wikipedia.org)*

The process of harvesting the silk from the cocoon kills the larvae. Therefore, Gandhi was critical of silk production .It led to promotion of cotton and a type of wild silk made from the cocoons of wild and semi-wild silk moths.

“Why use up the forests which were centuries in the making and the mines which required ages to lay down, if we can get the equivalent of forest and mineral products in the annual growth of the hemp fields?—Henry Ford

WOOL

Wool is the most commonly used animal fiber. The most valuable of wools is Merino wool which is very fine, long and staple. It has a natural stretch and elasticity and is ideal for manufacture of clothing and home furnishings. Wool from a wide range of animals can be



used for handicrafts and garments.

ALPACA



Camel Family (Alpaca/Llama/Camel/Vicuna)

Alpaca is a kind of wool warmer than the sheep's wool and lighter in weight. Yarns made from the fibers of these animals are very soft, lustrous, lightweight and warm.

The down hairs of the Llama, a closely related animal, produce a soft yarn, also suitable for the manufacture of apparel. Camel's hair is an extremely soft and fine fur collected from the undercoat of the camel. Camel's hair can be used alone, but is most often combined with fine wool for over coating, top coating, sportswear, and sports hosiery.

Vicuna, similar to Alpaca, but small and wild, also belongs to the Camel family. It yields the finest animal fiber in the world which is rare and very expensive.

ANGORA

Angora wool or Angora fiber refers to the down coat produced by the Angora rabbit which are of many types - English, French, German and Giant. Angora is prized for its softness. Angora fiber comes in various shades .

The future of our nation depends on our ability to produce food and fiber to sustain the world---Phil

Bredesen

Life Stream |



BISON

Bison is the soft undercoat of the American Bison. This undercoat is shed annually and consists of fine, soft fibers which are very warm.

CASHMERE

Cashmere wool is wool obtained from the Cashmere goat. Cashmere, also known as the fiber of kings, is produced from the fine, soft undercoat of hair of the Kashmir goat. Sixty percent of the world's supply of cashmere is produced in China, Mongolia and Tibet, and the remainder from Turkey, Afghanistan, Iraq, Iran, Kashmir, Australia and New Zealand. Cashmere yarn is extremely soft, lightweight, yet very warm. As each Kashmir goat is capable of producing only a small quantity of fiber, Cashmere is wool very expensive.

MOHAIR

Mohair is a silk-like fabric or yarn made from the hair of the Angora goat. It is both durable and resilient. It is notable for its high luster and sheen, and is often used in fiber blends to add these qualities to a textile.

QIVIUT

Qiviut is the fine underwool of the musk ox. It is approximately eight times warmer than sheep's wool and does not felt or shrink.

FIBERS FROM OTHER ANIMALS

Fiber from animals such as llamas, camels, yak, and possums are used in hand spinning. These fibers are generally used in clothing. Horse hair is used for brushes, the bows of musical instruments and has many other uses. Chiengora is dog hair.

Challenges

After World War II, synthetic fibers have significantly displaced natural fibers, as synthetics are mass produced and cost effective. Unlike natural fibers synthetic fibers have uniform strengths, lengths and colors, which could be put to specific applications. The relentless competition from synthetics and the current global economic downturn also has affected the livelihoods of millions of people in developing countries, which depend on natural fiber production and processing.

Revival

There has been a revival of interest in natural fibers in the context of increasing oil prices as well as ecological/economic considerations . Now natural fibers are being put to new uses within the textile, building, plastic and automotive industries. Traditional textiles are being used as components of composite materials, in medical implants, and geo- and agro-textiles.

Agriculture is the foundation of manufacturers,
since the productions of nature are the materials of
art-----**Edward Gibbon**



"The Golden Book Gown" made of recycled book pages (en.wikipedia.org)

Today the trend in fashion is to have more sustainable designs, wherein a product is created and produced based on environmental consideration and its social impact. Use of non-woody fibers from field crops and agriculture residues could be a substitute for woody raw materials. Lot more serious research needs to be done in the area of developing new products.

Agricultural strategies need to be carefully planned to widen the scope of agriculture industry- from that focussed on food production to one also meets the needs of other industrial sectors such as paper and textiles, without affecting overall food security.

The way forward

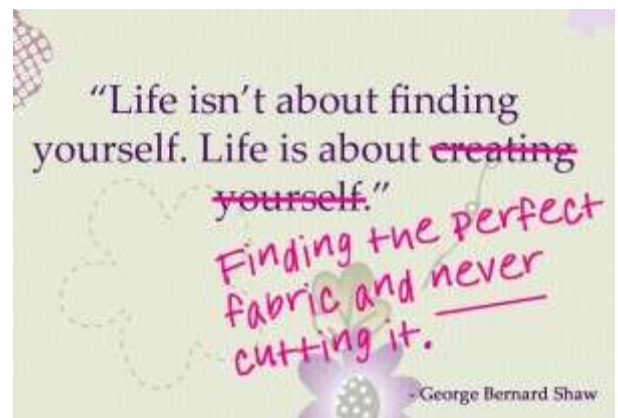
We have seen the variety of fibers that nature has provided us and the different products of beauty and utility the human hands have shaped from them. **The use of natural fibers is intimately linked to the way we choose to live.** Therefore, to live sustainably, we have no choice but to live with nature and the bounty she generously bestows on us.



Khadi spun from a charkha in India

(Credit: thebetterindia.com)

Ref: en.wikipedia.org/www.fao.org/
www.naturalfibres.com/www.britannica.com



The difference between style and fashion is quality--
-Giorgio Armani

MOTHER NATURE : WHAT ARE ALPACAS?

Have you ever wondered what are Alpacas? These are gentle, adorable and friendly creatures which yield Alpaca fibers. Highly prized for their luxurious fleece, the Alpacas are considered a treasure of the Andes Mountains and have been domesticated for thousands of years.

WHAT DO WE KNOW ABOUT THEM?



www.shutterstock.com · 182523065

The Alpaca is an animal indigenous to Peruvian Andean highlands. It is said that the Moche people of northern Peru often used alpaca images in their art. There are no known wild alpacas, though its closest living relative, the vicuña (also native to South America), are believed to be the wild ancestor of the alpaca. Vicuñas were first domesticated and bred into alpacas by the ancient tribes of the Andean highlands of Peru, Argentina, Chile and Bolivia.

Alpacas are classified as camelids along with camels and llamas,. Of the various camelid species, the alpaca and vicuña are the most valuable fiber-yielding animals: the Alpaca are known for the quality and quantity of its fiber, and the vicuña for the softness, fineness and quality of its coat. Unlike llamas, they were not bred to be beasts of burden; both were

bred specifically for their fiber. There are two breeds of alpaca; the Suri alpaca and the Huacaya alpaca.

According to www.aragonalpacas.com total population of these animals in South America is only around 5 million, of which about 80% are found in the highlands of southern Peru, where they are mostly still owned and raised native communities, as they have been since ancient Inca times. Further, the rare and exotic alpaca is a creature of antiquity that is rapidly gaining popularity around the world. Alpacas were exported from Peru in the mid-1980s and have become a premier livestock in North America and abroad.

HOW DO THEY LOOK LIKE?

Alpacas look like small llamas or long-necked camels with no humps. ‘They have shaggy necks and camel-like faces with thick lips, pronounced noses, and long ears. Their large, expressive eyes seem to exhibit both wisdom and childlike curiosity’. Easily domesticated, alpacas are friendly, gentle and curious. An adult alpaca generally is between 81 and 99 cm in height at the withers. They usually weigh between 48 and 84 kg (106 and 185 lbs).



HYBRIDS

Wikipedia mentions that there is a cross between alpaca and llama producing a

In a ball of yarn is the potential to make a dream that you have come true-**Melanie Falick**

material under the name "Huarizo". Crosses between the alpaca and vicuña have not proved satisfactory, as the crosses that have produced offspring have a very short fleece.

HABITAT

Alpacas live in the high mountain foothills and plateaux, at altitudes of 5,000 to 5,000+ metres above sea level, where daily temperatures fluctuate between 32°F and 104°F. Alpacas are kept in herds that graze on the level heights of the Andes of southern Peru, northern Bolivia, Ecuador, and northern Chile at an altitude of 3,500 m (11,500 ft) to 5,000 m (16,000 ft) above sea level.

WHY ARE THEY CALLED ALPACA?

According to bioweb.uwlax.edu in Peru Alpacas protect the sheep when they are out grazing in the Andes. **The Alpaca with its long neck is able to spot predators and protect the sheep like policemen; Alpaca is therefore, named Vicugna pacos —pacos means policeman.**



ALPACA FIBER



The hair of the alpaca is called 'fleece' or 'fiber' rather than 'fur' or 'wool.' **It is believed that two thousand-year-old Paracas textiles included alpaca fiber.** Alpaca fibers were used to make clothing for royalty, and, therefore called "The Fiber of the Gods".

The Alpaca has a very fine and light fleece. -- 'Thanks to a series of factors and a unique combination of natural circumstances, such as protein-free feed of ychu (natural Andean grass) and fungi plus extremely harsh weather conditions, these animals produce a fine hair of remarkable quality- softness, fineness, length, and strength , in different shades of colour'. Alpacas can be bred for specific color. Alpaca fleece occur in 22 natural shades ranging from black to silver and rose, white and gray, from mahogany brown to light fawn and champagne. All these features make alpaca a highly priced speciality textile fibre.

The fibers are water-resistant and also resistant to solar radiation, enabling the animal to adjust to extreme changes of temperature. Alpaca fibers are therefore a much sought after material.

"If you give the poor wool today, God you will have a sheep tomorrow"

— Vikrant Parsai



USES

Alpaca is used to make high-end luxury fabrics and outdoor sports clothing as alpaca fibers are 'soft and dense, or lustrous and silky'. Alpaca fiber is used for making a variety of knitted and woven items, which include blankets, sweaters, hats, gloves, scarves, a wide variety of textiles and ponchos in South America. Sweaters, socks, coats and bedding are also made out of the fibers.



Yarn spun from Alpaca wool En.wikipedia.org

In the textile industry 'alpaca' usually refers to the fibers of Alpacas from Peru. But now it

broadly refers to a specialised fabric made from alpaca fibers, and, also includes those made from similar fibers such as Mohair. However, traders make distinctions between alpacas and the several styles of mohair and other similar fibers.

In comparison with other natural fibres such as wool or mohair, the production of alpaca fibre is small: The price for alpacas in the US can range from US\$50 for a castrated male to US\$500,000 depending on breeding history, sex, and color.

Other uses: Alpacas are too small to be used as pack animals. Instead, they are bred exclusively for their fiber and meat. Alpaca meat was once considered a delicacy by Andean inhabitants which is said to be extremely lean and described as tasting somewhere between lamb and veal.

THE WAY FORWARD

We have seen that Alpacas are unique animals. **Their survival entirely depends on how we wish to deal with them.**

"We should remember in our dealings with animals that they are a sacred trust to us...[They] cannot speak for themselves." - said Harriet Beecher Stowe.

I am cut from a different clothe and they don't make that fabric any more--
Pink Achiever



fibers and materials/products made out of them are also critical. Application of appropriate technologies to improve efficiency would be welcome. Whichever way we look at, it the onus is on us humans. Let us not, however, forget that the survival of humans as a species depends on the survival of the entire eco-system.

Ref: www.aragonalpacas.com/
www.alpacacollectionperu.com Alpaca
Habitat - University of Wisconsin-La
Crosse/bioweb.uwlax.edu
[/www.alpacacollectionperu.com/en.wikipedia.org](http://www.alpacacollectionperu.com/en.wikipedia.org)

One could argue that all our choices ought to be based on hard-nosed economics. Selected breeders maintain their stocks with an eye on the niche-market for alpaca fibers. However, it should be remembered that Alpacas have been domesticated by centuries of breeding by Andean communities, and, provide livelihoods to many in the mountainous areas. There are no substitutes for the lovingly made fabrics at village homes. But can the communities continue doing what they have been doing for centuries together? **Now things are changing. Grazing lands are shrinking. Farm hands are no longer freely available. Rural youth migrate to urban areas in search of better employment and a better life. Cheap synthetics have penetrated even difficult and distant areas. Only by carefully selected interventions by the governments, by way of providing appropriate support and thus making rearing of animals, collection and processing of fibers economically viable, can help.**



Support for marketing processed

The rhythm of the needles create music for the soul-
anonymous

FARMING: BT-COTTON-FARMERS IN A SPIN?

---S.Jalaja

If one travels across the Sangrur-Mansa-Bhatinda belt of the State of Punjab in India, one could see acres and acres of cotton fields. On inquiry we are told that they are fields of Bt cotton. It is the same picture in other top cotton producing states like Gujarat, Maharashtra and Andhra Pradesh. India is now considered to be a major Bt cotton producing and exporting country.

On seeing those cotton fields some questions do arise in our minds. What is Bt-cotton? Is it beneficial to the farmers? Is it any way connected with farmer's suicides in India? In this article we try to find answers to these questions.



IMPORTANCE OF COTTON

Cotton is the largest and the most important fibre crop in the world. The Food and

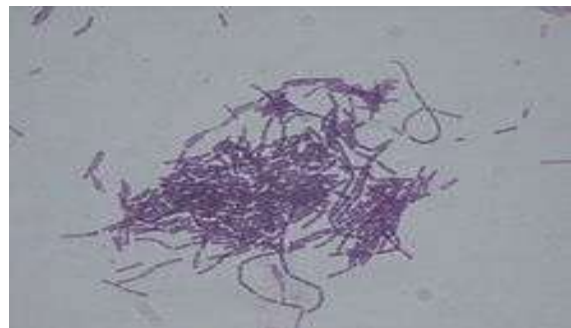
Sew much fabric, sew little time---quotemaster.org

Agricultural Organization (FAO) has estimated that its production approximately is around 25 million tons per annum. Globally, it accounts for almost 40% of the total textile fiber market.

The major cotton producers in the world are China, USA, India, and Pakistan. Bt cotton is also commercially grown in several countries like Australia, Mexico, South Africa, Argentina and Indonesia. Although many sub-Saharan countries produce substantial quantities of cotton, their quality is not considered to be sufficient to meet export demands.

WHAT IS BT COTTON?

Various types of pests attack cotton, causing extensive damage to the crops. Cotton, therefore, requires an intensive use of pesticides to fight the pests. The main pests in commercial cotton are lepidopteran larvae which have developed resistance to pesticides. Bt cotton, which is Genetically Modified (GM), was developed to reduce the heavy reliance on pesticides.



Gram-stain of *Bacillus thuringiensis* (Credit: grain.com)

HOW DOES IT WORK?

The bacterium *Bacillus thuringiensis* (Bt) naturally produces a chemical harmful

only to some insects, like the larvae of moths and butterflies, beetles, and flies, but is harmless to other forms of life. **The gene coding for Bt toxin has been inserted into the genome of cotton plant, causing it to produce this natural insecticide in its tissues.** The Bt protein produced by the newly inserted genes in Bt cotton kill the Lepidopteran larve, the main pests in commercial cotton. The need to use large amounts chemical insecticides is thus eliminated.

Bt Cotton seeds were introduced by Bollgard Cotton, a trade mark of the Monsanto group to the U.S. in 1996, according to the University of California, San Diego, and was aimed at reducing the effects of the tobacco bud worm.

BT COTTON IN INDIA



(Credit: www.agritech.tnau.ac.in)

Though cotton has been cultivated predominantly in many parts of India, its productivity is one of the lowest in the world, mainly due to attacks by pests/insects and low coverage of irrigation facility. Despite using pesticides, farmers are unable to control boll worm, the main pest in cotton, that ravages up to 80 per cent of crop output.

The soil is the great connector of lives, the source and destination of all---**Wendell Berry**

Bt cotton was introduced in India in March 2002 for commercial cultivation for protecting the crop from bollworm attack. According to the Director General of the Indian Council of Agricultural Research (ICAR), India uses about half of its pesticides on cotton to fight the bollworm menace. The use of Bt-Cotton in India has grown exponentially since its introduction. Recently, India has become the number one global exporter of cotton and the second largest cotton producer in the world.



(credit: www.agritech.tnau.ac.in)

According to the Union Agriculture Ministry, India, almost 90% of the cotton cultivation area, at present, is under Bt Cotton. The data, based on estimates for the year 2010-11, shows that out of total area of 111.42 lakh hectares under cotton cultivation, 98.54 lakh hectares are under Bt Cotton, of which Gujarat, Maharashtra and Andhra Pradesh are the top producers of cotton with 105, 88 and 53 lakh bales cotton respectively, and 81%, 92% and 98% of their total cotton cultivation area under Bt cotton. The ICAR attempted to develop a cheaper Bt-Cotton variety with seeds that could be reused. It had poor yield and also allegedly contained a DNA sequence owned by Monsanto; hence was removed within a year.

In parts of India cases of acquired resistance against Bt-Cotton have been reported.

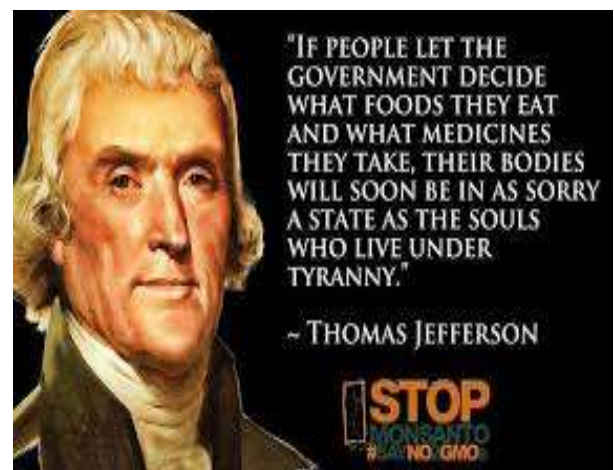
The cultivation of Bt cotton in India has now reached the saturation limit, as there is very little area available for it to expand. The GM-seed market, launched with a massive advertising campaign, is now worth an estimated \$364m. The seed companies have promised to introduce new varieties, which offer even greater resistance, while consuming less water and fertiliser, while those opposed to Bt cotton are calling for a total ban on it in India.

CONTROVERSIES

Introduction of Bt cotton has been mired in controversies, due to its alleged links with seed monopolies and farmer suicides. According to a report published in The Guardian news paper dated 5 May 2014, India is experiencing its biggest wave of suicides among cotton farmers and that more than 270,000 Indian cotton farmers have killed themselves since 1995-----“ Campaigners say a contributing factor may be the high price of genetically modified seeds flooding the market, which is piling pressure on poorly paid growers, forcing many into a cycle of unmanageable debt. **Most cotton farmers are barely able to cover their out put costs, let alone make any profit to support their families. India** – which competes with the likes of the US, where cotton is heavily subsidised – is grappling with the rising costs of genetically modified seeds, fertilizers and pesticides, as well as the impact of unpredictable weather patterns--- -----” Some observers have also linked the deaths to the introduction of costly genetically modified seeds, fertilizers and insecticides. **Many farmers turn to loan-sharks to pay for these items, for, unfavourable weather conditions, or**

even a mere dip in the global price of cotton, can spell disaster for growers. Bt seeds can cost up to four times more than traditional varieties and require irrigation (about 80% of farmland in Maharashtra is rain fed), as well as greater quantities of pesticides and fertilizers’.

On the contrary the link between the introduction of Bt Cotton to India and a surge in farmer suicides has been refuted by some studies, with the conclusion that the farmer suicides actually having fallen since the introduction of Bt cotton. Some experts are of view that ---“Bt cotton has dramatically altered the relationship between farmer and seed. Before the introduction of Bt cotton, less than 40% seeds used by the farmers were hybrids which is now over 90%. According to available reports, **field trials have shown that farmers who grew the Bt variety obtained 25%–75% more cotton than those who grew the normal variety.** Also, Bt cotton requires only two sprays of chemical pesticide against eight sprays for normal variety”. However, these claims are disputed by leading Farmer’s Groups.



Let there be worse cotton and better men-**Ralph Waldo Emerson**



(Credit: Guardian.com)

CONCERNS

Several concerns have been expressed about Bt cotton. Some of them are listed below:

- Traditional varieties have been developed by generations of selective breeding. Although their yields may be lower, unlike Bt Cotton, their seeds can be reused by farmers.
- Developing hybrid seeds is a costly and laborious technical process. As hybrid seeds cannot be reused, every year farmers must purchase fresh seeds.
- Monsanto's seeds are expensive and lose vigour after one generation.
- Cases of acquired resistance against Bt-Cotton were reported in parts of India in 2009. According to experts growing GM cotton requires adequate technical knowledge to get good results.
- To prevent diseases or insects developing resistance to GM varieties, local seeds must be planted in just the right proportions in the fields. Each of the 780 local varieties of cotton available is suitable only for a particular type of soil and have different fertiliser requirements. The farmers do not often comply with this requirement.
- Ten years after the introduction of GM cotton, local seed varieties have virtually disappeared. It is point out that “Small farmers have no idea what they're buying and even less idea how to grow these new varieties. Their traditional know-how is disappearing,”
- Bt cotton hybrids are pointing to drastic depletion of soil nutrients due to repeated cultivation.
- Crop failures and less yield from the use of transgenic seeds are causing suicides among Indian farmers.

There are controversies around GMOs on several levels, including whether growing them is ethical, whether food produced with them is safe, whether such food should be labeled and if so how, whether agricultural biotech is needed to address world hunger now or in the future, intellectual property and market dynamics etc.

“Don't judge each day by the harvest you reap but by the seeds that you plant.” — **Robert Louis Stevenson**

REPORTS FROM THE FIELD

In a news item was reported in the Times of India dated April 6, 2014, that the Government of Karnataka has issued a ban against Maharashtra Hybrid Seed Company (Mahyco) from selling two popular Bt cotton seed varieties in the forthcoming 2014-15 crop year (July-June), following reports of lower crop yields. The Bt cotton seeds supplied by the company to farmers failed to give expected results and there was only 50% crop in 10,983 villages, affecting 54,150 farmers in seven districts. Further, the company has also been "black listed" to prevent it from participating in any tenders for supply of seeds. The notification banning the company from supplying seeds also said that the company failed to create awareness amongst farmers about pest control. The report also pointed out that there are no legal provisions for farmers to get compensation from the seed companies for crop failures.

Reports from the field also indicate that quite a few farmers cultivating Bt cotton still continue to use the same quantity of pesticides as followed in the past, partly because of poor awareness, and, partly due to fear of bollworm attack. **In fact, farmers do not distinguish between Bt and non-Bt varieties of cotton at the time of spraying pesticides. Many Bt cotton growers fear that the bollworm can attack cotton crop any time and therefore, they tend to use more quantity of pesticides.** Besides increasing cost of cultivation, the overuse of pesticides increases the social cost by polluting the environment as well.

Quite a few farmers have

Americans don't know if the food they eat has been genetically modified. People have a right to know what they are eating--**Bernie Sanders**

reported the problem of premature dropping of bolls from Bt cotton varieties. **Monsanto has admitted that the pink bollworm is resistant to first generation transgenic Bt-Cotton that expresses the single Bt gene Cry1Ac.** This was the first instance of Bt resistance confirmed by Monsanto anywhere in the world. Bollworm resistance to first generation Bt cotton was also identified in Australia, China, Spain and the respond by introducing a second generation cotton with multiple Bt proteins, which was rapidly adopted. However, the information gathered from the field seems to indicate that the seed company has not taken any serious effort to disseminate any information this in the field.

RESEARCH STUDIES

An empirical analysis based on a field-study reported in the Eco-Political weekly in its June, 2006 issue concluded that **the Bt cotton produces higher yields compared to the conventional varieties. But the higher profits from Bt cotton cultivation is mainly due to its higher productivity, and not higher output price. The cost efficiency as well as profit per hectare is also found to be higher with those farmers cultivating Bt cotton crop.**

The profit realized by Bt cotton growers is nearly 80 per cent higher than that of non-Bt cotton cultivators. The study also shows that the costs of cultivation required for Bt cotton crop is substantially higher than that of non-Bt crop. Further, contrary to the claim made by the seed company, Bt cotton has not reduced the consumption of pesticides. In fact, farmers cultivating Bt cotton crop have had marginally higher expenditures on account of pesticides.

The Tamil Nadu Agriculture University (TNAU Agritech) in its

reports based on results from extensive Bt cotton trials under farmer field conditions, conducted from 1998 to 2001 confirmed that Bt cotton with the Cry1 Ac gene provides effective and safe control of bollworm and related pests. Field trials have confirmed that, compared to conventional hybrids, Bt cotton can increase yields by up to at least 40%, reduce insecticide sprays by at least 50 % or more (decrease from 7 to 2 or 3 sprays on average) equivalent to savings of Rs 2500/hectare, and increase overall farmer income from Bt cotton from Rs 3500 to Rs 10,000 or more per hectare.

MAHYCO commissioned a nationwide survey by AC Nielsen-ORG MARG in 2003. The survey covered 3,063 from Maharashtra, Madhya Pradesh, Andhra Pradesh, Karnataka and Gujarat. The data showed that a yield increase by about 29% (range 18 to 40%) due to effective control of bollworms, a reduction in chemical sprays by 60% (range 51 to 71%) and an increase in net profit by 78% (range 66 to 164%) as compared to non-Bt cotton. The net profit was estimated to an average of Rs.7, 724 (range Rs. 5,900 to 12,696) per hectare.

Bt cotton now makes up 95% of China's vast plantations. The Guardian news paper in its issue dated 13 June 2012 quoted new research, published in the journal Nature, which involved monitoring both insect pests and predators between 1990 and 2011, in 36 sites across six big cotton-growing provinces in northern China, where about 2.6m hectares of cotton and 33m hectares of other crops – notably maize, peanut and soybean – are grown each year, by more than 10 million small-scale farmers.

Since its introduction in 1997, pesticide use has halved and the

“Many of the genetically modified foods will be safe, I am sure. Will most of them be safe? nobody knows---**Jeremy Rifkin**

study showed this led to a doubling of natural insect predators such as ladybirds, lacewings and spiders. These killed pests not targeted by the Bt cotton, in cotton fields, but also in conventional corn, soybean and peanut fields. Crops genetically modified to poison pests can deliver significant environmental benefits

THE WAY FORWARD

Activists are concerned about the toxicity and the ‘contaminative’ aspects of Bt seeds as reasons for its ban, but experts point out that “it is really the ‘corporatization’ of seed that is at the heart of most friction between them and crop companies, who are now pushing for Bt to be introduced in other plants such as brinjal. According to experts, nevertheless, there is overwhelming empirical data built up over the years to show that the Bt toxin does not, in anyway, impact human health. Or at least, the risks it poses aren’t yet detectable by current scientific risk assessment techniques and therefore beyond the realm of rational debate”.

Today Bt cotton is grown across more than 66m hectares around the world as reported in 2011. As mentioned research studies conducted so far indicate that Bt cotton has helped farmers get a significantly higher yield of cotton than conventional varieties. However, in rainfed areas farmers faced distress due to vagaries in the Monsoon. This together with higher input costs are compelling the farmers to borrow heavily from loan-sharks and have forced them into debt-traps and consequent suicides. **It could, therefore, be inferred that big farmers with assured irrigation, and the means to have costly inputs, are able to make use of Bt cotton efficiently to get higher yields**

and higher profits. However, it is the small and marginal farmers who

suffer. The environmental/health studies conducted so far also have not reported anything adverse about Bt cotton. Indications are that the Bt Cotton is here to stay. However, for it to be successful and widely accepted by farmers a number of policy measures need to be taken by the governments.

- Even as corporate participation in this sector increases, there is a need for an independent regulator.
- The seed cost of Bt cotton needs to be reduced through short-term measure; direct subsidy could be extended for Bt cotton seed for a specific period of time.
- The role of the public sector should be expanded in transgenic cotton seed production by activating research and development activities.
- Since Bt cotton is a new crop to the farmers in India and other developing countries, adequate efforts need to be taken by seed companies to propagate effective practices to be followed in cultivating Bt cotton.
- Though Bt cotton farmers have not faced any severe crop losses due to bollworm attack, the cost of cultivation has increased due to higher use of pesticides. Therefore, scientific trials at the farmers' field need to be carried out periodically whether or not Bt cotton varieties are free from bollworm attack.
- If crops are really found to be damaged due to bollworm attack, government authorities should help the affected farmers to get adequate compensation from the seed companies. If required, government should also penalise the companies for making false

propaganda about their seed varieties.

The lesson we learn from the introduction of Bt cotton to India and other developing countries is that technology per se may not be bad; but how we put it to use and how it impacts people at different levels seem to make it appear good or bad to us.

References: edugreen.teri.res.in/ TOI Apr 6, 2014, www.livemint.com/www.ehow.com
economictimes.indiatimes.com
www.agritech.tnau.ac.in



Credit:clipart.co

There doesn't seem to be any other way
of creating the next green revolution without
GMOs---**E.O.Wilson**

SCIENCE: COMPOSITE FIBERS

Today technology has penetrated every aspect of human life. It has, no doubt, helped us improve our health and enhanced our well-being to a remarkable level. But, on the other side, it has drawn us away from nature.

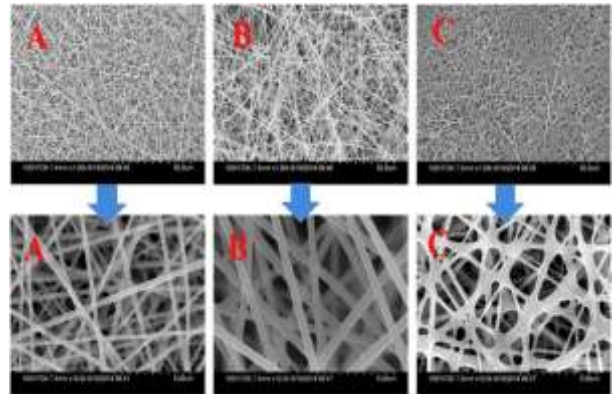
It is heartening to note that distressed by the damages it has caused, we are becoming more and more conscious of the health of our environment, as never before. Efforts are, therefore, being made to once again use the products from nature to substitute synthetics, to minimize the extent of damage.



www.compositesworld.com

During the last decade there has been a renewed interest in natural fibres as substitute for glass and other synthetic materials. We are glad to note that scientists have been, for some time, trying to develop composite materials, integrating natural fibers with synthetic materials, which have applications in industry, especially automotive industry and construction, and,

also as wood substitutes. We touch upon here the development and use of composite materials derived from natural fibers.



Nano cellulose composite fibers Credit: science direct.com

FIBER-REINFORCED COMPOSITE (FRC)

It is reported that the use of natural fibres for technical composite applications has recently been the subject of intensive research. Wikipedia has defined Fiber-Reinforced Composite (FRC) as a composite building material that consists of three components--the fibers (as the discontinuous or dispersed phase), the matrix (as the continuous phase), and the interphase region. Further, this technology involves refining, blending, and compounding natural fibers from cellulosic waste to form a high-strength fiber composite material in a polymer matrix. The base raw materials used in this process are those of waste thermo-plastics and cellulosic waste, including rice husk and saw dust.

The fibers of all things have their tension and are strained like the strings of an instrument- **Henry David Thoreau**

FIBERS IN AUTOMOTIVE INDUSTRY



Fiber-Reinforced Composite-FRC- (en.wikipedia.org)



www.naturfasererbundwerkstoffe.de

WOOD COMPOSITES www.wiley.com mentions that over the past two decades, there has been a shift in research and industrial practice, and products traditionally manufactured primarily from wood are increasingly combined with other nonwood materials of either natural or synthetic origin. Wood and other plant-based fiber is routinely combined with adhesives, polymers, and other “ingredients” to produce composite materials.

The composite material, developed through molecular re-engineering, successfully integrates selected physical and structural properties of wood in addition to having other critical attributes, including yield-related properties. It is reported that FRC is superior to contemporary wood and unlike other composites, can be recycled up to 20 times. However, the disadvantages reportedly include ‘delamination, in longitudinal ma debonding, fiber

The auto-industry too , driven by increasing environmental awareness, has made efforts since 1990s in the development of natural fiber composites, and made significant advancements. Use of natural fibre composites in this industry is motivated by

Potential advantages lie in the reduction in costs , light weight, renewability and marketing based on demands for eco-friendly products, rather than any technical consideration. The range of products is restricted to interior and non-structural components like door upholstery or rear shelves.

The composites are used primarily in automotive interiors.Natural fiber-reinforced thermo-plastics and thermosets in door panels, package trays, seat backs and trunk liners have featured in a number of vehicle

Europe and USA..Many ents are already produced ites, mainly based on l natural fibres like flax, also been pointed out that

Nature is a brilliant engineer and builder. It knows how to create seashells that are twice as strong as the most resistant ceramics human beings can manufacture, and it produces silk fibers five times stronger than steel. Nature also knows how to create multipurpose forms **Neri Oxman**

the light-weight natural fiber composites can improve fuel efficiency and reduce emissions.

AS GLASS FIBER SUBSTITUTES

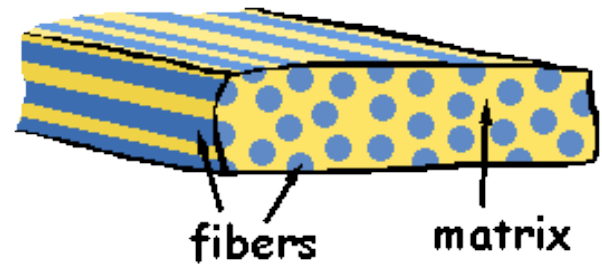
It is reported that natural fibers are also emerging as superior alternatives to glass fibers in composites due to their light weight, lower raw material costs, lower environmental impacts compared to glass fiber production (natural fiber composites have higher fiber content reducing the use of more polluting base polymer content) and 'thermal recycling' or the ecological advantages of using resources which are renewable. Another advantage of the composites is that end of life incineration of natural fibers results in recovered energy and carbon credits. However, natural fibres have their shortcomings too, and these have to be resolved in order to be competitive with glass fibers. Their moderate mechanical properties restrain the fibers from using them in high-tech applications, but for many reasons they can compete with glass fibers.

FIBERS IN COMPOSITE APPLICATION

BAST FIBERS

Cellulose is a natural polymer with high strength and stiffness per weight, and it is the building material of long fibrous cells. Cellulose can be found in the stem, the leaves or the seeds of plants. Flax, hemp, jute, kenaf, ramie (china grass) are bast fibers.

a close-up of what a composite might look like



These fibers are derived from the bast which consists of a wood core surrounded by a stem. The basts of these plants have a number of fiber bundles, each containing individual fiber cells or filaments. The filaments are made of cellulose and hemi-cellulose bonded together by a matrix, which can be lignin or pectin. The pectin surrounds the bundle thus holding them on to the stem. By retting (allowing the material to rot) pectin is removed. This enables separation of the bundles from the rest of the stem.

During the processing of a composite, the bundles are impregnated with a resin to strengthen the lignin between the individual cells. If the bundles are pre-treated to separate the cells, by removing the lignin between the cells, a much stronger composite is obtained. Boiling in alkali is one of the techniques used.

Flax and hemp are two fibers that have replaced glass in a number of components, especially in the automotive industries. Flax fibers are strong and can be grown in temperate climates. The fibers are spun to fine

yarns for textile (linen). Other bast fibers like jute are grown in warmer

There are no such things as applied sciences, only applications of science----- **Louis Pasteur**

climates. Jute fiber is cheap, and has a reasonable strength and resistance to rot. Jute is mainly used for packaging (sacks and bales).

Sisal, abaca (banana), palm are leaf fibers which are coarser than the bast fibers. Therefore, they are useful in making ropes, and coarse textiles. Sisal is the most important leaf fiber. Composites are developed with sisal often applied with flax in hybrid mats, to provide good permeability when the mat is treated with a resin. In some interior applications sisal is preferred because of its low level of smell compared to fibers like flax.

Cotton, coir, kapok are seed fibers. Cotton is the most common seed fiber and is used for textile all over the world. Cotton is blended with synthetic fibers to make it light, durable and easy to handle. Coir is the fiber of the coconut husk; it is a thick, strong and coarse and is used in making ropes, matting and brushes. Other seed fibers are used in making upholstery. With the rise of composite materials there is a renewed interest for natural fibers.

NATURAL FIBERS --ADVANTAGES

- They have low specific weight, which results in a higher specific strength and stiffness than glass.
- Their production requires little energy; CO2 is used while oxygen is given back to the environment.
- Low production cost
- Ther mal recycling is possible unlike glass

New materials and techniques have given us great opportunities-**Eero Saarinen**

which causes problems in combustion furnaces.

- Good thermal and acoustic insulating properties

DISADVANTAGES

- Lower strength particularly its impact strength
- Variable quality, due to changing weather and other conditions
- Absorbs moisture which causes swelling of the fibers
- Restricted /maximum processing temperature.
- Lower durability
- Poor fire resistance
- Price can fluctuate by harvest results or other factors

ENVIRONMENTAL IMPACT

According to suppliers of natural fiber, actual growth in the development of natural fiber composites has been at 10 to 15 percent per year, lower than the expected levels. The reasons pointed out are limitations in processing technologies and molded part performance as well as plunge in auto sales due to economic down turn. However, advantages of natural fiber reinforcements are well understood. It has been pointed out that “--on average, the production of natural fiber suitable for composites is some 60 percent lower in energy consumption than the manufacture of glass fibers. The advantages in energy and environmental

comparisons are becoming more quantifiable through the use of Life Cycle Analysis methodology being promoted by the U.S. Government”.

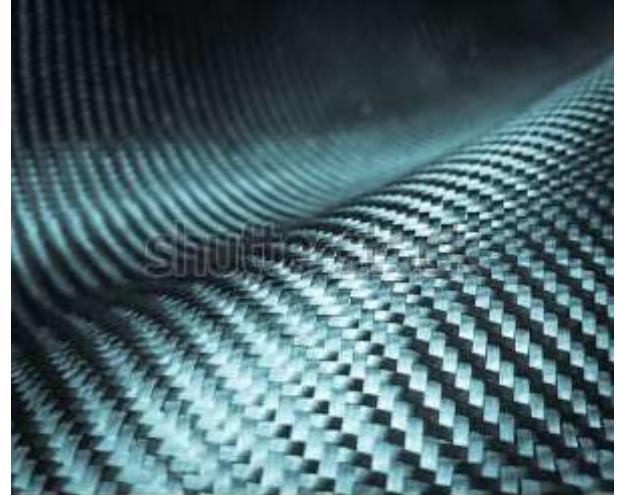
The use of natural fibres for technical composite applications has recently been the subject of intensive research in Europe.

THE WAY FORWARD

With the rise of composite materials, no doubt, there is a renewed interest in natural fibers. Up to now only limited numbers of composite products have been developed. The main reason could be that at present research in the area is limited only to Europe, USA and other developed countries. **A vast area remains unexplored in developing countries. With more advanced research, there is every possibility that natural fibers occupy the pride of place in our daily life once again.**

References:- www.fao.org
www.wiley.com/www.pslc.ws/en.wikipedia.org

Technology... is a queer thing. It brings you great gifts with one hand, and it stabs you in the back with the other ~**C.P. Snow**,



www.shutterstock.com - 409077508

Carbon fiber material bakground (credit shutterstock.com)



Table top tray made from flax seeds Credit pintrest.com)

ECONOMICS: BIO-FIBER ECONOMY

Is there a role for natural fibers in a Bio-based economy?

Man's intimate relation with nature finds expression in the colors, design and texture of our clothes and objects of our daily use, for, the beauty and diversity in nature are copied faithfully nowhere else than in the clothes we wear and the natural wares we use. However, in today's world we have moved far away from nature-from natural to synthetics, from diversity to uniformity, from many colored to black, from bio-friendly to fashion crazy attires. Will natural fibers continue to have a role in today's technology-driven world when we are being forced to look for greener and sustainable options?

CULTURA



L DIVERSITY

Thai costume-stock photos

All cultures across the globe have developed their own unique ways living with nature. In India we have a mind-boggling variety of clothings, from the nine yard sarees of Tamil Nadu to the simple *mundu* of Kerala. **The green paddy fields dotted with sarees in myriad colors is an unforgettable sight in rural India.** We have the colorful, mirrored costumes, contrasting with the yellow-brown sands of Rajasthan to the multi-colored hand woven costumes of the North-east; also the maroon and mustard-yellow dresses of the Lamahs in the backdrop of the Himalayas. Neighbouring countries like Pakistan, Afghanistan, Sri Lanka, Thailand, have their own distinct dressing styles. African countries have their own elaborate types of costumes. They stand out in their eye-catching styles, colors and patterns.

Besides, the clothes we wear, there are thousands of articles and artifacts that surround us which are made of natural fibers. These types of costumes/objects are dependent on the local availability of the raw materials, local climate, types of plants, animals, minerals and other natural resources available in the locality. Modern American and Western style dresses/synthetics are popular today around the world which often do not take these factors into consideration. In the fast-paced modern world the preference is for light-weight-easy to handle materials which have the advantage of minimum wear and tear; can be manufactured on a large scale in factories, mostly with the help of machines.

“It's a recession when your neighbor loses his job; it's a depression when you lose your own.” —

Harry S. Truman

Raw materials can be synthesised, and, their availability does not depend on the vagaries of the rainfall. Natural-fiber made fabrics/objects, on the otherhand, depend on plants grown in the fields.



www.shutterstock.com · 136933787

Their production and processing are labor-intensive and cumbersome. However, natural fibers are bio-friendly; They are more suited for protecting the human body from the natural elements. They are aesthetically pleasing. But they have to be competitive and economically viable, vis-à-vis synthetic fibers, in order to survive.

WHY NATURAL FIBRES?

I can eat a man, but I'm not sure of the fiber content.

Jenny Eclair

FIGHTING HUNGER AND RURAL POVERTY

Production, processing and export of natural fibers are central to the economies of many developing countries and the livelihoods of millions of small scale farmers and low wage workers. The fiber and textiles industries are among the most labour-intensive industries. According to the FAO they include 10 million people in the cotton sector in West and Central Africa, 4 million small-scale jute farmers in Bangladesh and India, one million silk industry workers in China, and 120000 alpaca herding families in the Andes. Natural fibres contribute to economic growth and help fight hunger and rural poverty.

RENEWABLE SOURCE

Natural fibres are a renewable resource. According to FAO growing one tonne of jute fibre requires less than 10% of the energy used for the production of polypropylene. Natural fibres are carbon neutral. Processing produces residues that can be used in bio-composites for building houses or to generate electricity. At the end of their life cycle, natural fibres are 100% biodegradable. The benefit of those sustainable resources is that they can be regrown within the foreseeable future, without negative side-effects on global bio-diversity.

MOVING TOWARDS BIO-ECONOMY

The FAO has pointed out that 'stringent environmental legislation and consumer awareness are driving the transition to a bio-based economy and models of sustainable development which offer high perspectives for natural fibre markets'. Many of the common raw materials that are currently derived from fossil or mineral resources need to be replaced

with products produced from renewable resources, if we are to move towards a bio-based economy. Natural fibers can be used to substitute raw materials from fossil fuels or minerals.



Stock photos

The era of manufactured fibers began with the development of rayon in France in the 1890s. Rayon is derived from a natural cellulose and cannot be considered synthetic, but requires extensive processing in a manufacturing process, and led the less expensive replacement of more naturally derived materials. A succession of new synthetic fibers were introduced by the chemicals industry in the following decades. Acetate in fiber form was developed in 1924. Nylon, the first fiber synthesized entirely from petrochemicals, was introduced as a sewing thread by DuPont in 1936, followed by DuPont's acrylic in 1944. Some garments were created from fabrics based on these fibers, such as women's hosiery from nylon, but **it was not until the introduction of polyester into the fiber marketplace in the early 1950s that the market for cotton came under threat.** The rapid uptake of polyester garments in the 1960s caused economic hardship in cotton-exporting economies, especially in Central American countries, such as Nicaragua, where cotton production had boomed ten fold between 1950 and 1965 with the advent of cheap

Economy is too late when you are at the bottom of your purse----**Seneca**

chemical pesticides. Cotton production recovered in the 1970s, but crashed to pre-1960 levels in the early 1990s (Ref: En.wikipedia.org)

VERSATILITY OF NATURAL FIBERS

The versatility and eco-friendly nature of natural fibers have advantages over synthetic alternatives. The hard fibers like Acaba, Coir and Sisal, and bast fibres Jute and Kenaf can be used for a variety of purposes. It may be noted that apart from natural fibers, many of these plants yield other items of use like cooking oil (coconut, cotton), building materials (coconut palm), fodder (cotton seed, copra after crushing for oil). Many fiber crops also yield by-products (kapok, linseed, hemp), and many oilseed crops yield fibrous residues as in the case of coir, which is a by-product from the coconut oil production. Research is increasingly demonstrating the technical and economic benefits of including natural components in industrial products. In all countries natural fibers are produced and used to manufacture a wide range of traditional and novel products from textiles, ropes and nets, brushes, carpets and mats, mattresses to paper and board materials. The long fibers are transformed to threads or yarns that are used to join, connect or attach and to form bonds, networks or weaves.

USE OF WASTE MATERIALS

There is considerable loss of yield when natural fibers are processed to final products. Processing produces residues that can be used in bio-composites for building houses or to generate electricity. Waste biomass from natural fibers can be used in ethanol fermentation or for production of

biogas. The growing competition for renewable resources for energy and products will also open new possibilities for exploitation in bio-refineries of biomass from agro-industrial residues for production of energy, bio-gas and electricity, but also many other products like animal feed and organic soil improver, constructive building products and composite materials, or even textiles or pharmaceuticals.

NEW OPPORTUNITIES

The economic value of fibre crops is assessed on the basis of their end-use market and costs of production. The scope of possible uses of the future fibres is stated to be high. It has been pointed out that as the use of natural fibres in industry will throw new opportunities for natural fibres in high-end value markets.

Fiber composites are useful in packaging, building, and furniture materials in addition to their traditional uses such as rope, twine and carpets. **The FAO has reported that car makers in Europe are using an estimated 80,000 tonnes of natural fibres a year to reinforce thermo-plastic panels. India has developed composite boards made from coconut fibre that are more resistant to rotting than teak. Brazil is making roofing material reinforced with sisal. In Europe, hemp wastes are used in cement, and China used hemp-based construction materials for the 2008 Olympics.**

INTERNATIONAL YEAR OF NATURAL FIBRES

2009, declared as the International Year of Natural Fibres, celebrated fibers produced by plants and animals and did not include modern man-made artificial

Economy does not consist in saving the coal, but in using the time while it burns.--**Ralph Waldo Emerson**

and synthetic fibres such as rayon, nylon, acrylic and polyester. Relentless competition from synthetics and the current global economic downturn impact the livelihoods of millions of people who depend on natural fiber production and processing. That is why the International Year of Natural Fibers 2009 aimed at raising global awareness of the importance of natural fibers not only to producers and industry, but also to consumers and the environment.

Natural fibres are a responsible choice

Natural fibres are of major economic importance to many developing countries and vital to the livelihoods and food security of millions of small-scale farmers and processors.

Natural fibres are a sustainable choice

The emerging "green" economy is based on energy efficiency, renewable feed stocks in polymer products, industrial processes that reduce carbon emissions and recyclable materials.

Natural fibres are a high-tech choice

Natural fibres have good mechanical strength, low weight and low cost. That has made them particularly attractive to the automobile industry.

Natural fibres are a fashionable choice

Natural fibres are at the heart of an eco-fashion or "sustainable clothing" movement that seeks to create garments that are sustainable at every stage of their life cycle, from production to disposal.

There is growing demand for organic cotton and wool, for recyclable and

biodegradable fabrics. Fair trade practices offer producers higher prices and protect industry workers. Producers of natural fiber, textile manufacturers and the clothing industry need to make use of these opportunities provided at the global level. Packing sector may provide a niche market for natural fibers in order to comply with stringent EU regulations. As environmental considerations, including eco-efficient production and sustainable commerce are important considerations for governments as well as the industry at present, natural fibers can make use of this opportunity in a big way. Increased use of natural fibers also can generate additional income from carbon trade (CDM) which promotes (foreign) investments in local projects.

CHALLENGES

There are many challenges facing the development of natural fibers as an option in the place of synthetics.

- In many of the less developed countries the fiber and textile sectors are still poorly developed.
- The impact of their cultivation on food security, land use and deforestation and rural development is also a matter of concern as fiber crops compete with food crops for land, water and nutrients .
- Experts are of view that there is need for development of technologies to suit the scales of production in developing countries. Better agricultural practices, land utilization, higher productivity, related research etc need to be attended to.
- Strategy for each individual crop and products need to be framed separately, instead

of having a uniform strategy for all fiber crops together.

- Although the global cotton demand has shown a growth rate of more than 5% in the recent years, other industrial natural fibers are produced in substantially smaller volumes, all together not exceeding 6 million tons production. These production volumes have stagnated in the last decades and these fibers are only supplying only 2-3 percent of the textile fiber market.
- Trade markets and exports of most of the natural fibers (Sisal and Henequen, Jute and Kenaf, Flax and Hemp) have seen a decline in the past decades, which is often attributed to introduction of cheaper synthetic substitutes.
- The market for jute bags for transport of agricultural products, for example, has seen dramatic decline, also due to increased container shipments.
- The value of the end-product is not always reflected in the benefits for the agricultural production. In the production chain from farm to customer many steps are taken and quality improvement is attained at the cost of substantial losses.
- By-products, residues and wastes commonly are not contributing to the value addition. On the contrary, these may cause environmental pollution or add to costs for disposal. Often agricultural production utilises only a small part of the total fixed carbon in the biomass produced or harvested. These wastes can be utilised far better. For example, only 2-4% of the harvested biomass of sisal is

Economists are economical, among other things, of ideas; most make those of their graduate days do for a lifetime.--**John Kenneth Galbraith**

converted to economic value.

RESEARCH AGENDA

In order to make natural fibers competitive in the world market, high-end research needs to be undertaken. Jan E.G. van Dam, Wageningen University, in the Proceedings of the Symposium on Natural fibers published in connection with the International Year of Natural Fibers in 2009 has identified the thrust areas of research concerning natural fibers. According to him only those products based on renewable resources that have high quality, show excellent technical performance and do not harm the environment can compete with synthetic products based on petrochemical materials. The environmental benefits that emanate from the use of fibers, needs to be carefully evaluated. He has suggested that numerous unexplored areas can be identified for research, such as in the case of building materials, where comparisons of **'LIFE CYCLE ASSESSMENT' (LCA) need to be undertaken, taking into consideration the costs of maintenance and replacement in relation to the performance of the material.** In other areas, as in the case of horticultural production inputs, where data on their contribution to the environment is not available, LCA could be used to promote fiber-based products. Other fields of research suggested by him include improvement of the fiber and cellulose extraction process from fiber crops (sisal, abaca), underutilised crops (bamboo) and crop residues (straw, bagasse) and waste control, novel fiber production processes and applications and the production of natural binders (lignin) and coatings (wax) such as for the manufacturing of boards from coir husks.

Ecological impact assessments are to

Economy has frequently nothing whatever to do with the amount of money being spent, but with the wisdom used in spending it.--**Henry Ford**

be comprehensive. Further, by-product utilisation and installation of waste treatment systems and whole crop utilisation substantially contribute to an enhanced sustainability of (fiber) crop production chains.

The effects of technical modernisation of production systems on the total LCA of fiber products need to be balanced with economical competitiveness and social aspects of labour input.

Eco-labeling and certification of the best practices need to be developed. Biomass residues could be used for production of energy, bio-gas and electricity; many other products like animal feed and organic soil improver, constructive building products and composite materials, or even textiles or pharmaceuticals could be produced from bio-wastes.

FUTURE PROSPECTS

Development of a sustainable global economy, which permits improving purchasing power and living standards of people without exhaustion of resources for future generations requires a fundamental change in attitude. Taking up environmentally friendly production and processing technologies along with fostering economic development by strengthening the participation of small holders in the value chain are now very much needed.

Ref: www.fao.org

[/wikipedia.org/www.naturalfibers.com](http://wikipedia.org/www.naturalfibers.com)

ART & CULTURE : FIBER ARTS

Can natural fibers find a place in the world of art too? All through the centuries natural fibers not only provided us food, shelter and clothing, but also have gifted us a medium for expressing our imagination, emotions and aesthetic sensitivity. Fiber art refers to fine art wherein natural or synthetic fiber and other components, such as fabric or yarn are used as the base material. The focus is on the materials and on the manual labour on the part of the artist, and, prizes aesthetic value over utility.

THE DEVELOPMENT OF FIBER ART

The term fiber art came into use by curators and art historians to describe the work of the artist-craftsman following World War II. Those years saw a sharp increase in the design and production of "art fabric." In the 1950s, as the contributions of craft artists became more recognized—not just in fiber but in clay and other media—an increasing numbers of weavers began binding fibers into non-functional forms as works of art.

The 1960s and '70s brought an international revolution in fiber art. Beyond weaving, fiber structures were created through knotting, twining, plaiting, coiling, pleating, lashing, and interlacing. Artists in the United States and Europe explored the qualities of fabric to develop works that could be hung or free standing, "two or three dimensional, flat or volumetric, many stories high or miniature, noble or figurative, and representational or fantasy." The women's movement of the same era was important in contributing to the rise of fiber art because of the traditional association of women with

textiles in the domestic sphere; indeed, many of the most prominent fiber artists are women.

Since the 1980s, fiber work has become more and more conceptual, influenced by post-modernist ideas. For fiber artists, in addition to long-standing experimentation with materials and techniques, this brought "a new focus on creating work which confronted cultural issues such as: gender feminism; domesticity and the repetitive tasks related to women's work; politics; the social and behavioral sciences. (Ref:en.wikipedia.org)



Printed art fabric, 1876, by William Morris (en.wikipedia.org)

“No great artist ever sees things as they really are. If he did he would cease to be an artist.” **Oscar Wilde quotes**

TAPESTRIES

Woven pieces of fabrics called "tapestries" started taking the place of paintings on walls in Europe between the fourteenth and seventeenth centuries. "Tapestry is a special type of weaving in which the weft yarns are manipulated freely to form a pattern or design on the front of the fabric...Often the weft yarns are of several colors and the weaver can use the different-colored yarns almost as flexible as a



Figure 1. One of the tapestries in the series *The Hunt of the Unicorn: The Unicorn is Found*, circa 1495-1505, the Cloisters, Metropolitan Museum of Art, New York City

painter uses pigment on canvass”

One of the tapestries in the series *The Hunt of the Unicorn: The Unicorn is Found*, circa 1495-1505, the Cloisters, Metropolitan Museum of Art, New York City.

Every canvass is a journey all of its own-**Helen Frankenthaler**



RUGS AND CARPETS

While tapestries were being developed in Europe, in the Middle East, fiber artists created beautifully crafted rugs. Rug making is an ancient craft, and covers a variety of techniques. . An authentic oriental rug is a handmade carpet that is either knotted with or woven . People from different cultures, countries, racial groups and religious faiths are involved in the production of rugs. Unlike the tapestries, the woven rugs do not depict scenes in a story, but instead used symbols and complex designs.

THANGKA PAINTINGS

I don't paint dreams or nightmares; I paint my own reality----**Frieda Kahlo**



A thangka, also known as tangka, thanka or tanka is a painting on cotton, or silk appliqué, usually depicting a Buddhist deity, scene, or mandala.

QUILTED FIBER ART

Another fiber art technique is quilting in which layers of fabric are sewn together. Although this technique has not been around for as long as weaving, it is a popular form of art in American history.



www.carpets-rugs-guide.com

Quilting as an art form became popular in the 1970s and 80s. Recently, quilted fiber art wall hangings have become popular with art collectors. This non-traditional form often features bold designs and colors.

Fiber Revolution is a network of professional textile artists coming together to share their knowledge and experience under the banner of Fiber Revolution, with the goal to provide greater visibility for their art, and also to organize sale of their artwork while educating the public about it. Fiber Art uses fiber as their medium 'dyeing it, painting it, cutting it, tearing it, stamping it, fusing it and embellishing it'. The final step comprises of stitching through the layers of fabric, which brings a dimensional depth to the artwork that mere painting cannot. Given are some examples taken from the website www.fiberevolution.com



OTHER FORMS OF FIBER ART

In art, the hand can never execute anything higher than the heart can imagine." **Ralph Waldo Emerson**



A coir wall hanging
(www.indianhandicrafts.co.in)

Other fiber art techniques are knitting, rug hooking, felting, braiding or plaiting, macrame, lace making, flocking (texture) and more. There are a wide variety of dye techniques. Artifacts are made from fibers by local communities in different parts of the world. Cotton fabrics



have provided the medium for a variety of fiber arts. Even coconut fibers and shells are used for producing innovative art forms.

We have shown here only a few samples of fiber art forms developed by different societies; synthetic fibers are also used as medium in modern times though. The designs, colors and unique beauty of the different art forms developed by communities in different part of the world remained blended with our daily life till now. Needless to say that with the decline in use of natural fibers, the survival of natural fiber art, as a way of artistic expression, seems to be doubtful, although some people may patronize it out of sheer love for it or for capitalising its commercial value. It is sad to imagine that these beautiful pieces of art may remain confined to museums all over the world.



Loom-en.wikipedia.com



THE WAY FORWARD

We may have to consciously promote natural fiber art products in our daily life like rugs, door mats, decorative pieces, even though the synthetic alternatives may be easy to handle and maintain.



Kente cloth ---en.wikipedia.com

“If people knew how hard I worked to get my mastery, it wouldn't seem so wonderful at all.”-

----**Michelangelo**

POEM-1: COCO-DE-MER

----Dr.Akhilesh Tiwari

Here is a short and sweet poem on a natural fiber plant—a variety of coconut (double coconut----Lodoicea sechellum) from Seychelles.



In Valley de Mai, Tonight is still,
 Tomorrow may bring a storm
 And your crown will dance the Segá,
 Oh lovely palm
 I stand beneath your canopy and gaze as the
 sun peeps
 Over streams and rocks
 Over lichens and moss
 Calm and tranquility prevails
 And aeons seem to pass...
 Suddenly,
 Raindrops channel down your fronds,
 The sunlight disappears
 And soft darkness descends
 The black parrot whistles

And the green gecko
 Slithers down your trunk
 To its sieve bowls embrace.
 Tonight is still,
 Tomorrow may bring a storm
 And your crown will dance the
 Segá,
 Sending pollen from your starry
 Blooms
 To your lady Coco-de-Mer.
 Seven years after
 You'll gift
 The most fascinating and
 the largest seed to the world.



POEM- II : NOT A CRIME!

(NOTE: Many farmers committed suicide in different parts of India since the introduction of BT cotton . It is not the case that BT cotton does not provide higher yields, compared to conventional varieties. Lack of facilities for irrigation, high costs of seeds and inputs, vagaries of the monsoon, higher family consumption all together have led them into debt-traps, from which there seemed to be no escape. They, therefore, chose death over dishonor to their families.

Here is a poem about the dilemma of a cotton farmer who has also fallen into a death-trap. His fellow farmers have committed suicide. He needs to make a choice. In his case Mother Nature herself persuades him against it, reminding him that life is a gift. He then feels that his children should live in this world, and, therefore, he also needs to live, and, he then consoles himself that a life in poverty is not a crime.)

*He stood silent, staring at the field,
From which he gathered no yield.
His face hard and set, with no hint of the turmoil in his mind
That kept him in a bind.
Beneath his feet lay the scorched earth,
Harsh, lifeless, and sans any mirth.
Nothing stirred, except the wind,
Bringing in images of the dead to his mind.
His fellow-farmers for another world left,
For they were deeply in debt.
Oh, what would my fate be?
No choice but to follow thee?
Deep in thoughts he sat in the shade on a boulder,
Winding his hands around his knees and hunching his shoulder.
In his mind's eye he saw white cotton-wool clouds,
Turning dark and spinning themselves into a thousand yarns
Of rain to cover the earth in a mantle,
Green, sublime, and genteel.
He then heard Mother Nature whisper to him thus: 'life is but a gift',
'Although fortunes may shift, keep it adrift'.
He then saw light and said to himself "I shall live, so that my children too may live,
In this world of beauty, let them thrive.
Though I must work in dirt and grime,
Living in poverty is not a crime!-*

“Wandering re-establishes the original harmony which once existed between man and the universe.”

– Anatole France

PERSONALITIES: SPINNING FOR FREEDOM

This is a write-up on how khadi or coarse cloth made by spinning cotton, became a political statement, and, an icon of the Indian freedom struggle led by Mahatma Gandhi.

Mahatma Gandhi was a fascinating personality. All through his life he experimented with a variety of things; in this endeavour he did not spare even the clothes he wore ! **He made spinning on the charkha and the daily use of khadi, or coarse cloth made from homespun yarn, powerful symbols of freedom and self-reliance.**

Gandhi believed in a life of simplicity and self-sufficiency. After having spent the early part of his life in India, he was educated in England, and had, for some years, lived in South Africa.. He was, therefore, used to wearing traditional Gujarati clothes -long turbans, kurta and dhoti- or western clothes until in 1921, when he adopted the short dhoti, the dress he wore until his death.



Mohandas Gandhi spinning yarn in 1942.

“All work, even cotton spinning, is noble; work alone is noble” **Thomas Carlyle**

WHY HE WORE KHADI

On 22 September 1921, a year after launching the non-cooperation movement, which sought swaraj in one year, he announced----“I propose to discard at least up to 31st of October, my topi and vest and to content myself with a loincloth, and a chaddar, whenever necessary, for protection of my body. I adopt the change because I have always hesitated to advise anything I may not be prepared to follow ... ’

Mahatma Gandhi visited Madurai in 1921, and stayed in the residence of Sri Ramji Kalyanji, 175 A, West Masi Street. On his way to Madurai he had seen farmers and poor people wearing the simplest of clothes , a small towel like *dhoti* around their waist. He came to know that some of them washed and wore the same clothes as they did not possess any other . He was much disturbed and was haunted all through the night by the scenes that he had witnessed . Overnight he took a decision to dress in a simple way, just like so many of the people of his beloved country. He started wearing his dress in this new way from the very next day, much to the surprise of everyone present. He explained to them about his decision and attended the meetings in Madurai. He continued to dress this way through out his life.

Soon **he consciously rejected all other forms of attire and adopted the dress of the poorest Indian. Khadi, white and course, to him was a sign of purity, of simplicity, and of poverty..---** -“Having taken to the occupation of weaving and agriculture, and having taken the vow of swadeshi, my clothing is now entirely hand-woven and hand-sewn and made by me or my fellow workers. I wear the national dress

because it is the most natural and the most becoming for an Indian. I believe that our copying of the European dress is a sign of our degradation, humiliation and our weakness; and that we are committing a national sin in discarding a dress which is best suited to the Indian climate and which, for its simplicity, art and cheapness, is not to be beaten on the face of the earth and which answers hygienic requirements. **Had it not been for a false pride and equally false notions of prestige, Englishmen here would long ago have adopted the Indian costume”.**

VISIT TO LONDON

When the British invited Gandhi to London to attend the Round Table Conference in late 1931, he wore a short dhoti, without a shirt. He was in the same attire when he went for an audience with King George V at the Buckingham Palace. During his entire stay in England Gandhi was followed by the press everywhere, and after the audience with the king at the Buckingham Palace, he was asked if he had felt under-dressed. He was reported to have retorted in his typical style -- “The king had enough on for both of us”!! Winston Churchill disparagingly referred to Mohandas Gandhi as the ‘half naked fakir’.

Wearing home-spun clothes and daily spinning were essential parts of Gandhi’s philosophy and politics and represented a rejection of Western culture and a symbolic identification with the poor of India. **His commitment to Khadi became a powerful political statement which inspired the masses to follow his example.**

THE KHADI MOVEMENT

The Khadi Movement started

Happiness is when 'what you think, what you say, and what you do are in harmony-**Mahatma Gandhi**

in India as resistance to the British policy of buying cheap cotton from India, exporting it to Britain and bringing it back to India as manufactured goods and selling at high prices to the Indians. The Khadi movement, therefore, aimed at boycotting foreign goods, including cotton, and, promoting the use of Indian goods. **Mahatma Gandhi promoted the spinning of khādī and its usage in order to inculcate self reliance in people and to enable them to be self-employed.** Gandhi claimed that “---Spinning thread in the traditional manner also had material advantages, as it would create the basis for economic independence, and the possibility of survival for India’s impoverished rural multitudes. This commitment to traditional cloth making was also part of a larger swadeshi movement, which aimed for the boycott of all British goods”.

SWADESHI

Gandhi himself had clarified that by his insistence on wearing home-spun Khadi he did not advocate a rejection of all modern technology but he was opposed to the exploitive economic and political system of textile manufacture, marketing and distribution.

THE MESSAGE OF THE CHARKHA

- I see God in every thread that I draw on the spinning-wheel. (YI, 20-5-1926, p. 187)
- The spinning-wheel rules out exclusiveness. It stands for all inclusiveness. It stands for all including the poorest. It, therefore, requires us to be humble and to cast away pride completely. (H, 13-10-1946, p. 345)

- I ... claim for the Charkha the honor of being able to solve the problem of economic distress in a most natural, simple, inexpensive and business like manner..... It is the symbol of the nation's prosperity and, therefore, freedom. It is a symbol not of commercial war but of commercial peace. (YI, 8-12-1921, p. 406)

- The message of the spinning-wheel is much wider than its circumference. Its message is one of simplicity, service of mankind, living so as not to hurt others, creating an indissoluble bond between the rich and the poor, capital and labor, the prince and the peasant. That larger message is naturally for all.

(YI, 17-9-1925, p. 321)

- The message of the spinning-wheel is, really, to replace the spirit of exploitation by the spirit of service. The dominant note in the West is the note of exploitation. I have no desire that our country should copy that spirit or that note. (YI, 2-2-1928, p. 34)

- The Charkha is the symbol of non-violence on which all life, if it is to be real life, must be based. (H, 27-4-1947, p. 122)

www.mkgandhi.org

Said Gandhi, "Machinery in the past has made us dependent on England, and the only way we can rid ourselves of the dependence is to boycott all goods made by machinery. This is why we have made it the patriotic duty of every Indian to spin his own cotton and weave his own cloth." The Guardian Newspaper wrote

"A man is but a product of his thoughts. What he thinks he becomes---**Mahatma Gandhi**"

"---The image of the emaciated, almost naked, and obviously nonviolent Gandhi hard at work at his spinning wheel had an electric effect on millions in India and across the world. He was hailed as the father of Indian independence, and starting in 1931, his traditional spinning wheel became the primary symbol on the flag of the (Provisional) Government of Free India".

Peter Gonsalves, a teacher of social sciences at a Paris University, in his book "Clothing for Liberation" observed that "---discarding of Western fashion was his (Gandhi's) loudest cry on behalf of colonized humanity and the zenith of his search for sartorial significance". "For those who heeded Gandhi's cry, this 'clothing for liberalization' was equivalent to putting one's life on the line. It meant giving up time, family and social privileges in the cause of moral duty. **The choice for khadi was no arbitrary fashion statement; it was an option for perfect and uncompromising integrity,**" Further, 'Gandhi's decision to reduce his conventional clothing to a mere waist-covering dhoti transformed him into an international icon'.

GANDHI, THE DESIGNER

Was Gandhi a good designer? 'Gandhi's experiments and creative search can be illuminated by the category of design, it also follows that Gandhi's life can tell us something more about what it truly means to be a designer, wrote Guardian Newspaper. "-- We note, first of all, his imperviousness to conventional wisdom and public opinion. Then, there is his inquiry into and critical appreciation for the underlying meaning of things based on their societal and moral

effects, not merely their visual effects or their commercial play in the market. He made attempts to reconfigure the relations between different elements of the value chain, so as to increase equity, participation, and overall value in the socio-economic system. There is his ability to see and recognize whatever comes out of that newly designed system as something good and true, and then his power to enable others around him to see things in that way as well”.

THE SIGNIFICANCE OF CHARKHA

Now look at the restorative powers of the charkha. To quote the Guardian again “--It allowed the 'cunning of hands' to be expressed, it allowed the mind to unravel and come to rest. It could even bring about silent community, when several people worked on their respective wheels together. **On account of that quiet, meditative penance, something of value was created, almost as an excrescence, a process as natural as spiders spinning or plants flowering.** Scholarly treatments of Gandhi's thought routinely overlook or proactively excise these elements of his life as 'eccentricities,' but this is surely a mistake. The idea and possibility of bodily health, as a necessary means for the attunement of the self in its relationship to the world of people, places, animals and things, drove Gandhi to articulate a total life style, attitude, and philosophy of life, all of which was expressed through the concept of khadi. The term translates into something like nourishing, nutrient-filled, fertilizing, giving-of-life. Gandhi was himself the greatest brand ambassador for this line of products, wearing plain white robes folded around his person with timeless simplicity”.

THE CHARKHA TODAY

“I claim that in losing the spinning wheel we lost our left lung. We are, therefore, suffering from galloping consumption. The restoration of the wheel arrests the progress of the fell disease.” Mahatma Gandhi

The charkha which occupied a central place in the Indian struggle for independence is today considered redundant in an increasingly fast-paced world. Khadi, the symbol of self-reliance, is confined to some of the government-sponsored establishments. Due to its high price, it is generally patronised by only the elite.

AUCTION OF GANDHI'S CHARKHA

The BBC in a news item on November 5 ,2013 reported that one of Mahatma Gandhi's most prized possessions, the 'charkha' he used in Yerwada Jail, was auctioned at £110,000 (\$180,000).It quoted the Auction House Mullock's specialist Richard Westwood Brookes "This would have been one of Gandhi's most prized possessions as he devised the workings of it himself. The charkha was used by him in Yerwada Jail whilst fighting for the rights and independence of India. It has impeccable provenance and is unquestionably the most important Gandhi artifact we have ever had for sale." The charkha used by Gandhi while he was in the prison at Pune during India's freedom struggle, was presented by Gandhi to American Free Methodist missionary Rev. Floyd. A. Puffer. Puffer was a pioneer in Indian educational and industrial cooperatives. He invented a bamboo plow that was later adopted by Gandhi.

THE WAY FORWARD

In India and elsewhere the handloom industry

“I know that spinning sets me in a trance; it soothes me and charges my batteries at the same time’---.

— Elizabeth Zimmermann

is facing a deep crisis. It may not be perhaps possible for all of us to use a spinning wheel to make our clothes, but the least we could do is to promote the handloom clothes weaved by the poor living in the villages spread across India and other similar countries. This way we will be not only making an ethical/economic choice, but also contributing to the protection of the environment.

References:-en

wikipedia.org/
www.newzfirst.com/
www.sunday-guardian.com/
www.academia.edu/
www.bbc.com

There is no beauty in the finest clothe if it makes hunger and unhappiness-**Mahatma Gandhi**

FOOD & DIET: FOOD FROM FLAX

In this article we discuss the health benefits of flax.

Flax (*Linum usitatissimum*), also known as linseed, is a member of the family Linaceae. Flaxseeds are slightly larger than sesame seeds and have a hard shell that is smooth and shiny. Their colour ranges from deep amber to reddish brown, depending on the variety.

HEALTH BENEFITS



Flax seeds are one of the richest sources of omega 3 fatty acids. Omega-3 fats are used to produce substances that reduce the formation of blood clots. This can reduce the risk of heart attack and stroke in patients with atherosclerosis or diabetic heart disease. Besides omega-3 fatty acids, flax seeds contain high levels of lignans. Lignans may benefit the heart and possess anti-cancer properties.

Flaxseed meal and flour provide a very good sources of fiber that can lower cholesterol levels. Because of their fiber, ground flax seeds are considered to be useful in the treatment for constipation and irritable bowel syndrome . (Note:-Nutrition experts caution that excessive consumption of flax seeds can cause diarrhea).

USES

"A diet is when you watch what you eat and wish you could eat what you watch."— **Hermione Gingold**

Flaxseeds are available in the market as whole grains or in powdered form or as flaxseed oil. Flax seeds can be ground in a coffee grinder or in a kitchen mixer-grinder.

FLAX SEEDS AS FOOD

Flax seeds can be made use of in different ways. Experts suggest that ground flaxseeds can be sprinkled on to hot or cold cereal or added to baked items like home made muffin, cookie or bread recipe. Ground flax seeds will add nutritional value to milk shakes, yogurt and smoothies. Sprinkling ground flax seeds give cooked vegetables a nuttier flavor. Flax seed oil can be mixed into salad dressings, steamed veggies etc.

Here are two simple recipes using flax seeds from the collection of Tara Dalal, popular Indian cookery specialist.



Flax seeds-Amber grains (Stock Photos)

FLAX SEED RAITA

Preparation Time: 10 mins

Cooking Time: 10 mins

Makes 4 servings

Ingredients

- 1 cup thickly grated bottle gourd (lauki)
- 1 cup fresh beaten low-fat curds
- 1/2 cup finely chopped mint leaves
- 1/4 tsp roasted cumin seeds (jeera)
- 1/4 tsp black salt
- 1/2 tsp sugar
- 1 1/2 tbsp roasted and coarsely ground flax seeds
- salt to taste



METHOD

1. Cover and cook the grated bottle gourd with a little water in a deep pan on a medium flame for 4 to 5 minutes or till all the water evaporates. Keep aside to cool.
2. Combine all the ingredients, including the cooked bottle gourd in a deep bowl and mix well.
3. Refrigerate for at least 1 hour.
4. Serve chilled.

(Note:-Blend 1½ tbsp of flax seeds in a mixer to get 2 tbsp of flax seeds powder)

Caution: Flax seed is very high in fiber. Drink lots of fluid while eating

flax. To get the benefits, grind flax seed into meal

2. FLAX CHUTNEY POWDER

Ingredients

- 1 cup flax seeds
- 1 tsp chilli powder
- 1/4 tsp turmeric powder (haldi)
- salt to taste
- 1 tsp coriander-cumin seeds (dhania-jeera) powder



METHOD

1. Roast the flax seeds for 5 minutes, then add all the above ingredients and blend into the mixture.
2. Serve with chapati or jawar roti with oil and curd.

HEALTH BENEFITS

One hundred grams of ground flax seed supplies about 450 kilo-calories, 41 grams of fat, 28 grams of fiber, and 20 grams of protein.

Ref:-Vegetarian times/taradalal.com

The second day of a diet is always easier than the first. By the second day you're off it."— **Jackie Gleason**

TRAVEL: THE SILK ROUTE

The Silk Route has caught the imagination of the people all over the world, for, its very name evokes a sense of mystery, adventure and challenge in their minds. The Silk Route being one of the oldest and historically important trade routes in the world is considered to be the most celebrated trade route in human history. Here we give an account of the ancient trade route.

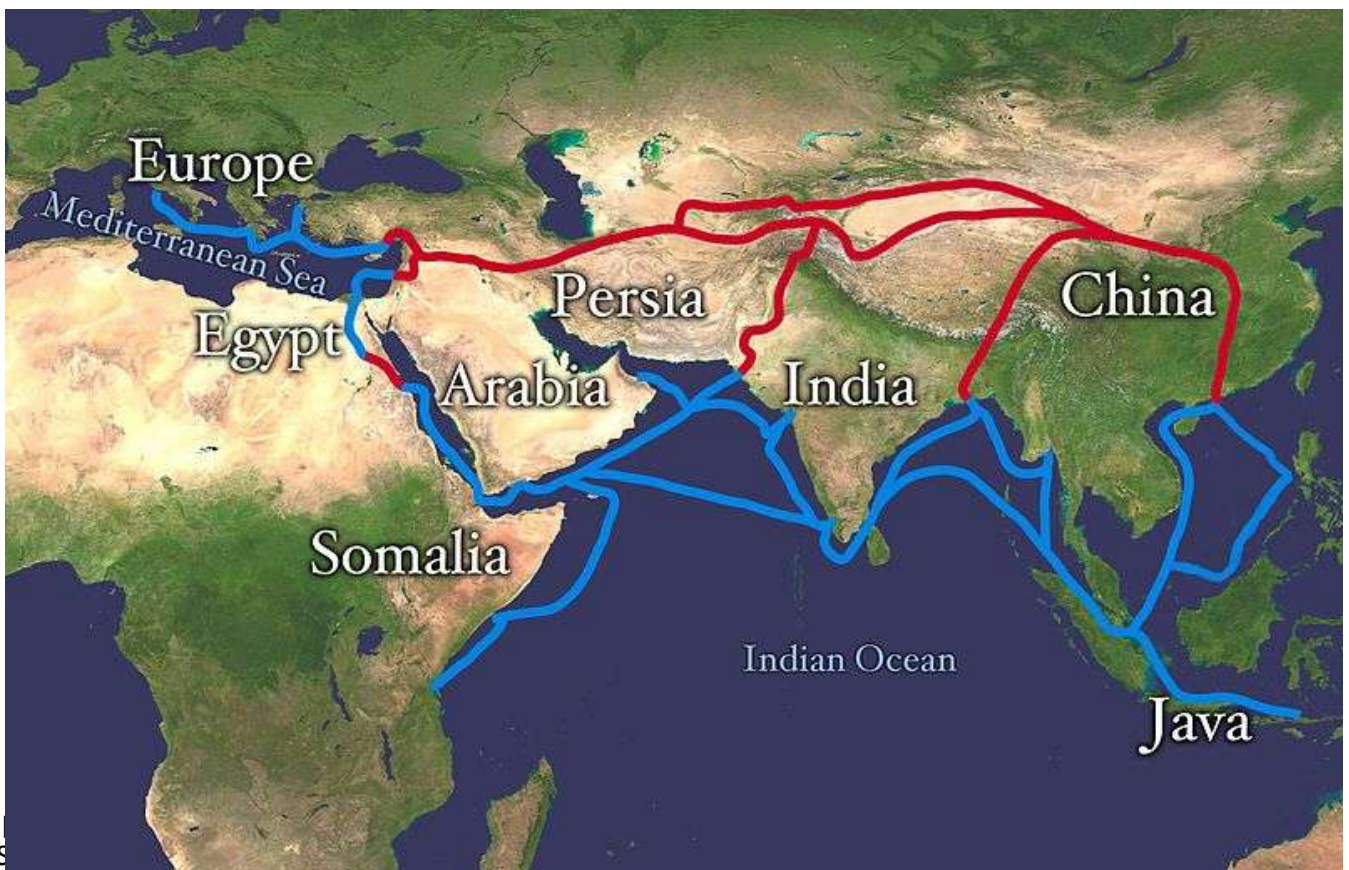
Spread over harsh mountainous terrains, running over vast grassland steppes and valleys, passing through burning deserts, stopping at welcome oases, the Silk Route is imprinted in our collective memory as something that symbolises man's restless spirit in search of material wealth and spiritual knowledge.

The Silk Route is not really a single road, rather a network of ancient trade routes, extending 4,000 miles (6,437 kilometres). The Silk Road derives its name from the trade in Chinese silk carried out along its length, beginning during the Han Dynasty (206 BC).

It is reported that caravans have been travelling the Silk Road for over 2000 years, and Chinese silk was reaching Rome before the time of Christ. According to wikipedia, the routes were used by traders, merchants, pilgrims, monks, soldiers, nomads, and urban dwellers from China to the Mediterranean Sea over centuries and that it connected the East and the West, facilitating cultural interaction through regions of the Asian continent.

THE TRADE IN SILK

The Silk Road was first used sometime between 206 BC and AD 220 during the Han Dynasty in China and played an important role as a trade-route until the end of the Yuan dynasty in 1368. Under the Han Dynasty, Chinese trade in silk gradually extended out to encompass nearby Central Asian peoples, and then spread further westward. Soon, Chinese silk graced the courtiers of the Byzantine Empire (Eastern Roman Empire) in Byzantium, now called Istanbul, Turkey. The height of the importance of the Silk Road was during the Tang dynasty, with relative internal



stability in China after the divisions of the earlier dynasties since the Han.

Silk Road Many Europeans first learned about China, when the armies of Alexander the Great expanded his empire along the Silk Road into Central Asia. In 329 BCE, Alexander founded the city of Alexandria Eschate ("Alexandria the Furthest") about 400 miles west of the Chinese frontier. In the centuries that followed, trade grew between

known as the Silk Road', because, of all the precious goods crossing this area, silk was perhaps the most sought after item by the people of the West.

It is believed that the Romans had first come across silk in one of their campaigns against the Parthians in 53 B.C. They reportedly learnt from Parthian prisoners that it came from a mysterious tribe in the east, who they came to refer to as the silk people, or 'Seres'. This new



Figure 2 The mouth of the Hexi corridor in Gansu, where the Gobi meets the Taklimakan.

the Roman Empire in the west and the Han dynasty in China.

The distance between ancient Rome and ancient China was about 4,000 miles by land. It is said that 'any route that any trader took from China to Rome used to be

material quickly became very popular in Rome, due to its attractive lustre, soft texture and drape. The Romans sent their own agents out to explore the routes to the places where it came from, and to try to get silk at a cheaper price.

As a result the trade route to the

"A good traveler has no fixed plans and is not intent on arriving---Lao Tzu

East was seen by the Romans as a route for trading silk, rather than the other goods that were traded. The name 'Silk Road' itself did not originate in Rome, however, but was stated to be coined by the German scholar, von Richthofen in the nineteenth century.

TRADING IN OTHER COMMODITIES

The Silk Road did not exclusively deal in silk. Many goods were traded along the routes. Ivory, gold, animals and plants were among other commodities. It also provided passages for various technologies, religions, and philosophies. According to www.great-wall-of-china.com the Eastward headed caravans brought gold, precious stones, ivory and metals to China. Westward caravans carried ceramics, jade, bronze and iron. It

the trading along the routes was a relay system. They were often traded repeatedly between different posts, until they reached their destinations. The middlemen controlled each small market along the way, so that, by the time goods reached their destination, the price was exorbitant. Further, no trader made the whole trip, along its entire length, as it was too dangerous. 'The desert had little or no water. The mountains were brutal. Sand storms would blow up out of nowhere. The snakes were poisonous. On top of the natural barriers, there were pirates'.

IMPORTANT SILK ROUTES

In ancient times, for trade of items, including silk, several different routes developed crossing Central Asia and passing through different oasis settlements. These routes



Figure 3 The ruins of Gaochang city, near Turfan

mentions that most of these materials did not follow a direct route, and, that

People travel to faraway places to watch, in fascination, the kind of people they ignore at home." – **Dagobert D. Runes**

started from the capital in Changan, headed up the Gansu corridor, and reached Dunhuang on

the edge of the Taklimakan.

There were two main Silk Routes—the northern and the southern. The northern route has much better infrastructure compared to the southern route. The vast grassland steppes provided fertile grazing, water, and easy passage for caravans, enabling merchants to travel long distances.

The northern route passed through Yumen Guan and crossed the neck of the Gobi desert to Hami (Kumul), before following the Tianshan mountains round the northern fringes of the Taklimakan. It passed through the major

on to Turkmenistan, before crossing into Iran from where the Silk Road branches off again.

The southern route is also called the Jade Road. It was from this road that the famous Hotan Jade was imported into China. The southern route branched off at Dunhuang, passing through the Yang Guan and skirting the southern edges of the desert, via Miran, Hetian (Khotan) and Shache (Yarkand), finally turning north again to meet the other route at Kashgar. Kashgar was an important center that led to Samarkand, the Caspian Sea and India.



Figure 4 The Great Wall of China at Jinshanling (en.wikipedia.org)

oases of Turfan and Kuqa before arriving at Kashgar, at the foot of the Pamirs. After Kashgar, the main route goes across the Pamirs into Central Asia. It passes through Kyrgyzstan, crosses Uzbekistan and continues

Two cross-desert highways bisect the Taklimakan connecting the northern and southern rim of the desert: Other routes branched off of these main arteries. The southern route crosses through Baghdad, Iraq

into Damascus and Syria, before eventually ending up in Alexandria, Egypt.

Numerous other routes were also used to a lesser extent; Marco Polo followed the northern route which involves crossing into Turkey to reach Istanbul, reaching China overland via Khotan and beginning his homeward journey with a ship on the Maritime Silk Road from Quanzhou to Iran. According to wiki travel many travellers today follow all or part of this ancient path by train, bus and private car.

As the years went by, a civilization of sorts grew up along the Silk Road. Temples appeared. There were even cities built on the rare oasis. It was never easy to travel by land from China to Rome. But it was worth it. Rome traded gold and gems for China's silk and spices. **But more things travelled the Silk Road than traders and goods. Ideas which transformed the world also traveled along the Silk Road as well'.**

THE TERRAIN

The region separating China from Europe and Western Asia is not the most hospitable in the world. Much of it is taken up by the

Taklimakan desert, one of the most hostile environments on our planet. There is very little vegetation, and almost no rainfall; sandstorms are very common, and have claimed the lives of countless people. The locals have a very great respect for this 'Land of Death'; few travellers in the past have had anything good to say about it. It covers a vast area, through which few roads pass; caravans throughout history have skirted its edges, from one isolated oasis to the next.

The climate is harsh; in the summer the daytime temperatures are in the 40's, with temperatures greater than 50 degrees Celsius measured not infrequently in the sub-sea level basin of Turfan. In winter the temperatures dip below minus 20 degrees. Temperatures soar in the sun, but drop very rapidly at dusk. Sand storms here are very common, and particularly dangerous due to the strength of the winds and the nature of the surface.

Unlike the Gobi desert, where there are a relatively large number of oases and water can be found not too far below the surface, the Taklimakan has much sparser resources. The land surrounding the Taklimakan is equally hostile. To the northeast lies the Gobi desert, almost as harsh in climate as the Taklimakan

itself;
on the



Figure 3. The Bezeklik Grottoes in the Flaming Mountains near Turfan (asianhistory.about.com)

remaining three sides lie some of the highest mountains in the world. To the South are the Himalaya, Karakorum and Kunlun ranges, which provide an effective barrier separating Central Asia from the Indian sub-continent.

THE GREAT WALL AND THE SILK ROUTE

The Silk Road has a history as ancient as the Great Wall. Both the Great Wall of China and the Silk Road are symbols of Chinese history. The Great Wall, constructed between 221 B.C. and A.D. 1644, spans 5,500 miles. It originally was built as a defense against the Mongols and today provides unity to the country and continues to amaze visitors from all over the world. The great wall of china is a feat in human accomplishment. Around the same time as the Great Wall construction during the Han dynasty, Zhan Qian opened the Silk Road route to trade with other countries such as India, Persia, Greece and Rome. Routes were extended and trade flourished during the remainder of the Han dynasty.

Slow-moving camel caravans laden with precious goods often made a tempting target for nomadic peoples along the way. In large part to protect the caravans that made it across the Gobi Desert and were on their way to Chang'an, the Han Dynasty extended the Great Wall to Dunhuang, the western edge of their territory and an important stop on the Silk Road. Wars with the Huns were fought along the Silk Road to gain control and keep the trade route open during the Han dynasty. After the Mongols gained power in 1271, the ruler Kublai Khan destroyed most of the toll gates and allowed for easier travel. Khan welcomed Marco Polo, the great explorer and gave him the right to travel the

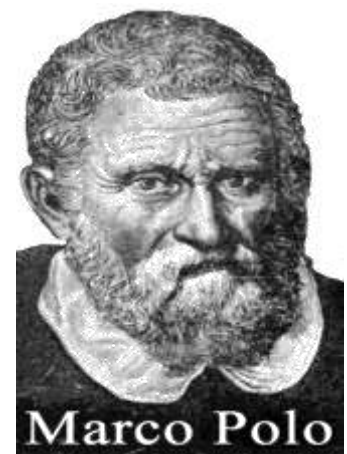
“Voyage, travel, and change of place impart vigor”
– Seneca

route whenever he liked. On the Silk Road, Chinese soldiers lost their lives defending the route from the Huns, mostly during the Han dynasty. Although they were successful at keeping the Huns at bay, many sacrificed their lives to maintain the trade route. (traveltips.usatoday.com)

Travel was very dangerous along the Silk Road. Merchants who traveled the routes were often robbed and killed. In the thirteenth century, Mongol armies used the Silk Road to expand their empire. The first Mongols on the Silk Road were nomadic warriors who attacked and looted the markets along the trade routes. In time, the Mongols developed their own efficient trade along the Silk Road.

FAMOUS TRAVELERS

Along with goods, ideas also traveled the Silk Road. **Buddhism which was introduced to China during the Han Dynasty by merchants from India, over time, lost much of its influence in India, but became very popular in China. Islam also reached China by this route.** Some Silk Road areas have important relics of those religions. Various ideas from the East also reached the Islamic countries and sometimes Europe.



The first Europeans to reach Kubilai's court

were Northern European traders, who arrived in 1261. However, the most well known and best documented visitor was the Italian Marco Polo. As a member of a merchant family from Venice, he was a good businessman and a keen observer. Starting in 1271, at the age of only seventeen, his travels with his father and uncle took him across Persia, and then along the southern branch of the Silk Road, via Khotan, finally ending at the court of Kubilai Khan at Khanbalik, the site of present-day Beijing, and the summer palace, better known as Xanadu. He travelled quite extensively in China, before returning to Italy by ship, via Sumatra and India to Hormuz and Constantinople. He wrote a book about his adventures, but his stories of China were so amazing that many Europeans could not believe that they were true.

During this period, in the seventh century, the Chinese traveler Xuan Zhuang crossed the region on his way to obtain Buddhist scriptures from India (ref: Wikipedia).

DECLINE

The demise of the Silk Road owes much to the development of the silk route by sea. The Road was used with varying levels of activity until the 15th Century when a sea route was discovered that linked the East and West. It was becoming rather easier and safer to transport goods by water rather than overland. Ships had become stronger and more reliable, and the route passed promising new markets in Southern Asia.

The advance of Islam, temporarily halted by the Mongols, continued until it formed a major force across Central Asia, surrounding the Taklimakan. As a result, the artwork of the region suffered, leading to the destruction of much of the originals. Many of the grottos have been defaced in this way, particularly at the sites such as Bezeklik, near Turfan.

The attitude of the later Chinese dynasties was the final blow to the trade route. The



Figure 6 The fort at Jiayuguan marks the Western end of the Great Wall

isolationist policies of the Ming dynasty did nothing to encourage trade between China and the rapidly developing West. This attitude was maintained throughout the Ming and Qing dynasties,

PRESENT

Trade on the Silk Road was a significant factor in the development of the civilizations of China, the Indian subcontinent, Persia, Europe, and Arabia, opening long-distance, political and economic interactions between the civilizations. The treasures of the ancient Silk Road are now scattered around museums in perhaps as many as a dozen countries. The biggest collections are in the British Museum and in Delhi, due to Stein and in Berlin, due to von Le Coq. The manuscripts attracted a lot of scholarly interest, and deciphering them is still not quite complete. Most of them are now in the British Library, and available for specialist study, but not on display. From its birth before Christ, through the heights of the Tang dynasty, until its slow demise six to seven hundred years ago, the Silk Road has had a unique role in foreign trade and political relations, stretching far beyond the bounds of Asia itself. It has left its mark on the development of civilisations on both sides of the continent.

Today, centuries after it disintegrated with the decline of the Mongol empire and the rise of sea power, the old Silk Road is being reinvented in a network of highways and arteries linking the remote desert of north-west China with cities in Europe, the Middle East and Russia.

CAN YOU VISIT THE SILK ROUTES?

According to information provided by traveltips.usatoday.com the Silk Road consists

of three main routes and spreads over 6,214 miles. Many guided tours of parts of the routes are available. The most common tour will take you through Beijing, Urumqi, Kashgar, Turpan, Dunhuang, Xian and Shanghai over two weeks. A few of the highlights include the Great Wall, the Terra-cotta Warriors of Xian and the Great Mosque in Shanghai.

According to wikitravel many travellers today follow all or part of this ancient path by train, bus and private car. Some Wikitravel itineraries partly follow the Silk Road.

- Istanbul to New Delhi over land
- Europe to South Asia over land
- On the trail of Marco Polo
- Eurasia By Train
- Guangzhou to New Delhi by Sea

The silk routes you visit today may only be a remnant of the grand, long-winding and treacherous routes they were once, with most of the land marks destroyed or ruined with the passage of time. However, to relive history of a place is also a unique personal experience.

References: -en.wikipedia.org/www.theguardian.com/
www.amnh.org / www.ess.uci.edu-All pictures courtesy/
[wikitravel](http://wikitravel.org) traveltips.usatoday.com/ asianhistory/about.com/
www.great-wall-of-china.com/ www.mrdowling.com

We wander for distraction, but we travel for fulfillment.” – **Hilaire Belloc**

UNIVERSE: THE FABRIC OF THE UNIVERSE

--A compilation of views on space-time by Anup Sinha

Today we know that the Universe is 13.7 billion years old, and, that it spans a diameter of over 150 billion light years (a **light-year** is the distance **light** travels in **one year**; **one light-year** is about 5.88 trillion miles or 9.5 trillion km) **When we visualise the vast expanse of space in the universe, to most of us it appears to be nothing but an empty void.** Is it really an empty void or is there anything called the fabric of the universe?

We do know that a ‘fabric is made of woven fibres that are sewn together in a characteristic pattern’. The conventional wisdom is that space embraces everything, it is non-deformable, it is three-dimensional and Euclidean. According to Brian Greene, author of the famous book “The Fabric of the

OF THE UNIVERSE

The observable universe is about 46 billion light years in radius. Scientific observation of the Universe has led to inferences of its earlier stages. These suggest that the Universe has been governed by the same physical laws and constants



throughout most of its history. The early development of the Universe is described by the Big Bang theory, according to which it is estimated to have begun 13.798 ± 0.037 billion years ago. The discovery of the cosmic microwave background radiation or CMBR



(Courtesy: NASA)

Universe” ‘**Space is a dynamic fabric that can stretch, twist, warp and ripple under the influence of gravity**’

THE BEGINNING

We come spinning out of nothingness, scattering stars like dust” **Jalal ad-Din Rumi**

supports this inference. According to

www.universetoday.com — ‘ Considering only the largest structures, the Universe is made up of filaments, voids, superclusters, and galaxy groups and clusters. The vast empty

spaces are known as voids. That the Universe is clumped together in certain parts and empty in others is consistent with measurements of the CMBR'.

THE CONCEPT OF SPACE-TIME

Wikipedia mentions that the Universe is all of space-time and everything that exists therein, including all planets, stars, galaxies, the contents of inter-galactic space, the smallest subatomic particles, and all matter and energy. Further, in physics, space-time (also space-time, or space-time continuum) is any mathematical model that combines space and time into a single inter-woven continuum. In cosmology, the concept of space-time combines space and time to a single abstract universe. Also, the space-time of our universe is usually interpreted from a Euclidean space perspective, which regards space as consisting of three dimensions, and time as consisting of one dimension, the 'fourth dimension'.

In classical mechanics, the term Euclidean space is used instead of space-time, as time is treated as universal and constant. It is independent of the motion of an observer. On the contrary, according to the Theory of Relativity, time cannot be separated from the three dimensions of space. This is because the observed rate at which time passes for an object depends on its velocity relative to the observer, and also on the strength of gravitational fields, which can slow the passage of time for an object, as seen by an observer outside the field. The website curiosity.discovery.com points out that ----- 'while we have the ability to control our experience of the first three dimensions (height, width and depth), we

Time and space are modes by which we think and not conditions in which we live" -- **Albert Einstein**

do not seem to have the ability to navigate, manipulate or control our experience of time, even though physics tells us that it is merely a dimension like all the others. For human beings, time seems to be a one-way street with a pretty strict speed limit'.

SPACE-TIME IN CULTURE AND LITERATURE

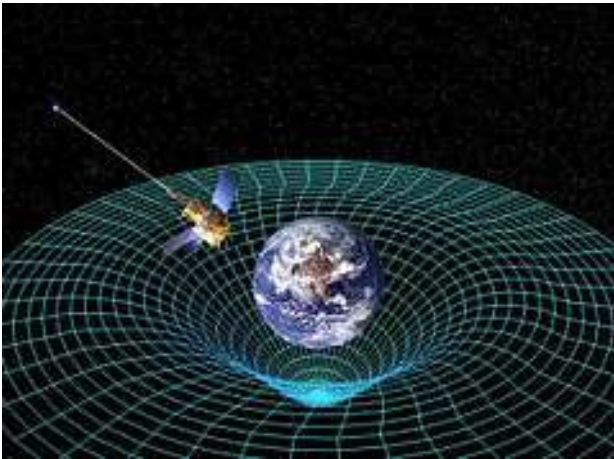
The Incas regarded space and time as a single concept, referred to as *pacha*. The peoples of the Andes believe in this concept. Arthur Schopenhauer wrote *On the Fourfold Root of the Principle of Sufficient Reason* (1813): "--- The representation of coexistence is impossible in Time alone; it depends, for its completion, upon the representation of Space; because, in mere Time, all things follow one another, and in mere Space all things are side by side; it is accordingly only by the combination of Time and Space that the representation of coexistence arises".

The idea of a unified spacetime is stated by Edgar Allan Poe in his essay on cosmology titled *Eureka* (1848) that "Space and duration are one". In 1895, in his novel *The Time Machine*, H. G. Wells wrote, "There is no difference between time and any of the three dimensions of space, except that our consciousness moves along it", and that "any real body must have extension in four directions: it must have Length, Breadth, Thickness, and Duration".

GRAVITY AND SPACE-TIME

According to Einstein's theory of gravity, also known as theory of General Relativity, gravity warps space-time. All objects with mass tend to curve the space-time 4-dimensional fabric. This

is because gravity is actually curving the 'space-time', around objects. The effect of gravitation on space and time was found to be most easily visualized as a "warp" or stretching in the geometrical fabric of space and time, in a smooth and continuous way. A very heavy star warps the space around it, causing a deep well in the fabric, and pulling in anything that comes too close (See picture).



MINKOWSKI AND SPACE-TIME

Space and Time were combined into a new mathematical/physical entity called 'space-time', because 'the equations of relativity show that both the space and time coordinates of any event must get mixed together by the mathematics, in order to accurately describe what we see. Because space consists of 3 dimensions, and time is 1-dimensional, space-time must, therefore, be a 4-dimensional object. It is believed to be a 'continuum' because so far as we know, there are no missing points in space or instants in time, and both can be subdivided without any apparent limit in size or duration. **So, physicists now routinely consider our world to be embedded in this 4-dimensional Space-Time continuum, and all events, places, moments in history,**

A human being is part of a whole, called by us the Universe, a part limited in time and space-**Albert Einstein**

actions and so on are described in terms of their location in Space-Time'.

While the idea of space-time is closely linked with the Theory of Special Relativity propounded by Albert Einstein in 1905, it was Hermann Minkowski, the famous mathematician who actually coined the term three years later in 1908, in response to Einstein's Theory of Relativity. In 1906, soon after Albert Einstein announced his Special Theory of Relativity, his former college teacher in mathematics, Hermann Minkowski, developed a new scheme for conceptualizing space and time that emphasized their geometric qualities. In a public lecture on relativity, he announced that ----'the views of space and time which I wish to lay before you have sprung from the soil of experimental physics, and therein lay their strength. They are radical. **Henceforth, space by itself, and time by itself, are doomed to fade away into mere shadows, and only a kind of union of the two will preserve an independent reality'.**

According to Brian Green, by combining space and time into a single manifold called Minkowski space, physicists have significantly simplified a large number of physical theories, as well as described in a more uniform way the workings of the universe at both the supergalactic and subatomic levels.

IS THE SPACE REALLY EMPTY?

The website about.com points out that one of the most amazing consequences of Einstein's theory is that *empty space isn't really empty.*

'In fact, empty space can possess its own energy; it is inherent to the very fabric of space-time. In

general relativity this manifests itself as the Cosmological Constant in the Einstein's Field Equations. It essentially acts to explain that as more space comes into existence - another property arising out of general relativity - that this new space would appear with this vacuum energy'. This vacuum energy could be the missing dark energy of the Universe, causing space-time itself to expand. It is, however, not understood where this energy comes from. The only supporting evidence is that mysterious acceleration of the Universe may or may not be linked to this phenomenon. Scientists say that dark energy makes up 70% of the universe. Physicists call it dark energy driving space to expand even more quickly; but they have no idea what it is dark energy. Some are of view that dark energy is the result of virtual particles being created - then annihilating- in the quantum foam of the Universe. "These virtual particles - caused by fluctuations of the background field of the Universe - are also thought to be responsible for carrying forces - like the electromagnetic, weak and strong forces - between objects. So it seems like a perfect candidate for dark energy. However, calculations attempting to estimate the total energy of such particles that would be randomly popping in and out of existence throughout the entire Universe were much too large. This does not necessarily discount the theory, but clearly there is something that we still do not understand about the nature of when and how these virtual particles are created'.

DISCUSSIONS IN THE FORUM

www.physicsforum.com In Forum discussion it is pointed out that time and space are large scale perceptions that emerge from some more fundamental processes at microscopic level. As per the Uncertainty Principle formulated by Heisenberg, smaller

the scale, the more chaotic space-time geometry is likely to be, and, that it may not even have a well defined dimensionality down near or below planck scale. Concepts like length, area, volume and angle may be indeterminate, just as in ordinary quantum mechanics the position and momentum of a particle are not completely determined. Smooth space and regular time may be illusions which appear at a macroscopic scale, emerging from a microscopic reality, which is not so smooth and regular.

Space and time are large scale perceptions that emerge from some more fundamental processes at microscopic level. Space, far from empty, is filled with some of the deepest mysteries of our time. (www.ws5.com/spacetime)

Some of the participants in the Forum discussions point out that first of all, space-time is not a fabric. Space and time are not tangible 'things' in the same way that water and air are. Further, it is incorrect to think of them as a 'medium' at all. No physicist or astronomer versed in these issues considers space-time to be a truly physical medium; however, that is the way in which our minds prefer to conceptualize this concept, and has done so since the 19th century. Back then physicists talked of ether. Today we know that ethers of the kind that behave like a physical medium are simply not present. We really do not know what space-time is, other than two clues afforded by quantum mechanics and general relativity. It is also pointed out in the Forum that, according to

"Beauty is the moment when time vanishes. Beauty is the space where eternity arises."

— Amit Ray

Albert Einstein, "Space-time does not claim existence in its own right, but only as a structural quality of the [gravitational] field". Added to that are comments by theoreticians such as Nobel laureate Steven Weinberg "Space and time coordinates are just four out of many degrees of freedom we need, to specify a self-consistent theory. What we are going to have [in any future Theory of

moves."-----“

Finally, as Einstein noted "*Space and time are modes in which we think, not conditions in which we exist*" which is a view also expressed in 900 AD by the Arabic physicist Ikhwan al-Sufa, "Space is a form abstracted from matter and exists only in consciousness".

When the fabric of the universe becomes unknown, it is the duty of the university to produce weavers.

QUOTEHD.COM

Gordon Gee
American Educator

Ref:-en.wikipedia.org

www.universetoday.com/

www.ws5.com/spacetime/

www.about.com/

www.ethertheory.org/en
/www.physicsforums.com/
curiosity.discovery.com

Everything] is not so much a new view of space and time, but a de-emphasis of space and time",

A similar view is expressed by Michael Green, a co-inventor of super-string theory. He is also quoted in the Forum discussions: "In the theory of gravity, you can't really separate the structure of space and time from the particles which are associated with the force of gravity [such as gravitons]. The notion of a string is inseparable from the space and time in which it

"The joy in looking and comprehending is nature's most beautiful gift "-
- Albert Einstein

The whole fabric of the space-time continuum is not merely curved, it is in fact totally bent—**Douglas Adams**

LIFE STREAM is a quarterly magazine on holistic life published by a group of people who are committed to spreading the message of living in harmony with nature.

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SERVICE IN TRUSTEESHIP

ABOUT US

The Life Science Foundation is a Not- for- Profit Public Charitable Trust registered on 30th December, 2009. It is a unique initiative by two officers belonging to the Indian Administrative Service (Bihar cadre) namely S. Jalaja and A.N.P. Sinha (IAS-1974) who have retired as Secretaries to Government of India. Their long experience with Governments at the National and State levels have instilled in them the will to continue to serve people, although from a different platform. Service through the medium of a public charitable Trust is in keeping with the Gandhi's ideal of Trusteeship.

OUR VISION

The term Life Science encompasses all aspects of life from Right to life- an inalienable right of every human being- to the interconnectedness of the entire web of life. Our vision, therefore, is to promote holistic understanding of life and its purpose, and improvement of quality of life of all.

OUR MISSION

Our mission is to improve quality of life through policy formulation, applied research and real life action. The Gandhian ideals of Sarvodaya and Trusteeship will be the guiding spirits.

OUR AIMS AND OBJECTIVES

To accomplish the above vision and mission, the Foundation will initially have the following aims and objectives. In course of time, more could be included:

1. To promote strategic thinking and suggest policy interventions on holistic and sustainable development.
2. To promote holistic health care system based on simple living, preventive healthcare, and both modern and traditional health systems.
3. To undertake studies, research and action-oriented projects pertaining to holistic life.
4. To undertake pilot projects of good governance including e-governance and eventually support the governments in adopting and up scaling successful pilots.
5. To work towards promoting quality of life of vulnerable sections of population, including women and children.
6. To promote all- round human resource development.
7. To design self- sustaining livelihood projects which minimise subsidies and donor-dependency.
8. To undertake other activities which are conducive to pursuit and fulfilment of the vision, Mission and Objectives of the Foundation.
9. Network with institutions and agencies to achieve the above objectives.

