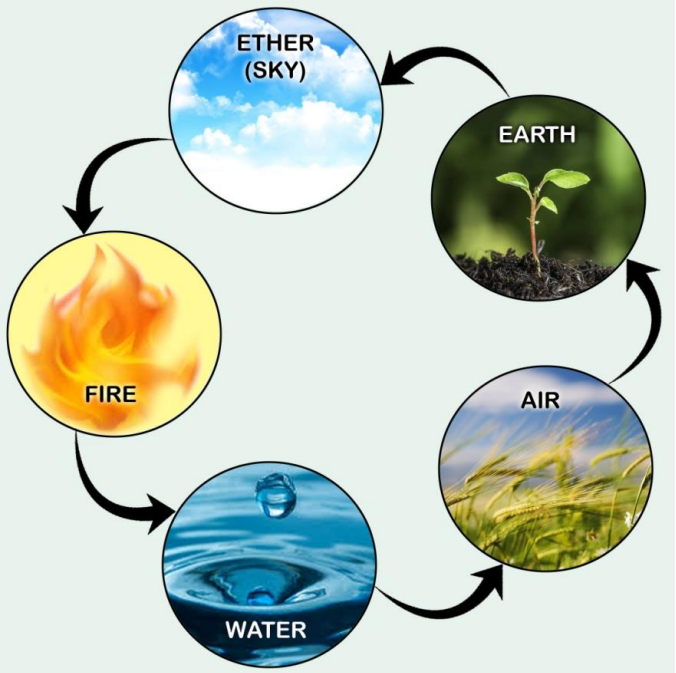
L–16: Impact of Development on Ecosystem: Panch-tatva *(पंच-तत्व)*



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Lesson – 16

Impact of Development on Ecosystem: Panch-tatva (*पंच-तत्व*)

Learning outcomes: At the end of this lesson, you will be able to:

LO 1. Describe the role of Panch-tatva in sustenance of human life.

LO 2. Describe the impact of development on the Panch-tatva.

LO 3. Describe role of technical teachers in managing Panch-tatva.

Contents

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1.0 INTRODUCTION

The word 'panch-tatva' is a combination of two words from Sanskrit. 'Panch' stands for five while 'tatva' means the basic *'elements'* of the planet earth. One of the laws states that, everything on this planet is composed of five basic *elements* (tatvas) viz: Earth (Prithvi), Water (Jal), Fire (Agni), Air (Vayu), and Space/Sky (Akash). The widespread exploitation of these five elements (Panch-tatva) in the guise of development is affecting the sustainability and thereby have a negative impact on human life. The '*ecological footprint'* is one way of measuring sustainability, which refers to the ability of a population to support itself in the present without compromising that ability for the future. Footprintnetwork.org defines *Ecological Footprint* as: A measure of how much area of biologically productive land and water an individual, population or activity requires to produce all the resources it consumes and to absorb the waste it generates, using prevailing technology and resource management practices. This lesson discusses the various dimensions of the delicate balance of the use of panch-tatva with regard to ecological footprint.

2.0 ROLE OF PANCH-TATVA IN SUSTENANCE OF HUMAN LIFE

The 'panch-tatva' impact the human life in different ways. For a peaceful and healthy life, human beings need to learn how to manage their life by living in harmony with the panch-tatva. Therefore, this section discusses in brief some of the aspects of the 5 basic elements which God has created for the sustenance of human life.

2.1 Earth

Humans live on this earth which is one of the 'panch-tatva', which houses the soil, landscape, flora and fauna. With its tremendous magnetic fields and gravitational force, it keeps the ecosystem i.e. every living and non-living thing grounded to the earth. Human not only live on it, but also live because of it for sustenance and in this process exploit it. The earth contains various natural resources which help in the sustenance and well-being of human beings. They can be categorised as energy resources (such as petroleum, coal, uranium, renewable energy sources such as wind, tidal, solar and others), metallic resources (such as iron, copper, aluminium, gold and others) and non-metallic resources (such as soil for plant life, sand, granite, gypsum and others). All these are used by human beings and the unabated exploitation of the earth by the humans have created problems of sustainability which need to be addressed urgently.

2.2 Water

Water another *tatva* of the 'panch-tatva' is an important component of any ecosystem. 70% of the earth is water and the same goes for the human body. The role of water is to maintain all ecosystems on the planet. In an ecosystem, water cycles through the atmosphere, soil, rivers, lakes, and oceans. The main function of water is to propel plant growth; provide a permanent dwelling for all species that live within it, or provide a temporary home or breeding ground for multiple amphibians, insects and other water-borne organisms; and to provide the nutrients and minerals necessary to sustain physical life.

As nature's most important nutrient, all human beings and living organisms need water to grow and survive. Fresh water makes up only 1% of the Earth's surface, but they provide a home for a considerably large number of the world's species. In many ways, human beings depend on freshwater ecosystems for survival, but their impact on these waterways can be devastating. However, the ecosystem of a freshwater lake or river can be extremely fragile. History records that over the centuries, many of the fresh water rivers are no more, such as the Sindhu and the others. Human activities can be detrimental to the health of the fresh water lakes and rivers in a number of ways: such as developing structures, diverting their flow, polluting them, and draining them of resources.

2.3 Fire

Fire is another *tatva* of the 'panch-tatva' and is the source of energy and light. Sun is source of fire that gives light on earth. In the absence of Sun, there will be no light on earth. Without the sun there would be no life on the earth. The fire emanating from the sun gives energy and light to all. Fire is the major source of all kind of energies on earth. The need of energy for human life is always a high priority. There are many energy sources available. Some pollute the environment and others do not such as the renewable energy sources of wind, solar, tidal and so on. It is the controlled use of fire that helps a sustainable development. This energy could be from various sources - coal, uranium, wood, solar, wind, waves, tidal power and so on. By understanding the characteristics of these, it will help in the right use of this 'tatva'.

2.4 Air

Air is another one of the 'panch-tatva' which can also be linked to the atmosphere. Absence of air means absence of life on earth or any other living thing for that matter. Air is composed of gases and elements that are essential for the survival of all species. It is another powerful life source that is important to sustain life in all its forms for the flora and fauna as well. Human beings breathe in oxygen because of which they live and life goes on. Further, it makes life comfortable. Although you cannot see it, you can feel it. The air thrown by the fan or the blower of the air conditioner gives comfort to the human beings. It can also be observed that without the air, neither the birds can fly nor can the aero planes move in the sky. Air is generally constructive, but at times it can be destructive, especially when it

attains very high speeds uprooting trees and causing damage to everything that comes in its way. Keeping the air pollution free is what has to be done by every human being.

2.5 Sky/Space

Sky/Space is another *tatva* of the 'panch-tatva'. Sky has been considered the free space of the universe. Space is the only element which does not have any limit. The clear blue sky above acts as a shelter to the earth in the day, while at night it serves as a gateway to the starry galaxies that exist light years away from human beings. Throughout history human beings have looked to the sky to navigate the vast oceans, to decide when to plant their crops, manufacture various things and such other matters. The sky is the vast open space that accommodates everything. When the activities in the space take place, then only the earth is able to receive light, heat, gravity, magnetic fields and others. All these changes in the natural phenomenon affects human life as well. Thus, the significance of space or sky cannot be overlooked when you think of sustainable development or sustainability.

3.0 ROLE OF TECHNICAL TEACHERS IN MANAGING PANCH-TATVAS

Development is required for the sustenance of human beings. In the race for development, knowingly and unknowingly, it is affecting the 'panch-tatvas', which in turn is affecting the life of human beings on this planet earth. How technical teachers can manage the panch-tatva, by involving the students is discussed in briefly in the following paragraphs.

3.1 Managing the Use of 'Earth'

The earth is responsible for the existence of human life and all species. Therefore, consumption of the geological or natural resources has become part and parcel of everyday life of human beings and has become essential for survival. However, you as a technical teacher need to communicate the judicious use of the various resources of the earth for sustainability through the various courses that you will be teaching.

Overuse or distorted use of the earth's resources without planning for remedial measures is mismanagement of the use of 'Earth'. Landfills are present all over the country. If the items before the land is filled are segregated, the soil and the groundwater will not be contaminated due to seepages. Alternatively, biomass energy could be generated from different types of wastes. For example, unless re-plantation of trees and vegetation are not undertaken after the cutting of trees and vegetation, it can affect rainfall, flooding, and related problems. The students need to be made aware of these through various types of student projects and activities. Therefore, as a technical teacher, students could be taught and encouraged to adapt various kinds of constructive techniques and technologies to utilise the earth’s resources without polluting the environment.

Activity 1

As a technical teacher, describe what you will do to spread the message in the students to manage the use of this 'tatva' i.e. Earth for sustainable development.

3.2 Managing the Use of 'Water'

A number of forces continue to seriously affect the natural water resources. Many of these are primarily the result of human actions and include ecosystem and landscape changes, sedimentation, pollution, over-abstraction and climate change. In the name of *development*, human beings are over-exploiting water around the world. A decrease in water availability can affect agriculture, farmland, livestock, and other living organisms (including humans) in the area. Human beings can damage Earth's fragile freshwater ecosystems in a number of ways. Industry can divert water away from other bodies of water

In many places, the humans are altering and even destroying fresh water ecosystems. When consumption outstrips the natural regeneration of the waterways, it will greatly affect the flora and fauna. Over-pumping of water from lakes and other reservoirs puts pressure on aquatic populations, reducing the amount of living space available. Often, municipal waste water and sewage water also contaminate the ground water. As a technical teacher it is your duty to stir up young minds to come up with ways and means to avoid contamination of water sources, ground water and ensure the judicious use of water bodies and waterways. **.** So whatever development projects are undertaken, the use of water should be from sustainability in view.

Activity 2

As a technical teacher, describe what will you do to spread the message in the students to manage the use of 'tatva' of '*water*' for sustainability.

3.3 Managing the Use of 'Fire'

The use of the tatva 'fire' (energy) judiciously will help in sustainable development on the planet earth. As the saying goes, 'Fire is good servant, but a bad master'. Fire i.e. energy can destroy or create many things. For example, for the first time in many centuries in early September 2019 the uncontrolled fire destroyed several hundred acres of the Amazon rain forests, that spans across several countries in the continent of South America, as well as the Australian bush fires and the California fires creating a panic of the climate change that could have been disastrous for the whole world. At the same time, it is known how the controlled coal fired thermal power stations generate millions of units of energy for the comfortable living of human beings. With the advancement of technology, renewable energy has become techno-economically viable for sustainable development. Therefore, it is high time that the students are continuously informed through the various courses and projects and through all the various technology programmes which are being offered that the lesser use of energy sources such as coal and others that pollute the environment is good for sustainable development.

Activity 3

As a technical teacher, describe what you will do to spread the message in the students to manage the judicious use the 'tatva' of *'fire'* for sustainability.

3.4 Managing the Use of 'Air'

Pure air is very much essential for all humans and living things. However, in today's villages, towns and cities, atmospheric pollution happens due to agricultural activity, construction, and mining. As days go by, the pollution level rises in various towns and cities, where uncontrolled industrial activities take place continuously. The industrial revolution has led to rapid increase in man-made air pollution. The fossil fuels burning pollute the atmosphere. Use of fossil fuel produces 10 times more greenhouse gases compared to that goes in the atmosphere through natural processes. This has created much discomfort and diseases in human beings and living things. This type of pollution is much grave during winters when the smog in the atmosphere even disrupts the landing and take-off of aero planes disrupting a sustainable living.

In this backdrop, it is the duty of the technical teachers and the technical education system to address these issues both in the teaching and curriculum. You can try out various types of activities which could be curricular, co-curricular and extra-curricular to help the students become aware of this issue and come up with innovations, methods and lifestyles to minimise air pollution.

Activity 4

As a technical teacher, list down some curricular, co-curricular and/or extra-curricular activities to address the issue of minimizing air pollution for sustainable development.

3.5 Managing the Use of 'Sky/Space'

The sky is the unlimited space which can hold as many things as possible. Its blue colour during the day, grey when the rains come and it is black when the sun 'hides' behind the earth, once in every 24 hours. The sky's capacity is limitless. It holds all the natural satellites that God has created in the sky. It also holds the additional artificial satellites that humans throw into it, through the various rocket launches. Many of the artificial satellites have been put into space by various countries for various purposes. Some of them are weather satellites for early warnings for the safety of human beings from the vagaries of the weather. This will help human beings on earth so that remedial measures are taken and human and animal lives are saved. Others are communication satellites in the sky and still others are military satellites for defence purposes. But question is should the sky also be littered trash, unless and until it is absolutely needed for a sustainable life. These are the questions to ponder and could also be taken up as debates and panel discussions for the students, by the students and of the students.

ACTIVITY 5

As a technical teacher, list the activities that will help the students to creatively manage the sustainable use of the 'sky'.

4.0 SUMMARY

'Ecological footprints' and 'Carbon footprints' are both ways of measuring something's impact on the environment. A carbon footprint measures the total amount of greenhouse gas emissions caused by an individual, organization, or activity. The Ecological Footprint definition is simply a way to measure how much you use and consume, in relation to the environment's capacity to provide and support your needs. It calculates your impact to the environment. Therefore, the discussion thus far on the 'panch-tatva' makes it the responsibility of the technical teachers as well to pass on and encourage the students whom they teach to manage all the 5 'panch-tatva' for the sustainable development on this planet earth.

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BIBLIOGRAPHY

[1] Network, G. F. (2016). Earth Overshoot Day. https://doi.org/Zuletzt zugegriffen am 28.01.2014 unter http://www.footprintnetwork.org/de/index.php/GFN/page/earth_overshoot_day/

[2] O'Neill, D. W., Fanning, A. L., Lamb, W. F., & Steinberger, J. K. (2018). A good life for all within planetary boundaries. *Nature Sustainability*, *1*(2), 88–95. https://doi.org/10.1038/s41893-018-0021-4

[3] UN. (2015). Global Sustainable Development Report: 2015 edition. *Global Sustainable Development Report: 2015 Edition*.

[4] Wachernagel, M., & Rees, W. (1996). Our Ecological Footprint: Reducing Human Impact on the Earth. In *The New Catalyst Bioregional Series*.

[5] Wackernagel, M., Monfreda, C., & Deumling, D. (2002). Ecological Footprint of Nations. *Sustainability Issue Brief*.

[6] Zakari, R., Zolfagharian, S., Nourbakhsh, M., Mohammad Zin, R., & Gheisari, M. (2012). Ecological Footprint of Different Nations. *International Journal of Engineering and Technology*. https://doi.org/10.7763/ijet.2012.v4.411

FURTHER READINGS

[7] https://sciencing.com/human-impacts-freshwater-ecosystems-23308.html accessed on 23September 2019

[8] https://www.theworldcounts.com/stories/Ecological-Footprint-Definition accessed on 23 September 2019

[9] https://www.footprintnetwork.org accessed on 23 September 2019

[10] https://www.thoughtco.com/what-is-ecological-footprint-4580244 accessed on 23 September 2019

Lesson -16 DISCUSSION FORUM

Start a discussion on social media on some methods/techniques/strategies of managing one or more of the Panch-tatva.