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# NESA

NATIONAL ENVIRONMENTAL SCIENCE ACADEMY

Vol. 22 Issue - 03 (MONTHLY)

March 2019

## NESA Award 2019 Notification No. 1 APPLICATIONS ARE INVITED

LAST DATE **30<sup>th</sup> June 2019**

### (1) NESA FELLOWSHIP AWARD

**AGE** 45 and above.

The recipients shall get Citation, Certificate, Memento and a Gold plated medal, and can suffix F.N.E.S.A. after their names.

### (2) NESA EMINENT SCIENTIST AWARD

**AGE** 40 and above.

The recipient shall get Citation, Certificate, Memento and a Gold plated medal.

### (3) NESA SCIENTIST OF THE YEAR AWARD

**AGE** 35 and above.

The recipient shall get Citation, Certificate, Memento and a Gold plated medal.

### ((4) NESA TALENTED EDUCATIONIST AWARD

**AGE** 35 and above.

The recipient shall get Citation, Certificate, Memento and a Gold plated medal.

### (5) NESA ENVIRONMENTALIST AWARD

**AGE** Up to 35 and above

The recipients shall get Citation, Certificate, Memento and a Gold plated medal.

### (6) NESA AGRICULTURE INNOVATION AWARD

**AGE** 35 and above

The recipients shall get Citation, Certificate, Memento and a Gold plated medal.

### (7) NESA GREEN TECHNOLOGY INNOVATIVE AWARD

**AGE** 35 and above

The recipients shall get Citation, Certificate, Memento and a Gold plated medal.

### (8) NESA YOUNG SCIENTIST AWARD

**AGE : Up to 35.**

The recipients shall get Citation, Certificate, Memento and a Gold plated medal.

### (9) NESA JR. SCIENTIST AWARD

**AGE : Below 35.**

The recipients shall get Citation, Certificate, Memento and a Gold plated medal.

### PREScribed APPLICATION FORMS

The application forms could be downloaded from [www.nesa-india.org](http://www.nesa-india.org)

Separate application form should be submitted for separate awards.

The application forms are non-transferable and it can also be obtained by sending a bank draft of Rs. 1000-00 only (per form). Drawn in favour of NATIONAL ENVIRONMENTAL SCIENCE ACADEMY payable at NEW DELHI.

### GENERAL SECRETARY

NATIONAL ENVIRONMENTAL SCIENCE ACADEMY, 206, Raj Tower-1, Alaknanda Community Centre, NEW DELHI-110019 (INDIA) Tel.: 011-2602 3614

E-mail: [nesapub@yahoo.co.in](mailto:nesapub@yahoo.co.in); [nesapublications@gmail.com](mailto:nesapublications@gmail.com) • Website: [www.nesa-india.org](http://www.nesa-india.org)

## ELECTION NOTICE (2019-2022)

Applications on Nomination Form are invited from the Life Members of the Academy for different posts of office bearers of the Academy for the year 2019 to 2022. The last date of the receipt of the Nomination Forms is **31<sup>st</sup> March 2019**:

Sl. No.	Name of the posts	Nos.	Last Date
1.	President	1	15.03.2019
2.	Vice Presidents	4	15.03.2019
3.	General Secretary	1	15.03.2019
4.	Joint Secretary (Treasurer) Local	1	15.03.2019
5.	Joint Secretaries (1 should be local)	4	15.03.2019
6.	Member of the Executive Committee	8	15.03.2019
7.	Member of the Executive Council	8	15.03.2019

The application forms should be sent to:

The Executive Secretary,  
National Environmental Science Academy (NESA),  
206, Raj Tower-1, Alaknanda Comm. Centre, New Delhi-110 019

### TERM AND CONDITIONS

According to the Academy bye-laws, the General Secretary will report to the President in decisions taken by him for smooth functioning of the Academy. The person to be elected as General Secretary must fulfill the following conditions:

1. An active life member of the Academy.
2. Physically fit and not more than 70 years.
3. A resident of Delhi / NCR.
4. Proven academic record with Ph.D. and minimum (20) years experience in teaching/higher research, not less than the grade of Professor/Director.
5. Willingness to devote time for the working at NESA Office at least twice a week.
6. The post is purely honorary and travelling allowance is not permissible on monthly basis.
7. The Life members may download the NOMINATION FORM from the Academy's website: [www.nesa-india.org](http://www.nesa-india.org)

## HUMAN ECOLOGY PERSPECTIVE OF MEXICAN BEEKEEPERS

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Beekeeping has been associated with human societies as a traditional profession from time immemorial. Every human civilization across all the human habited continents have reported archaeological evidences of some form of beekeeping activities, suggesting that bees have special place in the human society from the dawn of human civilization. Even primitive, cave dwelling, early humans have been known to collect natural honey and bees wax for their sustenance from wild bee hives from the primeval forest ecosystems. Thus, we can safely conclude that bees



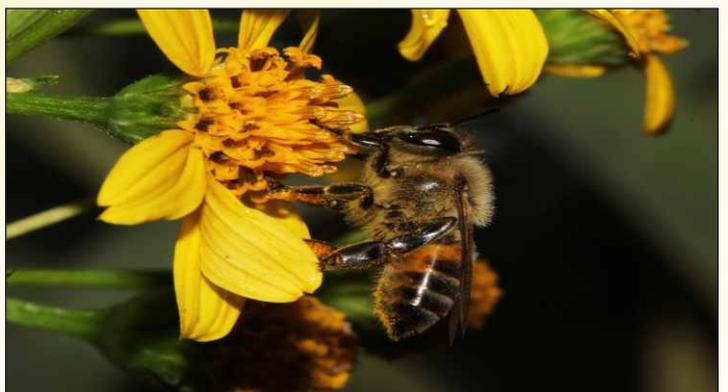
and beekeeping constitute a vital aspect of human ecology across the globe. We have attempted in understanding how their indigenous knowledge accumulated over generations could be utilized in resolving local livelihood, safety and security issues; as well as approaches to improve their life and to provide impetus to the local apiculture industry through long term sustainable, environment friendly approaches

Mexico is a predominantly agrarian developing country with strong focus on agricultural work for a significant section of the rural communities. The Yucatan Peninsula in Mexico is one of the well known honey producing region of the country covering the states of Campeche, Yucatan and Quintana Roo. Beekeeping is one of the main economic activities in the X Mabén community, located in Hopelchén, Campeche State, Mexico. It is one of the prominent honey producing areas of the country; although plagued with low quality honey production during the rainy season due to lack of melliferous plants flowering during that period resulting in acute food shortages for the local honeybees. This seriously impacts the livelihood of the indigenous people directly and indirectly dependent on the local apiculture industry.

Hence, we conducted a comprehensive survey based on interviewing 40 local beekeepers to identify the local melliferous flora with high apiculture potential, the contribution of nectar and pollen they can provide, their flowering patterns; and the necessary parameters for the vegetation to be established adjacent to local apiaries for high quality honey production in the X Mabén community of Hopelchén, Campeche, Mexico. The information we retrieved by interviewing the local beekeepers and comparative study of the herbarium material helped us to identify an exhaustive list of 56 local melliferous plants with apiculture potential; that needs to be planted around the local apiaries to provide sustenance for the honeybees in successfully running the beekeeping production cycle.

The diversity of melliferous flora of X Mabén community; therefore, constitutes a valuable resource for successful beekeeping in the region and adjacent areas. The data generated can help in further expansion of the local apiaries, beekeeping business and in building future opportunities for the local apiculture industry. The indigenous knowledge of the local beekeepers were found to be almost similar to the technical information we collected from the herbarium documents; further establishing the value of local community knowledge on beekeeping and melliferous flora with apiculture potential.

Our study is relevant to indigenous knowledge and information for successful beekeeping in Mexico; and related honey producing



developing countries sharing similar ecological well as socio-economic conditions in Latin America, Africa and Asia. From the perspective of human ecology, our study reveals the need for collecting, retrieving, analyzing and interpreting indigenous knowledge in performing traditional beekeeping activities without using expensive, modern technological innovations to resolve ecosystem based problems through long term, sustainable, traditional, environment friendly approaches. It is therefore, important to concentrate our efforts for collecting comprehensive data on human ecology, in interpreting and resolving natural issues

though ecosystem based approaches by utilizing indigenous community based knowledge; and then in making useful interpretations of the data in terms of modern science. Project acknowledgement: "Patrones de distribución, fenología y evaluación de la calidad del néctar de especies de Convolvulaceae: estrategia para incrementar los recursos florales de las abejas melíferas en periodos de escasez de alimento en Campeche, México" TecNM.

**Photo crédito:** Authors

## HYPERSPECTRAL IMAGING IN PLANT HEALTH MONITORING

Shantamma and Bheemanagouda Patil

### Introduction

The most significant recent breakthrough in remote sensing has been the development of hyperspectral sensors and software to analyze the resulting image data. Fifteen years ago only spectral remote sensing experts had access to hyperspectral images (HSI) or software tools to take advantage of such images. Over the past decade hyperspectral image analysis has matured into one of the most powerful and fastest growing technologies in the field of remote sensing.

The "hyper" in hyperspectral means "over" as in "too many" and refers to the large number of measured wavelength bands. Hyperspectral images are spectrally over determined, which means that they provide ample spectral information to identify and distinguish spectrally unique materials. Hyperspectral imagery provides the potential for more accurate and detailed information extraction than possible with any other type of remotely sensed data.

Hyperspectral images contain a wealth of data, but interpreting them requires an understanding of exactly what properties of ground materials we are trying to measure, and how they relate to the measurements actually made by the hyperspectral sensor. Hyperspectral images are produced by instruments called imaging spectrometers.

Hyperspectral images are spectrally overdetermined; they provide ample spectral information to identify and distinguish between spectrally similar (but unique) materials. Consequently, hyperspectral imagery provides the potential for more accurate and detailed information extraction than is possible with other types of remotely sensed data.

### Applications of Hyperspectral imaging

Hyperspectral imaging can be an extremely powerful tool in a wide variety of applications, due to the ability of producing scientific quality spectroscopic data with high spatial resolution at high speeds. Some of the main application areas are listed below. NEO's HySpex series of hyperspectral cameras can be employed in all of these application areas and many more.

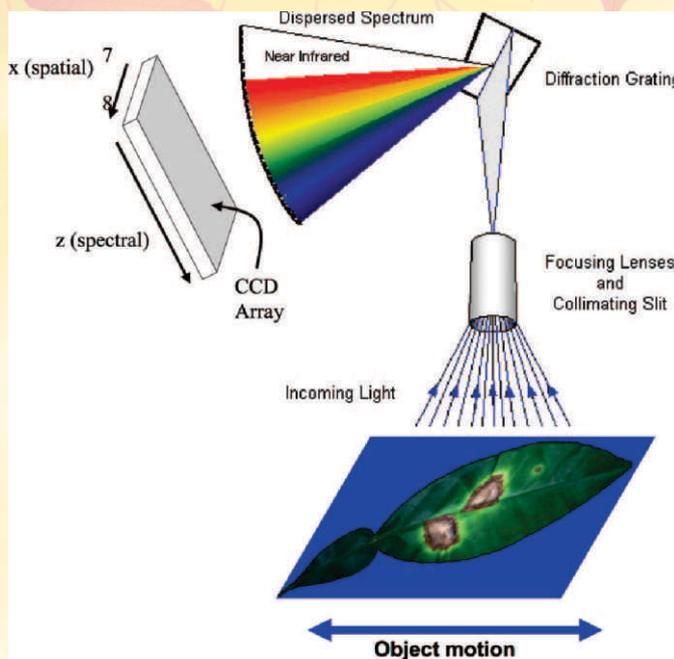
- **Defense and security:** Military target detection/identification, surveillance, search and rescue
- **Forestry:** Forest mapping/classification, forest health monitoring

- **Agriculture:** Precision farming, growth monitoring, yield prediction, governmental monitoring
- **Geology:** Mineral mapping, environmental impact around mine areas
- **Environmental monitoring:** Algae blooming, oil spill detection, land and sea monitoring
- **Government:** Land use monitoring, urban planning/management

### General applications

In target detection projects, investigators are generally trying to locate known target materials. This can sometimes involve distinguishing targets from very similar backgrounds, or locating examples of targets that are smaller than the nominal pixel size. For example, hyperspectral imagery has been used by military personnel to detect military vehicles under partial vegetation canopy, and to detect small military objects within relatively larger pixels. Scientists have also successfully used hyperspectral imagery to identify vegetation species (Cochrane, 2000), and to detect vegetation stress and disease (e.g. Merton, 1999).

Another interesting example of a target detection project is Jim Ellis' work using hyperspectral imagery to detect oil seeps and oil impacted soils (Ellis, 2003). The spectral characteristics of oil seeps and oil-impacted soils are generally too subtle to be detected by traditional multispectral sensors. In addition, oil seeps are limited in a real extent, and are usually mixed on the surface with other materials. Under these difficult conditions, hyperspectral sensors have sufficient spectral resolution to identify even small amounts of hydrocarbon-based material through their spectral signatures.



In a material identification project, investigators do not know which materials are present in the scene. Under this scenario, the analysis is designed to use hyperspectral imagery for identifying the unknown materials. This analysis may also be accompanied by material mapping in which the identified materials are geographically located throughout the image. Material mapping is also performed with hyperspectral imagery when the materials present in the scene are known beforehand. For example, hyperspectral images have been used by geologists for mapping economically interesting minerals (e.g. Clark *et al.* 1995, 2003). They have also been used to map heavy metals and other toxic wastes within mine tailings in active and historic mining districts including superfund sites.

### Hyperspectral technologies for mining

The huge volumes of multidimensional data collected by hyperspectral systems make a wide diversity of mining applications

possible, in particular:

- Mineral deposit detection
- Identification and monitoring of mining operations
- Identification and monitoring of tailings and overburden piles
- Mine pollution monitoring

Mineral deposits, and their related indicator materials, have a unique spectral signature based on their relative compositions. Hyperspectral reflectance data may be used to identify concentrations of target mineral deposits over large areas. This is particularly useful in regions where difficult terrain hampers manual site testing.

"Hyperspectral imagery is incredibly useful for mine management," says Moir. "The technology allows SMC to provide a detailed spatial and spectral analysis of mining operations in any location. The extent of mining operations and how they change over time can also be identified and monitored on a regular basis through the high resolution imagery."

Mining operations pose significant problems in terms of land, water and air pollution. After the crushing and grinding (milling) processes, some of the metal-containing minerals are left behind as small tailing particles. Mine tailings are often rich in metal contaminants, such as arsenic, lead and cadmium. As tailings erode due to wind and water exposure, fine particles and their associated contaminants are dispersed as dust particles great distances from their point of origin. Hyperspectral reflectance data has made it possible to accurately identify the spatial distribution of metal contaminants among mine tailings. Erosion patterns and resulting chemistry changes may also be monitored in support of pollution management and tailing rejuvenation projects.

Effective mitigation and management of a mine is incredibly important when it comes to minimizing the impacts of mine pollution on people and the environment. Hyperspectral imagery allows the

mining industry and environmental managers to obtain spatially comprehensive, accurate environmental effects.

#### Advantages of hyperspectral imagery

- Massive amounts of data and information about the target is acquired at one time
- If a good automated system can be developed (very few reported) then it can be particularly discerning

#### Disadvantages of hyperspectral imagery

- It is expensive
- Enormous file size, which can be slow to capture and process
- Still a new technology, not fully tested or adapted to the needs of plant disease severity assessment
- Not established how to deal with multiple diseases but offer more possibilities
- Substantial training and expertise is required to use it to its full potential

#### Conclusion

Over the last thirty years there have been huge advances in understanding plant disease assessment and applying new technologies, particularly image analysis, and more recently hyperspectral imagery. Both of these are likely to play an increasing role in the assessment of disease severity. Hyperspectral imagery provides opportunities to extract more detailed information than is possible using traditional multispectral data. The availability of commercial hyperspectral analysis tools is good, and these tools are continually becoming easier to use and more effective. It consists of about a hundred or more contiguous spectral bands. The present need of agriculture is to increase the production by optimum utilization of resources.

## SUSTAINABLE LIVING: THE VANCOUVER MODEL, AN EXPERIMENT FROM BRITISH COLUMBIA, WESTERN CANADA

C. Caswell & S. K. Basu

The cost of living is at an all time high. Everyone is feeling the pain. Over half of Canadians are \$200 (1 CDN\$ = 52 Indian rupees) away from going into debt. In the major Canadian cities like Toronto and Vancouver it's almost impossible to stay above water. In Vancouver it's around \$1.5 million for a house. At this point only the wealthy are buying. If a person rents then they will never get to financial freedom. As an alternative there are more and more recreation vehicles popping up in Vancouver. It has to be a direct result of sky high rent and mortgages. Recreational Vehicles (RVs) are also referred to as motor homes; which is a perfect description of what they are, a home that has a motor, giving it the ability to move at moments notice. With a history of transient and homeless Vancouver, one of the most famous global city in the western Canadian province of British Columbia adjacent to the mighty Pacific Ocean has become a home to many people struggling addiction or mental health illnesses. Vancouver is considered a Mediterranean climate it's situated in the warmest

region in Canada. Police from other provinces have admitted to buying 1-way bus tickets to Vancouver as a way to rid their city of homeless or people struggling with mental illness. It's very difficult to be homeless in most of Canada just because of the extremely cold winters.

Gastown in the Greater Vancouver area started out as a home for squatters. Now it's a Canadian Government national heritage and historic site. With that label it is under extra protection. Changing from a squatter village to an industrial area; and now to a posh neighbourhood with an energy filled experience, Gastown has demonstrated rapid urbanization. If you meander a couple blocks east it is the one of the most homeless populated area in the greater Vancouver area, with a small tent city nearby. A tent city is a group of tents that have taken over a community park. Some would say they have to liberties with the term public park. There is a certain intermingling between the two cultures. The people that live, shop and dine in Gastown are mostly upper class members because of the high real estate prices. There are interactions here daily: some positive, some not so positive; but, very rarely dangerous. Violent people go to jail very fast. They are not accepted in the community. Some are schizophrenic or need mental care support but peaceful and drug addicts who are too one tracked minded to be too evil. Bad things do happen in this neighbourhood and it is not recommended to go there at night. Single woman can walk through this area during





daytime hours without any problem. There is a certain understanding amongst both the rich and the poor, that they are both busy and don't have the time for the other group. With stores like Versace and other up scale boutiques now call their home; where only a few decades ago someone would have a make shift lean to on the same piece of land.

Abbotsford has the biggest tent city. It was the tent city represent in the landmark case establishing the rights for the existence of tent cities. It was evacuated because of three fires over five days, it will be up running again. The fires were started with propane heater due to extreme cold weather. It has been a cold February. Local reports indicate that residents from the tent city have been given shelter organized by British Columbia housing. It might be a blessing to get the unfortunate homeless out of the cold; while the police and fire departments could thoroughly investigate the root causes of the repeated fire incidents. Most probably a blanket getting too close to a propane heater was the most reasonable explanation of the unfortunate fire incidents. There were little propane canisters that were found in the fire. When heated up they can turn into mini bombs.

Vancouver is on the forefront of how cities and countries should handle additions. The city has adopted a "do no harm" approach to unfortunate addicts and substance abusers. Public workers, police and counsellors, are instructed to treat the patients like a brother or sister. Here's an example of what police would do to an addict in the past, if they found someone doing drug they would confiscate the drugs, rough him or her up a bit and tell them to 'shape up". History has proven that this authoritarian approach never ever works. Drug addicts have a one track mind, in that case as soon as the police leave that addict will steal, rob; beg, sell them or do whatever they have to find their next dose. It's an illness. Vancouver's approach is to gather up the man or woman suffering from their illness and take them to a safe injection site. That way he or she can talk to counsellors and they have a fighting chance of getting clean.

Although this is a little far away from the original topic of alternative living; but it is important to get an understanding of the political climate of a global metropolitan like Vancouver. This alternative living arrangements is in the same category as homeless. If the dirtiest, sickest, craziest, strung out addict still gets treated with respect, then you know everyone is getting a fair shake. The people staying in recreational vehicles are not ideal but they are regarded as people too. The city will occasionally give a \$60 ticket; but it has said that it will never tow because they understand the people are not in a great place financially and they don't want to cause undo harm to people already down on their luck. Cities are in a tough spot balancing the safety of the community and rights of the homeless. Even though homeless people are on the fringe of society, they are protected under the Canadian Charter of Rights and Freedom. The recent rulings, the Supreme Court of British Columbia has struck down city bylaws evicting homeless from parks, homeless have the right to make temporary homes in park as part of their Canadian's right to safety. British Columbia is the most liberal and socialist democratic province in Canada. Provinces like Saskatchewan would interpret the laws differently. Saskatchewan is very traditional province, and is not open to these new ideas.

Vancouver has always had a history of squatters. People would travel from all over the world to find work in the fisheries. When they got here there were more workers than work. They would setup makeshift communities under bridges. Also swarms of people would trace this way in search of gold during the gold rush. More people found poverty than found gold. Abbotsford and Maple Ridge, suburbs of Vancouver have had "tent cities" pop up. In community parks homeless have erected make shift homes and tents. The city tried to chase them away with chicken manure, slashing tents and pepper spray. The mayor of Abbotsford later apologized for these extreme measures. The most vocal about this issue are the homeowners adjacent to the parks that host the tent cities. Their concerns are understandable, it's like a homeless shelter popped up in front of their house. It hits home owners in the wallet because of decreased value for their homes also there are concerns about safety.

Most areas in Canada are not suitable for "boondocking", a term used to describe people living in motor homes where they live where ever the park. With the advancement of solar panels and storage, this type of lifestyle is getting to be my convenient. It's all more sustainable and it reduces the carbon foot print. Most motor homes are equipped with a propane refrigerator which is surprisingly energy efficient. The process used to use propane as fuel for cooling is a great lesson in basic science. Some people may find boondockers (yes it can be a noun too) unsightly, because they are only slightly above homeless but Mother Nature likes them and planet does get cleaner, if only slightly, when more people elect for a simple lifestyle. This maybe a way to tackle the global warming problem and our over crowded cities in the future. The city of Vancouver has thus started a new initiative and an underground movement of sustainable and affordable living style for



low income group. Today it is a small initiative; but tomorrow it has the possibility of becoming an alternate living style for some people who love to be nature ad environment friendly an also does have huge and substantial income to live in a booming modern metropolitan like

Vancouver. We have named this as 'Vancouver model' of alternate life style and may find a niche with similar indeed people across the globe one day.

Photo credit: Authors

## SOURCES AND FACTORS AFFECTING THE CONCENTRATION OF FLUORIDE IN GROUNDWATER

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Fluorine is the most reactive and electronegative of all known elements. It is the thirteenth most abundant element available in the earth's crust. Its abundance in the continental crust is about 626 µg/g. It rarely occurs free in nature, therefore in minerals, fluorine is generally found as the fluoride ion (F<sup>-</sup>). Fluoride has strong affinity to combine with other elements to produce compounds known as Fluoride. Fluoride ingestion at moderate levels can reduce the incidence of dental caries and, under certain conditions, promote the development of strong bones. Permissible limit of fluoride in groundwater is 1.5 mg/L. Generally ingestion of water having a fluoride concentration above 1.5-2.0 mg/L may lead to dental mottling, an early sign of dental fluorosis which is characterized by opaque white patches on teeth. In advanced stages of dental fluorosis, teeth display brown to black staining followed by pitting of tooth surfaces. Dental fluorosis produced considerable (tooth deterioration) and significant physiological stress for the affected population. Dental fluorosis is endemic in 14 states and 1,50,000 villages in India. The problems are mostly pronounced in the states of A.P., Bihar, Gujarat, M.P., Punjab, Rajasthan, Tamil Nadu and Uttar Pradesh. Skeletal fluorosis may occur when fluoride concentrations in drinking water exceed 4-8 mg/L, which leads to increase in bone density, calcification of ligaments rheumatic or arthritic pain in joints and muscles along with stiffness and rigidity of the joints, bending of the vertebral column and excessive bone formation or osteosclerosis, a basic symptom of skeletal fluorosis.

### Factors affecting the natural fluoride concentrations

The concentration of fluoride ions in natural water depends upon several factors like

- The accessibility of circulating water to these minerals.
- Distribution of easily weathered fluoride bearing minerals.
- The extent of fresh water exchange in an aquifer.
- Evaporation and Evapotranspiration.
- Formation of ion pairs such as CaSO<sub>4</sub>, CaHCO<sub>3</sub> etc.
- Complexing of fluoride ion with aluminum, beryllium, ferric iron and series of mixed fluoride hydroxide complex with Boron (Hem, 1991).

### Sources:

Fluorine occurs abundantly in the earth's crust as component of rocks and minerals as in high calcium granite (520 mg/L), in low calcium granite (850 mg/L), in Alkali rocks (1200-8500 mg/L), in shales (720 mg/L) and (270 mg/L) in sandstones (Karunakaran, 1974). The main sources of fluoride in natural waters are fluorite (CaF<sub>2</sub>), fluorapatite (Ca<sub>10</sub>(PO<sub>4</sub>)<sub>6</sub>F<sub>2</sub>), cryolite (Na<sub>3</sub>AlF<sub>6</sub>), magnesium fluoride (MgF<sub>2</sub>) and as replacement of ions of crystal lattice of micas, and many other minerals. Fluorine with its abundance at 1600 (in

relation to Si at 10<sup>6</sup>) in the cosmos is indicative of its widespread occurrence when one studies its distribution, which has been estimated as shown in Table:1.

Table 1: Distribution of fluorine in different rock types

Rock Type	Content of Fluorine (mg/L)
Meteorites	28-30.8
Dunite	12
Basalt	100
High Ca-granite	520
Low Ca-granite	850
Alkali rocks	1200-8500
Shale	740
Sandstone	270
Deep sea clays	1300
Deep sea Carbonates	540

### Nutritional Status:

Epidemiological observations have suggested that nutritional status may influence chronic fluoride toxicity. Results of diet surveys have indicated that low levels of calcium and vitamin C in the diet may be related to the severity of endemic fluorosis. Controlled studies carried out at the National Institute of Nutrition, using monkeys have, in fact, provided experimental proof that low amounts of calcium and low amounts of vitamin C in the diets predispose to the development of experimental skeletal fluorosis. The precise mechanism is, however, not known.

In addition to the role of these specific nutrients, body size is an important factor in determining the safe level of fluoride. Fluoride is known to be a bone-seeking element. For a person with a small stature with a consequent small skeleton, the amount of total fluoride that would be toxic may be expected to be less than that for a person with a big stature with a relatively big skeleton. The average weight of a well nourished western adult is around 70 kg., while the mean body weight of an agricultural labourer in our country, who is exposed to the risk of skeletal fluorosis rarely exceeds 55 kg.

### Dietary Factors:

The fluoride of food items depends upon the fluoride contents of the soil and water used for irrigation, therefore the fluoride content of the food items may vary from place to place. It has been observed

Table 2: Contents of fluorine (expressed in ppm).

Common food stuffs	Fluorine (ppm)
Milk	0.07 to 0.22
Wheat	0.5
Rice	0.7
Eggs	1.2
Tea	3.2 to 178.8
Garlic & Onion	10-17

that the common foodstuffs have the following contents of fluorine (expressed in ppm) (Table: 2).

The main contribution of fluorine in igneous rocks is from fluorite and fluorapatite apart from topaz, amphibole and micas. In sedimentary rocks it is related to fluorapatite while some amount is absorbed by the clay minerals. Its enrichment from 12 mg/L in Dunite to 1200 mg/L in alkali rocks is related to its progressive concentration in acidic rocks and the fluid phase. Solubility studies have indicated that transport of fluorine in aqueous solutions is dependent on the solubility of  $\text{CaF}_2$ . Further the quantity of fluorite dissolved or precipitated is also dependant on the presence of other electrolytes in aqueous solutions which are partially ionised. In experiments connected with possible conditions related to hydrothermal solutions, the ratio of the concentration of calcium to that of fluoride ions in solution appears to be important.

Studies on the fixation of fluorine in sedimentary rocks have indicated that 40% of fluorine is expelled during diagenesis and lithification but nothing is known about what happens to the expelled fluorine. The relative abundance of fluorine in deep sea

clays and carbonates is also interesting. Remobilisation is naturally associated with the metamorphic, palingenetic and anatectic processes with the fluid phase resulting in concentration of fluorine rich minerals. In this regard it is particularly interesting to point out that the association of barite-calcite-fluorite, association of boron with fluorine minerals indicate a volcanogenic association apart from its association with lithium and tin indicating late stage hydrothermal products. An important source of fluorine pertains to the rock phosphates which are increasingly being used as fertiliser in the efforts to achieve a green revolution all over the world. It is pertinent that the minerals fluorapatite and francolite in rock phosphates carrying the fluorine are also generally associated with pyrite often with Uranium, Vanadium (such as Korgai, Nigalidhar of Himachal Pradesh) indicating geochemical affinities. It has also been noticed that the oxides of Uranium, Thorium, Cerium and Calcium, fluoride has face centered cubic lattice with a cell size of  $5.50 \text{ \AA}$  and as such tend to occur in the same geological environment. This is also an important practical aspect in looking for fluorine bearing minerals in radioactive mineral prospects. Fluorine bearing minerals are shown in Table:3.

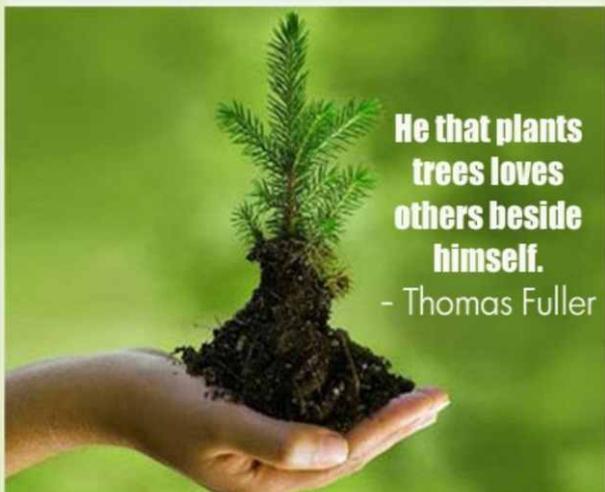
**Table 3: Some Fluorine bearing minerals**

	Name	Formula	% Fluorine Content	
			Theoretical	Range in analytical values
<b>A. Fluorides:</b>				
1.	Fluorite	$\text{Ca F}_2$	48.67	48.18 - 48.61
2.	Sellaite	$\text{MgF}_2$	60.98	
3.	Fluocerite (Tysonite)	$(\text{Ce, La}) \text{F}_3$	29.0	19.49 - 29.44
4.	Cryolite	$\text{Na}_3\text{AlF}_6$	54.29	53.55 - 54.88
<b>B. Phosphates:</b>				
5.	Fluor-apatite (carbonate-apatite)	$\text{Ca}_{10}(\text{PO}_4)_6\text{F}_2$	3.8	2.57 - 5.60
6.	Wagnerite	$\text{Mg}_2 \text{PO}_4 \text{F}$	11.68	5.06 - 11.48
7.	Triplite	$(\text{Mn,Fe,Mg,Ca})_2 \text{FPO}_4$		6.02 - 9.09
8.	Amblygonite	$(\text{Li Na}) \text{Al}(\text{PO}_4)(\text{F,OH})$	12.85	0.57 - 11.26
<b>C. Silicates:</b>				
9.	Topaz	$\text{Al}(\text{F,OH})_2 \text{SiO}_4$	20.7	13.23 - 20.37
10.	Humite group	$\text{Mg}(\text{OH, F})_2 \cdot n \text{Mg}_2 \text{SiO}_4$		Tr. - 13.55
11.	Sphene	$\text{Ca Ti}(\text{SiO}_4)(\text{O,OH,F})$		0.61 - 1.40
12.	Vesuvianite	Calcium-Magnesium silicate with $(\text{OH,F})_4$		Tr - 3.22
13.	Tourmaline	Complex boro-silicate with $(\text{OH,F})_4$		0.07 - 1.16
<b>Mica group</b>		<b>Sheet silicates with <math>(\text{OH,F})_4</math></b>		
14.	Muscovite	Potash mica		0.00 - 1.16
15.	Phlogopite	Magnesian mica		0.56 - 9.20
16.	Biotite	Iron-Magnesian mica		0.32 - 5.02
17.	Lepidolite	Lithium mica		4.93 - 8.08
18.	Amphibole group	Chain silicates with $(\text{OH,F})_2$		Tr - 2.95

*Earth provides enough  
to satisfy every man's need,  
but not every man's greed.*  
– Mahathma Gandhi



**He that plants  
trees loves  
others beside  
himself.**  
– Thomas Fuller



**It's not yours,  
not mine,  
It's Ours.  
So, Protect your  
mother who,  
nourish you**



## PLANTATION DRIVE BY THE ACADEMY



The Academy Members are requested that whenever they plant a tree on their birthday or any other event, please send us the photographs with report so we can publish the same in our newsletter. This will inspire and encourage many more life members of the Academy to participate in the "Green drive" of the Academy.

Members are also requested to preferably plant a medicinal plant which can benefit each and every one around us. Also they can form a committee in their RWA for plantation of tree on weekends.

**Dr. Shefali Gola**  
Editor, NESA E-newsletter

To,

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From

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## APPEAL TO LIFE MEMBERS

NESA Life Members are requested to submit short articles for the NESA e-Newsletter that are consistent with NESA's objectives to improve environment. The articles should focus on topics related to environment and facilitate communication and discussion among researchers, academicians and students. The articles for December edition can be submitted to [nesapublications@gmail.com](mailto:nesapublications@gmail.com) before **25th March, 2019**.

**Dr. Shefali Gola**, Editor, NESA E-newsletter