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ORGANIC GROWTH

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Trash to Treasure

WASTE TO WEALTH

The nature of waste has undergone significant changes over the last couple of centuries. Initially, with the growth of urban spaces, the volume of waste began to grow but it was still mostly comprised of coal ash and organic remains. With the spread of industrialization and technological advancements, there has been a tectonic shift in waste composition, which is now comprised of products and packaging, accounting for almost 71% of all waste. This transformation is a direct fallout of the changes in consumption patterns that have increasingly promoted single-use products, often containing toxic components that could be harmful if stored. Historians have contended that the preoccupation with waste and its management began with rapid urbanization caused by the Industrial Revolution, while the crowding of industrial cities led to the spread of diseases. The link between health and waste disposal was quickly established which led to the setting up of waste management and treatment units in industrializing nations.

The notion of waste was not simply restricted to the discarding of consumables after use but was also called into question during the production processes of consumable goods. Urban waste, combined with industrial waste in the form of toxic emissions into the atmosphere and the pollution of water bodies, have occurred at alarming rates over the course of the last century. The preoccupation in the 21st Century has thus been on how to consume sensibly and gradually move away from the idea of a 'throwaway society' that characterized the developed world. Innovative thinking about how to consume responsibly has given rise to ideas about reusing conventionally considered 'waste' matter in order to convert into a resource. An example of this would be the conversion of plastic waste into diesel fuel, at a time when the aquatic ecosystem is under grave threat given the proportion of plastic waste polluting our oceans. Plastic waste finds its way into oceans and other water bodies leading to the phenomenon known as plastic soup.Plastic does not decompose in the water but eventually breaks down into smaller pieces due to the effects of weathering, sunlight and wave action.The smaller the pieces, the more difficult it is to clean them up. 75% of all debris at sea is plastic and polystyrene. It was found that 36% of researched fish or consumption caught in the English Channel had plastic in their stomachs while 83% of crayfish researched in Norway had plastic fibres. Nearly 100% of the fulmars have plastic in their stomachs.In one decade the number of animals entangled in plastic has risen by 40%. Water bodies, constituting 75% of the planet's surface,are our primary source of oxygen. Pollution of the oceans has far reaching

detrimental effects on all life forms. The need to think disruptively about the ways in which we have been going about things has never been more urgent! The Swiss have been leading the way in conversion of waste to energy through their Zurich Disposal and Recycling Services (ERZ), where burnable trash is turned into CO2 neutral thermal heat and environmentally friendly electricity.In India too, the idea of converting waste to energy has caught on. It has been estimated that as many as 24 waste-to-energy projects to produce 233MW are currently in different stages of construction and five projects of 79MW have already been tendered, adding up to a total of 312 MW. Once all this capacity comes on stream, India's waste-to-energy capacity will go up by six-fold from the current 53MW produced from five such projects. As per estimates by the urban development ministry, about Rs.65,000 crore of public and private investments will flow into city waste management, cleanliness and waste-to energy projects over the next three years, according to reports carried in national dailies. New waste-to-energy capacity is coming up in places like Nalgonda district and Greater Hyderabad Municipal Corporation in Telangana, Bawana and Kidwai Nagar in Delhi, Jabalpur and Indore in Madhya Pradesh, Pune and Kolhapur in Maharashtra, Pallavaram in Chennai, Allahabad and Agra in Uttar Pradesh and Bathinda and Jalandhar in Punjab. (Source: Waste-to-energy projects see revival in investor interest, Livemint, 23 March, 2016)

The North East of India has, to a large extent, managed to escape the adverse effects of urbanization and industrialization to retain its diverse ecosystems and natural bounty. In order to ensure the perpetuation of these ecosystems and preserve the natural wealth of this region, certain proactive measures become necessary for government agencies, industry, private businesses, civil society and individuals. One such measure can be a prohibition on or reduction in the use of non-biodegradable materials. A good start to this would be advocating a ban on the use of plastic and other environmentally toxic material in product packaging.

The tea industry, an important sectorof the North East, is well-poised to address the issue of waste within their production processes, whether in the form of turning residual organic waste into compost; or better management of oil and coal as fuel resources; or aiming for water neutrality in the manufacturing factories. Amalgamated Plantations as an organization is committed to the principle of responsible consumption and production, where ideas about converting waste into resources for the manufacturing of tea is being constantly probed and propagated. Considerable effort is being taken to turn all our tea estate factories into waste neutral units, with a vision to eventually have systems in place to treat and recycle waste water within each of these units. To put into practice the cradle to cradle approach is what we are striving towards as an organization. However, the journey is not easy given the pulls and push of market forces. Government assistance in achieving these goals is crucial. One way to get there, at an industry-level, may be to set up an auditing system to certify zero-waste organizations, who then should be rewarded by governments for their achievements. The vision of replacing wasteful production and consumption with well-planned recycling and reusing of waste material, converting them into a resource base, may be a better roadmap for achieving sustainable wealth.

Ranjit Barthakur, Chairman, APPL Foundation

MAKING WASTE WORK

> Whatever nature produces has value for biota. Wasting waste is a characteristic of human societies.

1. The only species living on Earth capable of making something no one else desires is the human species. Nature does not make anything which remains without use. Nature operates in ecological and open systems, where complementary species ensure that all that is produced is consumed. Whatever nature produces has value for biota. Wasting waste is a characteristic of human societies.

2. Nature demonstrates that the problem is not the production of waste. After all, every living system generates waste. The real challenge humanity

faces is to figure out what to do with waste. Society has attempted to dispose solid waste through landfill, incineration, recycling and composting, to treat waste water aerobically and anaerobically, to reduce air emissions by installing filters and scrubbers. These have been costly to the consumer. Worse, the results have been unsatisfactory.

3. Economists are expected to design production and consumption models which do more with less. Enhanced productivity stands as the key goal of human activity. Effective competitiveness calls for society's capacity to combine capital, labor and raw materials so efficiently that higher quality products and services are generated at the right time, and at lower cost.

The challenge is now to go beyond the lower costs, rather to generate more value with available resources.

4. Business pursues the search for increasingly higher levels of productivity and competitiveness, adhering to the core business strategy, focusing on only one product. This strategy has worked remarkably well in the past, and represents the dominant corporate strategy of today, though it is unlikely that this strategy will lead to sustainable production and consumption in the future.

5. While the present economic system is likely the most efficient on record, it cannot be considered ideal. This economic model is incapable of producing, distributing and supplying sufficient goods and services to everyone on Earth. There are 100 million people without land or home; there are 1 billion looking for jobs, and 800 million who go to bed hungry. Time has come to improve the system so that it produces more with what the Earth already generates, thus responding to massive unmet demands. This can be achieved by putting waste to work.

6. The Earth produces much more than what industry processes and what societies consume. How can we otherwise explain the massive amounts of waste, which choke rivers, which fill up dumps, and contaminate the air? Every industry, as diverse as beer brewing, aluminum smelting, machine making, and paper milling, survived competition in this globalized market, because each revolutionized labor productivity, and produces more with fewer people, with less capital, and generates better return with less risk. But few industries have achieved dramatically higher levels of raw material productivity.

Time has come to improve the system so that it produces more with what the Earth already generates, thus responding to massive unmet demands.

7. Beer uses only 8 percent of malt; aluminum uses a mere 3 percent of bauxite; a catalytic converter of 12 lbs needs to process 6,000 lbs of ore; paper fibers are barely 6 percent of the tree's mass, and a cup of coffee only gives value to 0.2% of the biomass harvested by the farmer. Tea leaves are probably the champions of waste: only 0.1% gets ingested, and 99.9% is wasted. There is a lot of room for improvement. While capital and labor productivity has been managed successfully through innovations from within the industry, raw material productivity requires solutions outside the industry.

8. As long as industry remains within its core activities, response is limited to the well known: "reduce, reuse, recycle". A beer brewer can reduce the amount of water needed from 30 to 5 liters per liter of beer, then cool it to the required temperatures, and then add chemicals to make its pH neutral. While this benefits the environment, it increases costs. But the fermentation of beer can never be achieved without any waste water or spent grains.

9. Making waste work is only feasible and sustainable if and when new value is generated in the process. If alkaline water from a beer brewery were first processed in a digester, trapping organic matter, while letting water flow through, then the biomass could be mineralized up to 60 percent. If the three chamber digester is improved to a 12 chamber system, then the efficiency of biogas production increases to +90%. This generates biogas, and the residual mineralised matter in water can be used in algal farming, further mineralizing organic matter, converting organic solids into an excellent feed for pigs, or humans. Some of the spent grain can also be used as a substrate for mushroom farming, or for the baking of bread. What was first considered a problem and a cost, can now be converted into an engine for job and revenue generation. The first such brewery was inaugurated in 1997 in Namibia, and has been repeated over a dozen times. Imagine this turns into the standard for beer brewing around the world dramatically reducing the cost of bread, reducing the need for wheat, freeing up land for other core crops to feed an increasing number of earthlings.

Making waste work is only feasible and sustainable if and when new value is generated in the process.

10. The same logic applies to the coffee industry. Coffee producers generate coffee beans, which are just 3.7 percent of the plant. After toasting and brewing the beans, the solid matter which finally ends up in the cup that we drink is a mere 0.2 percent of the coffee biomass. The US$15 billion internationally traded crop of 10 million tons is thus based on the consumption of only a fifth of one percent of the coffee plant biomass. Most of the 99.8 percent residue, is considered waste, and ends up in local rivers and valleys, landfills and incinerators. If the farmer knew how to cultivate tropical mushrooms on coffee leaves, seed coasts, and branches, then he can harvest 75 kg of mushrooms on 100 kg of waste. One crop now generates a double stream of revenues: one from coffee, and one from mushrooms cultivated on coffee waste. The first mixed coffee/mushroom farms started operating in Colombia in 1999. Today, there are over 3,000 coffee to mushroom farms, from rural to urban sites, adapting to the local conditions and tastes. The same applies to tea.

11. When we add valued to what used to be discarded before, then there is no waste. This approach could end up in a surprising cluster of processes no one could envisage. The mushroom enzymes for example metabolise the biochemicals which previously impeded the use of coffee waste as cattle feed. The spent substrate is then enriched, since the mushroom mycelia contain up to 32 percent protein. What was once considered a problem, is now a source of income, enriched cattle feed, and a source of new jobs. The coffee farm which could not provide sufficient revenues at first, is now becoming a symbol of a new development paradigm: by making waste work. Better even, the coffee farmers' income increases thanks to the non-coffee income, making his business independent from the world market prices.

12. The scheme of using waste as a source for value generation offers a new vision for developing economies. When a particular economic activity does not generate sufficient income, there comes a need to diversify. It takes time to identify viable new alternatives. It requires financing to effect the conversion. But, based on the two cases presented, it is feasible to pursue a diversification strategy, without dropping the main business, by making productive use of the leftovers. This is called diversification from within. The improvement of resource efficiency reaches a surprising factor 12 for beer, and factor 500 for coffee, permitting growth of the economy, strengthening resilience in the community, generating jobs without exhausting the Earth or seeking recourse to genomes and genetics.

The scheme of using waste as a source for value generation offers a new vision for developing economies.

13. Just imagine: it is impossible to grow some specific high value mushrooms without coffee waste. It is also impossible to feed cattle with coffee waste biomass, before its metabolic conversion by the specific mushrooms. This diversification strategy within the ecosystem, typical for Africa, Asia, Latin America and the Caribbean, deviates from traditional management beliefs. First, it is believed that increased levels of productivity mean a reduction of jobs. Now, increased levels of productivity go hand in hand with job creation. Second, diversification strategies traditionally implied a substitution of one crop with another. Now, new revenue streams are conditional to the using of waste generated by the original crop. This empowers communities to respond to basic needs for all, with what they have.

14. What can be applied in agriculture in the Third World, also works in industry and in energy production of industrialized countries. Closing a cement plant costs money. Just imagine how a negative asset on the balance sheet can be converted into a source of income. The conversion of a defunct cement plant into one of the largest composting units in Europe, is a case in point.

15. The City of Stockholm will ship its solid municipal waste by boat to a "new" composting center. If such a center were to be built from scratch, it would be too expensive. Now it can use an infrastructure and a kiln which is useless for cement making, but ideal for composting. Hence, compost is produced at low cost, competing with synthetic fertilizer on both price and quality. Everyone gains: the cement company reduces decommissioning costs, the city lengthens the life of its landfill, local industry pays reduced waste charges, and farmers buy competitive compost. This creates new industries. Waste, including wasted plants and equipment, put everyone to work efficiently. The plant was inaugurated in May 2000. The technology was quickly adopted by the Japanese industrial group Taiheiyo Cement which accepts all waste from the nearby City of Hidaka. The gasification in the old cement kiln increased the energy content, saving 50% coal, reducing the impact using what is already available, including the stranded assets.

16. What could energy companies do with their excess generation of carbon dioxide? An overdependence on fossil fuels and their discharge of CO2 seems to lead to climate change. Protecting forests, planting trees or pumping of the gases

into the deep seas, do not offer a satisfactory answer. A more innovative approach is necessary. A housing programme based on giant grasses requires massive amounts of carbon dioxide as a source of carbon in their growth dynamics. This is the use of the generative capacity of ecosystems and the best of Nature to ensure that we formulate a response to the growing demand for housing.

17. The wood of these giant grasses (bamboo and related flora), also called "vegetable steel" has a better tensile and compression strength (based on weight/performance) than man-made steel. Once cut, grass grows again. Bamboo captures an estimated 40 times more carbon dioxide per hectare per year than a pine tree forest.

A programme launched in Brazil, Colombia and Ecuador to "Grow your own house", promotes increased use of carbon dioxide, to a level which is a multiple of what was the practice before.

If the energy sector is to produce a positive carbon balance, offsetting years of wastage, then it knows it is impossible within the industry. But if it is prepared to search for creative solutions outside its system, it can do so, and even supply competitive, beautiful and cheap housing in addition.

18. The elimination of the concept of waste and its conversion into matter and energy searching for value added use, offers a basis for a more efficient and competitive economy. The methodology supporting this concept starts from an inventory of all waste listed in input/output tables, as the ISO 14,000 certification process prescribes. Process engineers know very well how to undertake this. A project team then establishes an output/input table, whereby whatever was left over, is scrutinized until a new productive use has been found. This is only possible if a multidisciplinary team can cooperate and is prepared to go beyond the core business. This process is to combine the depth of science with the creativity of the entrepreneur. All inputs combined, lead to a clustering of industries. This is not only theoretically feasible: over one hundred projects around the world posted on ← www.TheBlueEconomy→ demonstrate that it is indispensable, if we wish to respond to the pressing needs of humanity without causing environmental degradation upon planet Earth.

19. The successful implementation of clustered industries requires a multidisciplinary research and development program. It searches for a portfolio of technologies which are integrated into a system, where techniques to combine and to separate, make full use of time, pressure, temperature, chemical (organic and inorganic) and other parameters. Whereas industry today may claim that this is impossible, it should reflect for a moment on the strides forward in the quest for just-in-time delivery of assembly parts to the automobile industry. Factories which have not succeeded in clustering hundreds of contractors in a tightly woven net of supply chains, loose, or have lost out against those car manufacturers who did slash inventory from 30 days to 30 minutes.

20. The "zero waste and zero emissions" concept is feasible. Its full scale implementation may take a generation. But it is likely to go faster than expected. Economics are influenced by expectations. When entrepreneurs expect waste to become income, then their perception of reality changes. Under such a perception, executives are prepared to take risks, and rapidly convert waste management into a productivity strategy. If business and finance would dedicate the same vigor to finding use for waste, as it focused on labor and capital productivity, then it is certain to produce results fast.

21. The waste challenge can be only solved by calling upon all actors to do more with what the Earth produces. Restrictive measures and legislation could provide a kick start. Science and technology can provide insights and ideas, but it is up to the entrepreneur to make the difference. Now, we can envision a market system which puts what once was considered waste, to work. This is a production and consumption model worthy of the 21st century.

The waste challenge can be only solved by calling upon all actors to do more with what the Earth produces.

Gunter Pauli

Author of the Report to the Club of Rome "The Blue Economy" founder of the Zero Emissions Research and Initiatives (ZERI)

The author established in 1994 a network of 3,000 scientists. Based on their creative solutions a portfolio of new businesses have emerged from Fiji to Japan, from China to Denmark, from Namibia to the Italy. Over 200 projects were implemented, +$4 billion were invested and more than three million jobs were created. A fresh look at productivity demonstrates that there is a great opportunity to unleash entrepreneurship worldwide. But these new businesses are not only responding to a real need in an innovative way, they are competing on price and quality, creating the economy many have been expecting after this long period of "downsizing". Upsizing is the real response.

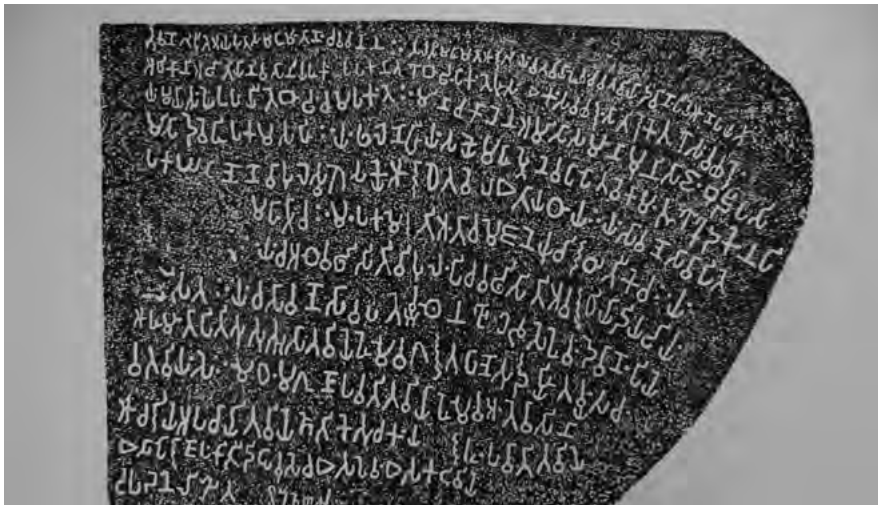
THE WORLD'S FIRST HABITAT AND SPECIES PROTECTION LAWS

We like to think that environmental protection is relatively recent invention, and that in particular the United States has been a pioneer in this area, establishing national forests and parks well over a century ago and promulgating the world's first endangered species protection act more than a generation ago.

In reality this is an extraordinarily provincial view; in ancient India in the 4th and 3rd Century B.C. there were arguably more advanced provisions for habitat and species protection than anything in the U.S. until the 20th Century.

The great Indian Emperor Ashoka (268—239 B.C.) commanded a huge empire that included most of today's India, Pakistan, and half of Aghanistan. Following a particularly bloody war in 260 BC Ashoka converted to Buddhism and promulgated a series of edicts based on non-violence, religious toleration, and protection of animals and habitat. These edicts were inscribed on rock faces and high stone pillars from Southern India to Afghanstan, and many can still be seen today.

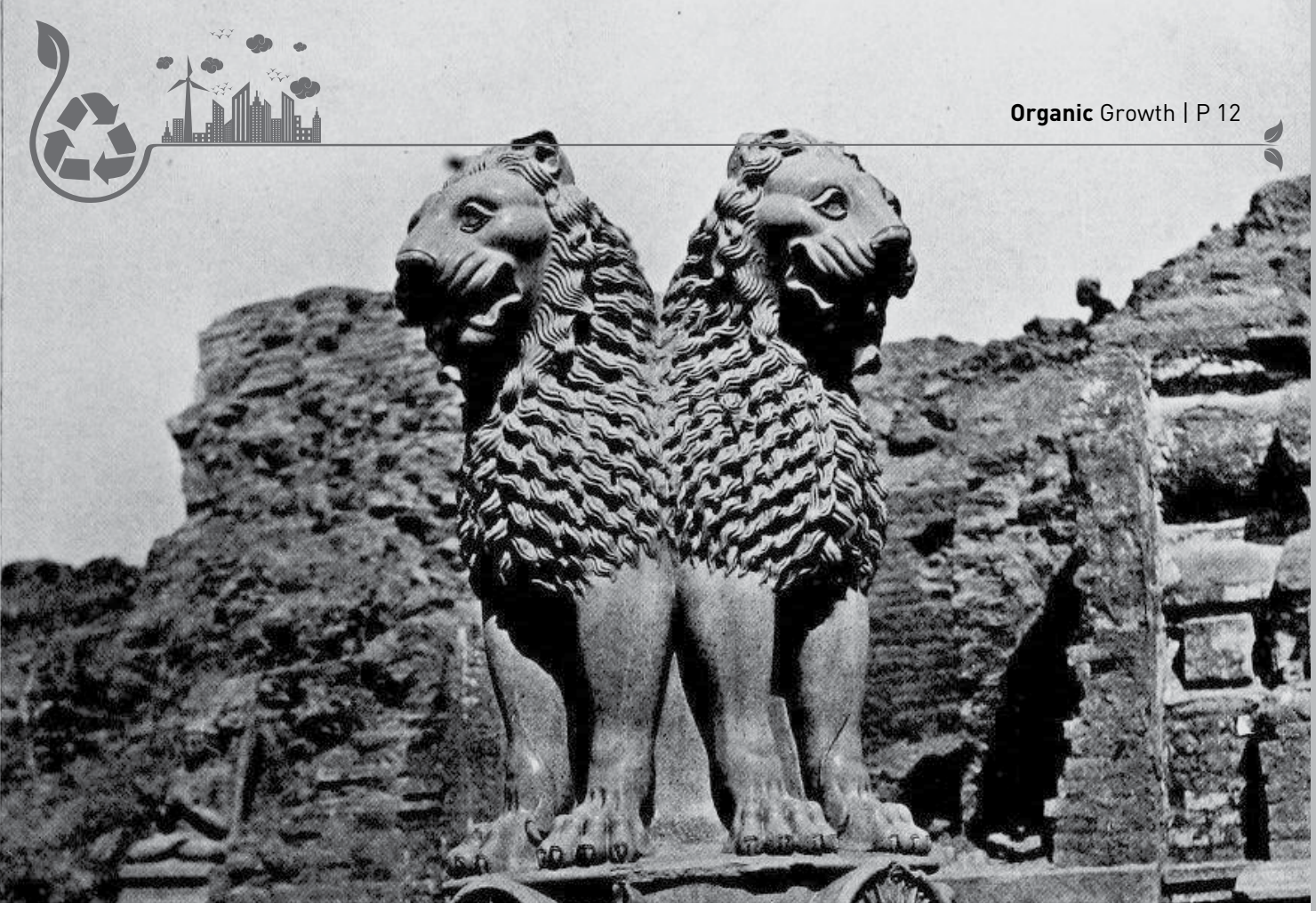
Ashoka's Fifth Pillar Edict, erected around 242-241 BC, is nothing less than a species and forest protection law.



It lists all of the kinds of animals declared as protected and exempt from slaughter—including tortoises, bats, ants, ducks, geese, swans, doves, porcupines, squirrels, deer, lizards, rhinoceroses and pigeons. In fact, all four-footed animals "which are not eaten and of no utility" are to be protected. He promulgates what we would call measures for habitat protection, declaring that "forests must not be set on fire either wantonly or for the destruction of life," and that the chaff in fields "must not be set on fire along with the living things in it." On numerous fixed days other kinds of animals may not be destroyed and elephant forests and fish ponds are not to be harvested. On other fixed days various ritual mutilations and sacrifices of other animals are prohibited, as well as the branding of horses and oxen.

One of the most intriguing provisions of Pillar Edict five is that "an animal must not be fed with another animal," a measure which could have stopped the spread of Mad Cow Disease in our own time and which goes against the entire practice of using fish and animal feed in raising modern livestock. We are increasingly seeing the environmental and public health consequences of using the processed remains of animals to feed other animals—not to speak of the ethical implications of turning normally vegetarian mammals into carnivores, even cannibals.

This is only one example where an Ashokan injunction rooted in considerations of respect and non-violence towards other sentient beings can have very practical environmental and social repercussions which only today we are becoming aware of. Another is the commandment to not burn the chaff in the fields so as not to kill the insects and animals that may be living in or off it. This is a practice which has enjoyed a revival in both India and the United States in recent years for different reasons.



In India there have been widespread protests by landless villagers for decades against attempts to replace traditional agricultural crops with eucalyptus tree plantations, since poor populations traditionally had access to farmers' fields to use the chaff of food crops for fuel and fodder. In the US, concern with the high financial and environmental cost of input-intensive agriculture has fostered a movement towards sustainable agriculture over the past decade and a half. One of the primary features of sustainable agriculture is no-till cultivation, whereby soil erosion is markedly reduced by not removing chaff from the fields after harvesting and not ploughing deep furrows for sowing. The decaying chaff provides a natural source of fertilization as well as protecting against erosion.

Kautilya advocates the establishment of various kinds of protected forests, "one for each kind of forest produce." The kinds of forest produce include besides hardwoods: reeds and bamboo; creepers and cane; fibres, such as hemp; materials for ropes; leaves for writing such as palm leaves; flowers used in dyes; medicinal plants and herbs; and plants used for poisons. Again there are interesting modern correlations here, since in the whole area of international forest conservation the issue of sustainable use of non-timber resources has become increasingly important since the early 1990s. The setting aside of 'extractive reserves' for non-timber resources such as natural rubber in the Amazon, chicle in the Guatamalan Peten rainforest, and ratan in Borneo, has become an important alternative in the struggle to promote conservation of forests that will allow economic benefits for local populations from the sustainable harvesting of non-timber products.

Kautilya advocates rational, long-term sustainable use of resources, including conservation of forests and protection of various species of animals and plants.

> Kautilya also advocates the creation of protected reserves "where all animals are welcomed as guests and given full protection."

There is to be imposed the highest fine...for binding killing or injuring deer, beasts, birds or fish for whom safety has been proclaimed and who are kept in reserved parks, the middle fine on householders (for these offences) in reserved park enclosures.

Apparently the fine for householders for poaching was less because it was assumed the motive would be personal use rather than sale. Of great importance too is the setting aside of special reserve forests for elephants, well-guarded, with the death penalty for poaching. Having a sustained supply of elephants was a matter of state security, for military victory 'depends principally on elephants.'

Kautilya enumertes a list of species "which should be protected from all dangers of injury." These include, besides cattle, various kinds of birds and deer. Beyond the protection of specific species, Kautilya also sets forth general rules against cruelty to animals. Causing hurt to small animals is punished by lesser fines, a higher fine if blood is drawn; hurting and drawing blood from larger animals entails still higher fines, and the offender has to pay for the treatment and recovery of the injured beast. Even individual plants and trees enjoy protection, and if the scale of fines is indicative, they rank higher than animals, at least in urban areas.. All of this is to be overseen by several special departments of government, including a Chief Superintendent of Forest Produce, a Chief Elephant Forester, and a Chief Protector of Animals and Controller of Animal Slaughter.

We have here a whole program of resource management and conservation which is more sophisticated and far-sighted than anything found in the United States until the late 19th century. Kautilya's approach might be compared to that of the utilitarian conservationists of the Gifford Pinchot school. Pinchot (1865—1946), the founder of the US Forest Service and of America's first Graduate School of forest management at Yale, was a close friend of Theodore Roosevelt. He is widely viewed as the founder and most eloquent spokesperson of his time for multiple use management of natural resources in the United States. Pinchot literally coined the term 'conservation,' defining it as 'the use of the earth for the good of man,' a definition which almost paraphrases Kautilya's description of artha. In fact, the story of how Pinchot chose the word 'conservation' to describe the then new approach to sustainable land and resource management a century ago relates to Indian history. Apparently Pinchot and a forester named Overton Price were discussing the need for a new term to describe their philosophy of resource use, and they remembered that in India the government forests were called 'conservancies.'

> The essence of Pinchot's approach was rational, multiple use of resources for economic and other ends, with careful attention to their stewardship.

His former friend, John Muir, later became his greatest opponent, for Muir was one of the first of whom we would call today deep ecologists, advocating the protection of nature and species as a value in itself, not as something that should be justified on any economic or utilitarian grounds. Ashoka's approach to conservation builds on that of Kautilya, but also transcends it in a higher ethos of respect and care for all life with which John Muir would have agreed.

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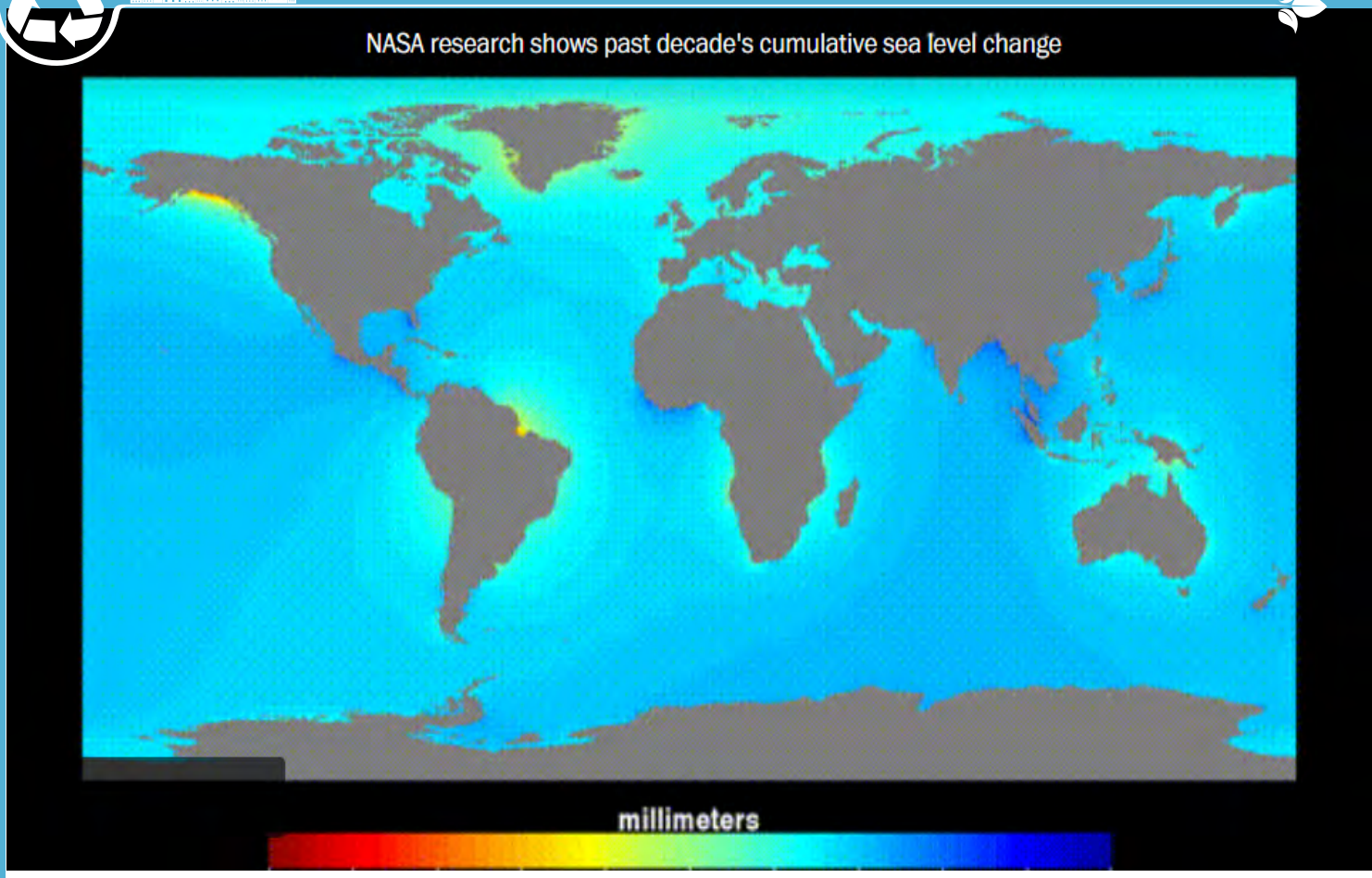
A STUNNING PREDICTION OF CLIMATE SCIENCE - AND BASIC PHYSICS - MAY NOW BE COMING TRUE

A lot of people deny climate change. Not many, though, deny gravity.

That's why a recent animation released by NASA's Jet Propulsion Laboratory — well, it came out in April, but people seem to be noticing it now — is so striking. Because it suggests the likely gravitational imprint of our changing climate on key features of the Earth in a way that's truly startling.

The animation uses measurements from NASA's squadron of GRACE satellites (Gravity Recovery and Climate Experiment), which detect changes in mass below them as they fly over the Earth, to calculate how the ocean changed from April 2002 until July 2013, based on corresponding changes in the mass of the continents. The resulting animation suggests the oceans gained mass overall, as seas rose, albeit with seasonal variations that result from water moving from the continents into the seas and back again.



But in key areas where glaciers have been melting — coastal Alaska, West Antarctica and, above all, Greenland — it suggests something very different happened. Here, the animation finds that the ocean actually fell, and in some places by as much as 50 millimeters (2 inches) over this short decadal span:

It's important to stress that the animation above shows a mathematical inference based on gravitational measurements and a model that extends them to the oceans, rather than a direct sampling of sea levels around Greenland's remote coasts. It also doesn't take into account other factors that affect sea level, such as ocean temperatures, currents and salinity.

But if it is right, well, then it's showing exactly what climate scientists have long been predicting would happen.

"When an ice sheet loses mass, for example, the gravity drops locally (remember that gravity is proportional to mass) — meaning the gravitational attraction between the continent and surrounding ocean diminishes, thus causing the ocean mass to move to the farfield," explains NASA's Surendra Adhikari, whose research is behind the animation.

The result, combined with other factors, is that "the relative sea level tends to drop locally and it tends to rise at a much higher pace than global mean (or eustatic) rate in the farfield," he said by email.

Erik Ivins, Adhikari's co-author, acknowledged that the animation does not present a direct measurement of sea level around Greenland from, say, local tide gauges. But given the strength of understanding of the core physics, he said,

> "we rather confidently predict these global and local sea-level rises and falls to be occurring over the same time scales as ice sheets change [their] mass."

Adhikari and Ivins were also behind recent research showing another, perhaps even more stunning consequence of mass change from the planet's ice sheets — the Earth's rotation has changed accordingly. The animation above takes into account these rotational changes as well and how they impact sea levels.

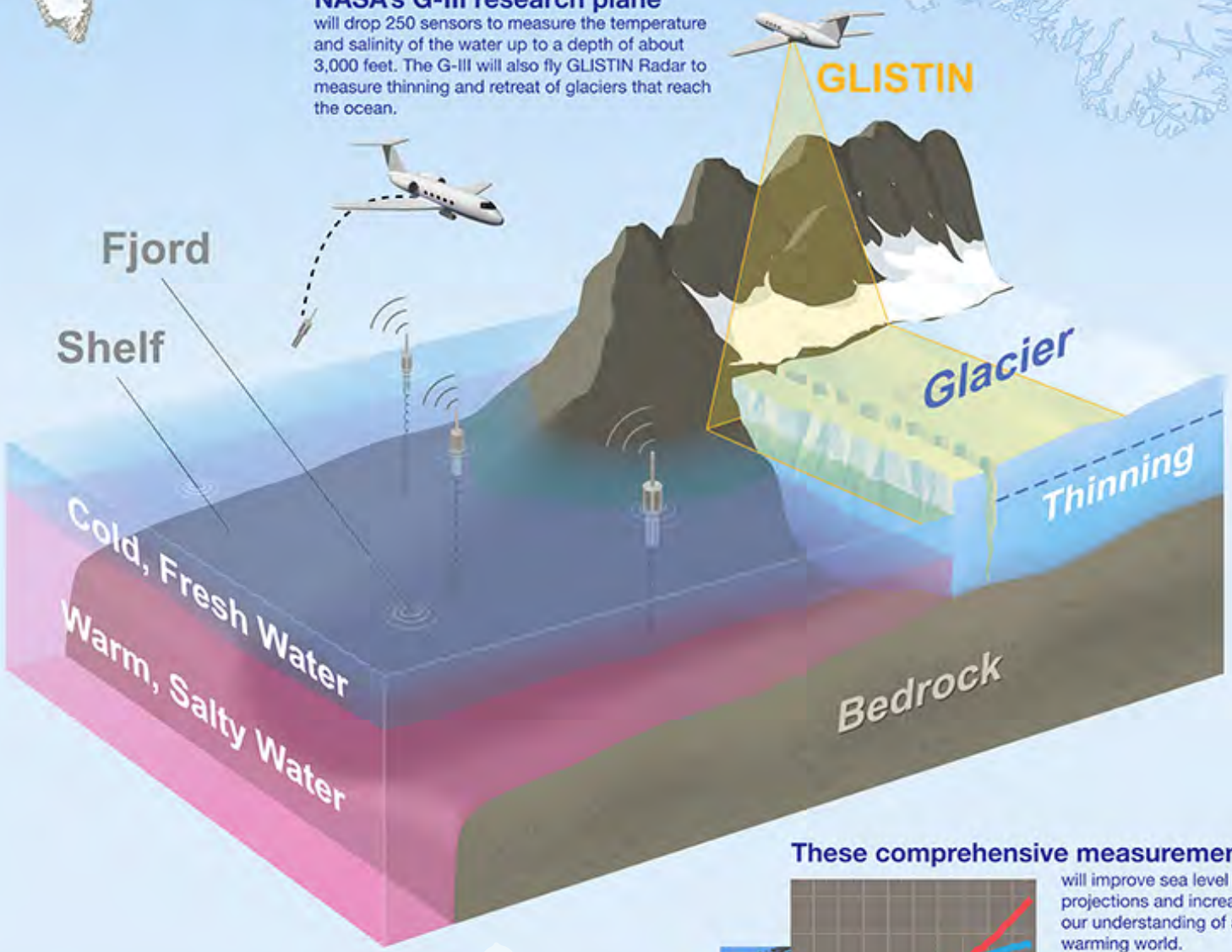
Greenland and Antarctic melt isn't just raising seas — it's changing the Earth's rotation

Measuring Greenland's Ice

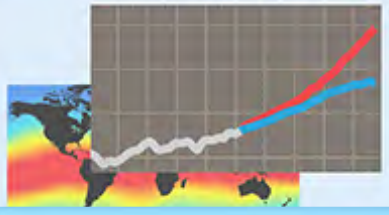
The Greenland Ice Sheet is three times the size of Texas (about 660,000 square miles) and a mile deep on average. And it's melting. The loss of Greenland's ice could raise global sea levels by 20 feet. The **Oceans Melting Greenland (OMG) mission** will help scientists understand how the Atlantic is joining with the atmosphere to melt the Earth's second-largest ice sheet.

By boat and plane, scientists are making the first high-resolution maps of Greenland's 27,000 miles of coast and the pathways along the ocean floor that allow warm, salty seawater to reach and melt the ice.

NASA's G-III research plane will drop 250 sensors to measure the temperature and salinity of the water up to a depth of about 3,000 feet. The G-III will also fly GLISTIN Radar to measure thinning and retreat of glaciers that reach the ocean.



These comprehensive measurements will improve sea level rise projections and increase our understanding of a warming world.



One thing is very clear: Greenland is losing large amounts of mass. Scientists recently reported that the ice-covered island lost 1 trillion tons of ice mass to the ocean in just four years, between 2011 and 2014. The animation shows a longer and not entirely overlapping period, but one in which the total mass loss was surely even larger.

Several scientists contacted by The Washington Post said the results were intriguing, while cautioning that they did not constitute a direct measurement of sea level.

"I find the results interesting and plausible," said David Holland, a New York University geoscientist who studies Greenland.

> "For sure the ice sheet in coastal Greenland has lowered, and since gravity is a very solid physical fact, then for sure one would expect the coastal ocean to lower, close to the ice sheet where there would be a sizable gravitational impact,"

Holland continued.

Holland said he has plans to more directly measure sea level around the icy island, which would confirm the results and put them on a "more solid footing."

"I believe that the authors have calculated that there now should be a signal of locally dropping sea level near the ice sheets from the mass loss causing reduction in the gravitational attraction of the ice for the ocean, but, the authors haven't measured that sea-level fall close to the ice sheet," added Penn State glaciologist Richard Alley by email. "Identifying it will be complicated by the lack of tide gauges, the high latitude (themain satellite sea-level analyses just reach the southern end of Greenland), and the various complicating things such as changing winds and changing salinity affecting the local sea level, etc."

"The ocean can adjust to these changes in gravity in the timespan of days to a couple weeks, making the impact happen quickly,"

noted Christopher Harig, a geoscientist at Princeton who also conducts research using the GRACE satellites, and who said the findings fit his expectations. "The effect is also much greater than the average sea level rise you would see far away. While sea level might rise a meter far away from the ice sheets, we would see a drop several times this in the sea level on the coast of Greenland for instance." But Harig, too, noted an important role for direct sea-level measurements to confirm the findings.

[The vast, shrinking northern glaciers that we never even talk about]

If those verify what the animation shows, incidentally, it would amount to a stunningly good example of scientific predictions about climate change being borne out.

Researchers have long predicted that we would see precisely this effect — although their calculations have more often tended to show seas falling around West Antarctica and rising around the United States, which is what you'd expect for major ice loss from the South Pole while Greenland stays relatively intact.

The U.S. has contributed more to global warming than any other country. Here's how the Earth will get its revenge

Yet Greenland, at least so far, has been outstripping Antarctica for ice loss because it is exposed to very warm Arctic air temperatures. Antarctica has vastly more ice to lose, but it has been more insulated from strong surface temperature change (although the oceans are melting parts of it from below). So the gravity calculations are currently weighting Greenland's loss, and its sea level consequences, more heavily than Antarctica's.

Accordingly, the animation suggests, sea level fall has been around Greenland, and the sea rise, in the "farfield," has been much farther away including East Antarctica and southern Africa.

"The fall we predict follows from extraordinarily straightforward physics — the physics [of] Newton and those who brought the rigor of 19th-century mathematical physics to bear on elastic response and gravitation," said NASA's Ivins by email.

ORGANIC NEWS

World Scenario

1. **Hawaii aims to be 1st to help farmers get certified organic**

http://www.seattletimes.com/business/hawaii-plan-would-offset-cost-of-organic-farm-certification/

- On a farm tucked under a lush Hawaii mountainside, Sean Anderson tends passion fruit, kale and salad greens — using only what nature provides.
- He creates his own compost and fertilizers and doesn't use chemicals. But he's not certified as an organic farmer because the cost is too high.
- "The margins on farming are so slim as it is that any additional cost really can make or break the success of your business," said Anderson, founder and farm manager of Green Rows Farm.

2. **Record growth in US organic farming**

http://www.thescottishfarmer.co.uk/news/record-growth-in-us-organic-farming.28829681

- ORGANIC farming is booming in the United States - helped along by around $1billion of investment by the US Department of Agriculture.
- The latest USDA figures show another significant increase in the number of certified organic operations in the US, which now stands at 21,781, continuing the sector's recent trend of double digit growth.

3. **ORGANIC OPERATIONS UP 12%**

http://www.agriculture.com/content/organic-operations-up-12

- THERE ARE 21,781 CERTIFIED ORGANIC OPERATIONS IN THE U.S.
- This brings the total number of U.S. certified organic operations up to 21,781 with the total number of global certified organic operations at 31,160. Since the NOP started creating these reports in 2002, organic operations have increased by almost 300%.
- "Organic food is one of the fastest growing segments of American agriculture," says agriculture secretary Tom Vilsack.

4. **Kiwis take to organics as the sector goes mainstream**

http://www.stuff.co.nz/business/farming/78630819/Kiwis-take-to-organics-as-the-sector-goes-mainstream

- New Zealanders are eating and growing more organic produce than ever before, with a rise of 127 per cent sold through supermarkets since 2012.
- The total value of the organics industry, both domestic and exported, is estimated at between $457-467 million, according to the 2016 New Zealand organic market report.
- That compares to $350m in 2012, a 30 per cent increase.

5. **Shippers seek organic supplies to meet growing demand**

http://www.thepacker.com/news/shippers-seek-organic-supplies-meet-growing-demand

- Demand for organic produce continues to outpace growth in the conventional category, and grower-shippers struggle to maintain the balance of increasing supply to match that growth.
- Haley Hastings, associate marketing manager for Nielsen Perishables Group, said organic produce growth is easily outpacing conventional growth.
- "In 2015, organic produce accounted for $3.9 billion, or 8.4% of total produce sales. In 2010, organic produce accounted for just 5% of total produce sales," Hastings said.

6. **Organic farmers encouraged to apply for cost-share program**

http://www.hutchnews.com/news/organic-farmers-encouraged-to-apply-for-cost-share-program/article_32582602-e6dc-5d38-afc7-5c00c64a87f6.html

- Kansas organic producers or farmers interested in receiving organic certification are encouraged to apply to receive cost-share funds. The National Organic Certification Cost Share Program is funded by the 2014 Farm Bill and can assist Kansas farmers in paying for organic certification or recertification.

7. **Organic industry sets new sales record, survey finds**

http://thehill.com/regulation/energy-environment/280554-organic-industry-sets-new-sales-record-survey-finds

- The industry set new records in 2015, with organic product sales hitting a new benchmark of $43.3 billion, up 11 percent from 2014. The survey found that of total organic sales, $39.7 billion were organic food sales, up 11 percent from the previous year, and $3.6 billion were sales of non-food organic products, up 13 percent.
- The OTA said nearly 5 percent of all

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food sold in the U.S. and 13 percent of all produce sold is organic. Organic produce remains the largest of all organic categories with $14.4 billion in sales, up 10.6 percent from 2014, the survey found.

- More than 200 companies responded to the survey conducted from Jan. 7 through March 25.

Indian Scenario

1. India's organic food market to treble in four years

http://www.business-standard.com/article/economy-policy/india-s-organic-food-market-to-treble-in-four-years-116051600098_1.html

- Farmers face challenges to bring area under organic farming; organic food, however, may not be adequate to feed the growing population
- The market for organic food in this country is likely to treble in the next four years, according to a report from business chamber Assocham and TechSci Research, a non-government body.
- It estimates the current market (pulses and foodgrain the bulk) at $500 million (about Rs 3,350 crore). It was $360 million (Rs 2,400 crore) in 2014, says the study.

2. 'Organic farming boosts productivity'

http://www.thehindu.com/news/cities/Hyderabad/organic-farming-boosts-productivity/article8545908.ece

- Three-day training programme for farmers in organic farming inaugurated
- Organic farming has to be encouraged and supported as it not only helps in improving productivity, but it is the ideal way of dealing with the effects of climate change, said C.S.R. Murthy, Deputy General Manager, National Bank for Agriculture and Rural Development (Nabard) here on Sunday.

3. Efforts on to turn farming in Ernakulam organic

http://www.thehindu.com/news/cities/Kochi/efforts-on-to-turn-farming-in-ernakulam-organic/article8658286.ece

- Awards have also been instituted for the best municipality, panchayat and corporation in the adoption of organic farming practices.
- The Principal Agriculture Officer (PAO) has said that intense efforts are underway to shift the entire farming methods in the district the organic way.

4. Push for disease-resistant organic fruits

http://www.thehindu.com/news/cities/bangalore/push-for-diseaseresistant-organic-fruits/article8525727.ece

- Horticulture experts to discuss issue at a symposium from today
- To promote organic cultivation of fruits, plant breeders are now focussing on developing disease-resistant fruit varieties which can be grown without using pesticides.
- Even as efforts are on to develop various cultivation practices to reduce pest attack, scientists now feel that developing varieties which are resistant to major diseases will go a long way in promoting organic cultivation.

5. Madhavan to help Shilpa Shetty set up an organic farm

http://timesofindia.indiatimes.com/entertainment/hindi/bollywood/news/Madhavan-to-help-Shilpa-Shetty-set-up-an-organic-farm/articleshow/52309456.cms

- Madhavan's organic garden at his home is the talk of social media. And seems like his fresh vegetable and fruit produce has inspired many of his industry friends, too.
- We hear that the actor's good friend, Shilpa Shetty Kundra, has sought his help in setting up her garden as well.

6. Organic agricultural fair reaps a bumper harvest

http://www.thehindu.com/news/cities/Kochi/organic-agricultural-fair-reaps-a-bumper-harvest/article8469085.ece

- Actor Mammootty tastes the payasam made from organically grown pokkali rice at a fair in the city on Tuesday.– Photo: ThulasiKakkat
- It looked as if the Malayalam New Year arrived a few days early in the city as Kochiites gathered in large numbers at the organic agricultural fairs on Tuesday, nearly emptying the sales counters and asking for more.
- About half a tonne of vegetables, ripe mangoes and other fruits as well as rice were sold at different venues. Organisers of the eleventh Organic Kerala Agricultural Fair said the rush at its counters at the Ernakulam Town Hall had begun before forenoon and it continued to increase throughout the day.

7. India's first organic fast food brand

ORGANIC NEWS

'YumBox' launched in Gurgaon

http://timesofindia.indiatimes.com/city/delhi/Indias-first-organic-fast-food-brand-YumBox-launched-in-Gurgaon/articleshow/51681175.cms

- Gurgaon based DivyatInfotech announces the launch of India's first organic fast food provider 'YumBox', which will offer wide range of healthy organic fast food items like burgers, pizzas, green salads, wraps, rolls, sandwiches, rice bowls, paranthas, pasta and smoothies among others.
- All items available at YumBox will be specially made from 100 percent natural and organic ingredients.

8. **'Organic farming solution for Agri problems'**

http://www.freepressjournal.in/cmcm/organic-farming-solution-for-agri-problems/847328

- Special emphasis was laid on organic farming by agro experts from India and abroad at KrishiKumbh during parallel session on the first day of at Ninaura on Thursday.
- Agriculture experts said that solution to farmers' agriculture-related problems lie in organic farming. The experts said that multinational companies should not be given patent rights over seeds and indigenous species should be protected and promoted to save bio-diversity.

NE Scenario

1. **Dungarpar farmers to take Sikkim trip to learn Organic Farming**

http://udaipurkiran.com/dungarpar-farmers-to-take-sikkim-trip-to-learn-organic-farming/

- With the government's move to promote the tribal dominated Dungarpur as the first Organic district in the state, selected farmers may soon be taken to a trip to Sikkim, India's first organic state.
- The government is likely to spend a crore on the educational trip wherein farmers, observers and representative would get an opportunity to interact with the Sikkim peasants and learn intricacies of organic farming.

2. **Sikkim Shows The Way Again! Becomes First State to Ban Mineral Water Bottles in Govt Events**

http://www.scoopwhoop.com/Sikkim-Becomes-the-First-Indian-State-to-Ban-Mineral-Water-Bottles-in-Govt-Programmes/

- For effective waste management in an eco-friendly manner, the Sikkim government has restricted the use of mineral water bottles in government programmes and banned the use of foam food containers all over the state.
- It suggested that as an alternative, departments can use filtered water or water from large reusable water dispensers or re-usbale water bottles in government functions.
- In another notification, the Chief secretary said that the government has been initiating various measures to manage the waste and maintain a clean environment but it has been found that a lot of disposable foam containers are being rampantly used not only in the bazar areas but also in the rural pockets.

3. **Need to take up organic farming on mission mode: Sikkim MP**

http://www.theshillongtimes.com/2016/05/27/need-to-take-up-organic-farming-on-mission-mode-sikkim-mp/

- After the declaration of Sikkim as the first organic state of India by Prime Minister NarendraModi, Sikkim MP Prem Das Rai has suggested that there is a need to take organic farming in mission mode.
- Speaking at the 65th NEC plenary session here on Thursday, he said that the North East region can be the organic food producers for not only India but the rest of the world.
- "The region has this unique opportunity to leapfrog economically which will help people get better livelihoods and value for their produce", Rai said.

4. **North-eastern states can be organic food producers : Chamling**

http://www.business-standard.com/article/news-ians/north-eastern-states-can-be-organic-food-producers-chamling-116052601639_1.html

- Sikkim Chief Minister Pawan Kumar Chamling on Thursday said the northeastern states can be the organic food producers for not only India but for the rest of the world.
- "A quick survey can be done to ascertain which states are ready for this exercise and we also need to look at the marketing," said Chamling at the North Eastern Council meeting.

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