

# SUSTAINABLE MINING AND GEOINFORMATION

Prof. Mukunda Dev Behera

Centre for Ocean, River, Atmosphere and Land Sciences (CORAL)

Indian Institute of Technology Kharagpur

Week – 08

Lecture 38: SDG 14, 15, 17

Welcome, today on 38th lecture, let us talk about the Sustainable Development Goal number 14, 15 and 17 and how the geo-information plays a very important role as far as attaining these three Sustainable Development Goal number 14, 15 and 17 as far as the mining sector is concerned. So, what we are going to cover? The concepts what we are going to cover are sustainable use of marine resources and monitoring the coastal mining activity. So, as far as SDG 14 is concerned, it deals with the monitoring and monitoring of coastal mining activity. So, that component of SDG 14 is involved here.



Coming to SDG 15, it is whole of the sustainable use of terrestrial ecosystem, so life on land. So, whole of this is applicable to mining sector and benefits from the applications of geoinformation. SDG 17 deals with strengthening the means of implementation and revitalize the partnership particularly the global partnership. Here also many of these sections or subsections are valid as far as the mining industry is concerned in terms of implementing the and strengthening the partnership. And then we will discuss about two case studies that leverages the geo-information technology as far as sustainable development goal is concerned.

So, let us start with goal number 14 which aims at conserving the use of world's ocean, seas and marine resources in sustainable way. So in totality it deals with life on water. So use of ocean, sea and marine resources. So what it includes? It includes the goal SDG 14 aims at reducing marine pollution, protecting marine and coastal ecosystems, thereby addressing overfishing, conserving at least 10% of the marine areas and supporting small-scale artisanal fisheries.

**Goal 14** To Conserve and Use World's Oceans, Seas, and Marine Resources in a Sustainable Way

- Include reducing marine pollution, protecting marine and coastal ecosystems, addressing overfishing, conserving at least 10% of marine areas, and supporting small-scale artisanal fishers
- Mining activities, particularly undersea and coastal mining, can significantly impact marine ecosystems
- Geoinformation provide tools to assess and mitigate these impacts.
- They enable large-scale data collection, high-resolution monitoring, and integration of spatial information for informed decision-making

**Applications:**

Monitoring Sedimentation	Assessing Habitat Destruction	Pollution Management
Environmental Impact Assessments	Ocean Acidification Assessments	Coastal Erosion and Habitat Loss Analysis

**Fig. Nutrient risk indicator categories of large marine ecosystems**  
(Source: <https://umstats.un.org>)

Legend:  
 Risk level 1 (Very low) Risk level 2 (Low) Risk level 3 (Medium)  
 Risk level 4 (High) Risk level 5 (Very high) No data

So, let us see as far as mining particularly the coastal mining is concerned, how the mining activities are concerned. So mining activities particularly undersea and coastal mining can significantly impact the marine ecosystems. So, geospatial technology or particularly geoinformation provide tools to assess and mitigate the impact as far as on the undersea and coastal mining is concerned and particularly impact because of this on the marine ecosystems. So in this way, they enable large scale data collection, high resolution monitoring and integration of spatial information for informed decision making. Let us see in terms of applications where geo information has to play a significant role is one is monitoring sedimentation, assessing habitat destruction, pollution management, EIA environmental impact assessments, ocean acidification assessment and coastal erosion and habitat loss analysis related assessment.

So, on the upper right hand side we have a nutrition risk indicator category of large marine ecosystems has been given here that talks about the risk level from a very low risk to a very high risk level 1, 2, 3, 4 and 5 and accordingly it varies the color goes from blue to red. So, this kind of studies on and around the coastal areas actually talks about the nutrient risk indicator. So, this is important or linked as far as the large marine ecosystems are concerned because nutrient is the important input as far as supporting the biodiversity or you say the coastal ecosystems. Now, what are the targets that can be

achieved using geoinformation tools? The target 14.1 that deals with reduction of marine pollution by 2025.

**Targets Achievable Using Geoinformation**

**Target 14.1: Reduce Marine Pollution (by 2025)**

- Map land-based pollution sources such as agricultural runoff and industrial discharge
- Pollutant dispersion in oceans and coastal areas can be modelled
- GPS-enabled systems track marine debris in real time

**Target 14.2: Protect and Restore Marine Ecosystems**

- Map and monitor coastal ecosystems (e.g., coral reefs, mangroves, seagrass beds)
- Time-series RS data analyse ecosystem health and changes over time
- Establishment and management of marine protected areas (MPAs)
- Identifying areas vulnerable to coastal erosion and flooding helps in mitigation planning

**Target 14.3: Address Ocean Acidification**

- Monitor spatial variations in ocean pH and SST
- GIS integrates global datasets to identify regions vulnerable to acidification
- Understanding the correlation between acidification and environmental variables

Small video inset of a man in a white jacket.

So, what geoinformation can do here? Geoinformation can map land-based pollution sources such as agricultural runoff and industrial discharge. It can also help in terms of pollutant dispersion in oceans and coastal areas can be modelled accordingly. And if it is enabled with GNSS, global navigation and network system enabled in terms of tracking the marine debris or the marine animals in terms of real time. So here we are dealing with the marine pollution, so marine debris tracking also is possible because

Many of these dumping are also happens to be intentional. So this can be very well monitored and information can be provided which can help in terms of reduction. So let us go to target 14.2 that talks about protect and restore marine ecosystems where map and mapping and monitoring of coastal ecosystems time series data as far as the change is concerned and establishment of few marine protected areas and identification of areas that are vulnerable to coastal erosion so This falls under the target 14.2 and now coming to 14.3 that deals with the ocean acidification. So that means if the pH so we need to monitor in terms of ocean pH and the SST sea surface temperature.

And remote sensing helps us in this in terms of identifying the vulnerable region for acidification and thereby it helps in terms of understanding the correlation between acidification and other environmental variables. now moving on to target 14.4 that deals with end over fishing and destructive practices it could be useful in terms of monitoring fishing vessels and also illegal unreported and under unregulated fishing activities so here in this case GIS based analysis supports and supports sustainable fishery management so the thereby helps in terms of tracking the trends in fish stock health over time and space.

Now coming to the next target, target 14.5 that aims at conserving the coastal and marine areas. We have a target which already been surpassed that has to be achieved by 2020.

**Targets Achievable Using Geoinformation**

**Target 14.4: End Overfishing and Destructive Practices (by 2020)**

- Monitor fishing vessel activities, ensuring compliance with fishing regulations.
- Illegal, unreported, and unregulated (IUU) fishing can be detected using satellite imagery.
- GIS-based analysis supports sustainable fishery management by identifying overfished areas and setting boundaries for fishing zones.
- Tracking trends in fish stock health over time is facilitated by geospatial technologies.

**Target 14.5: Conserve Coastal and Marine Areas (by 2020)**

- GIS helps delineate and monitor MPAs, ensuring effective conservation of biodiversity.
- Satellite imagery tracks habitat quality and biodiversity within protected zones.
- GPS technology ensures activities comply with MPA boundaries.

**Target 14.7: Increase Benefits to Small Island and Coastal Communities (by 2030)**

- GIS identifies suitable aquaculture sites based on water quality, temperature, and other factors.
- Mapping marine biodiversity hotspots supports eco-tourism initiatives.
- Monitoring fisheries ensures sustainable resource use, benefiting local economies.

**A Marine Protected Area (MPA) is a designated region of the ocean where human activity is regulated to conserve marine biodiversity, protect ecosystems, and support sustainable fisheries.**

**NPTEL**

So, GIS, GPS or GNSS and in totality the geoinformation tools helps in delineating and monitoring the marine protected areas. And coming to target 14.7, it deals with increasing the benefits to small island and coastal communities by 2030. So, in this 14, the target SDG goal number 14 that deals with life below water and all the activities that deals with seas, coastal and marine areas can be very well achieved or helped by using the geoinformation technology. And many of these are applicable as far as the coastal mining or seabed mining is concerned. So, using the geothermal technology through this route, it can address achieving sustainable mining through the target or the SDG goal number 14.

Now, let us move on to the next important one that is the SDG goal number 15 that deals with life on land. In this SDG goal number 15, the overview talks about focusing on protecting, restoring and promoting sustainable use of terrestrial ecosystems including forest management, reversing land degradation and mitigating biodiversity loss. So, geo information helps in terms of combining all the geospatial data and the remote sensing data or on a geo information platform to analyze and manage natural resources thereby providing efficient and providing and supporting or helping in terms of environmental conservation. So, the important point as far as geo information is concerned, it provides time efficient cost effective tools we have already discussed in terms of land use planning. So, it facilitates spatial planning at any level starting from block to global or here in this case particularly the mining areas over mining areas.

**Goal 15 Life on Land**

- SDG 15 Overview:** Focuses on protecting, restoring, and promoting sustainable use of terrestrial ecosystems, including forest management, reversing land degradation, and mitigating biodiversity loss
- Role of Geoinformation:** Combines geospatial data and RS to analyze and manage natural resources efficiently, supporting env.a.l conservation
- Key Features of GeoINFO:** Provides a time-efficient, cost-effective tool for handling large datasets and addressing complex env.a.l challenges
- Land-Use Planning:** Facilitates spatial planning at global/regional/block-level planning emerging as a practical unit for sustainable land management
- Decision-Support System:** Offers data-driven insights for sustainable resource utilization, balancing ecological preservation & development  
**Applications:** Monitors land degradation, deforestation, and biodiversity loss while modeling future land-use scenarios
- Long-Term Benefits:** Ensures sustainable livelihoods, climate resilience, and preservation of ecosystem benefits for future generations

Fig. Trend in forest area as a proportion of total land area, 2015–2020 (SDG, 2023)

NPTEL

So, thereby it helps in terms of sustainable land or mining land management. Now in terms of the DSS or the Decision Support System, it offers data-driven insights for sustainable resource utilization, thereby balancing ecological preservation and development. So applications could be monitoring land degradation, deforestation and biodiversity loss while modeling future land use scenarios. So long-term benefits includes ensuring sustainable livelihood, climate resilience and preservation of ecosystem benefits for future generations. Now, as far as this target 15 life on land is concerned, let us see all the subsections which benefits from the utility of geoinformation technology.

**Targets Achievable Using Geoinformation**

**Target 15.1: Conservation, restoration, & sustainable use of terrestrial & freshwater ecosystems**

- Mapping and monitoring of ecosystems (forests, wetlands and mountains) using imagery.
- Assessing ecosystem health and changes over time through time-series analysis.
- Identifying and prioritizing areas for conservation or restoration.

**Target 15.2: Sustainable management of forests, halt deforestation, restore degraded forests, & promote afforestation/reforestation**

- Monitoring deforestation and afforestation activities using RS (e.g., Landsat, Sentinel).
- Identifying degraded forest areas for restoration.
- Analyzing forest cover and carbon sequestration using LIDAR or hyperspectral imaging.

**Target 15.3: Combat desertification and restore degraded land**

- Mapping desertification hotspots and degraded lands using remote sensing.
- Monitoring soil erosion, drought, and flood-affected areas using satellite data.
- Assessing the impact of land restoration efforts.

**Target 15.4: Conservation of mountain ecosystems and their biodiversity**

- Monitoring mountain biodiversity and ecosystem health.
- Mapping glaciers, snow cover, and vegetation changes in mountain regions.
- Assessing ecosystem services provided by mountain regions.

NPTEL

As far as target 15.1 is concerned, it deals with conservation, restoration, sustainable use of terrestrial and freshwater ecosystem. We have already discussed about mapping and monitoring of all the ecosystem components including forest, wetland and mountains using satellite data and other allied geospatial technologies. So, it helps the geoinformation in general as a technique or as a tool helps in assessing the ecosystem health over time and space using various mechanisms such we also discussed about time season analysis. So, you can see what has happened over a period of time in a continuous

fashion. And target 15.1, again the third point is it deals with identifying and prioritizing areas for conservation and restoration.

We will see some of the example in terms of a case study. It has already been discussed also in previous classes. Now, let us move on to target 15.2. 15.2 deals with sustainable management of forests, halt deforestation, restore degraded forests, and promote afforestation and reforestation. So, monitoring deforestation and afforestation activity using satellite remote sensing is a very regular practice.

We use different types of satellite data based on the requirement. So if you are doing it at a global scale or at regional or at a very local scale accordingly the resolution vary. For a global scale we may go for 10 kilometer, 1 kilometer or 500 meter resolution which we may get from MODIS or NOAA AVHRR. But if we are doing it at a very local scale or you say a small area having the mining industry or the mine site, then we may go for higher resolution, 10-meter Sentinel-2 data that gives us a good quality optical data with 10-meter resolution. If we interpret it directly using supervised or unsupervised or any kind of feature extraction or classification technique, we can come to know the pre and post scenario.

Now, even if we can use some of the indices, particularly normalized difference vegetation index, the EVI enhanced vegetation index, all this also helps and are very very useful in terms of monitoring the deforestation and afforestation activities. Now the second point as far as 15.2 target is concerned, it deals with identification of degraded forest areas for restoration. it takes a while to qualify the forest area those are degraded. So this term, the term degraded has to be qualified based on other characteristics. Like you have very less species composition or the growth is not good or there are dryness or because of some other activities there have been degradation in the forest or over the forest areas.

So, that can be hunted out, and those layers can be integrated using GIS, and then we can properly plan for further restoration activities. The third point is analyzing forest cover and carbon sequestration using LIDAR and hyperspectral data. In this, we can also determine the forest cover and, using allometric equations or ground-based studies, we can estimate the amount of carbon it holds. Then, perhaps using other modeling tools—particularly dynamic vegetation models and some physiological models—we can assess the carbon sequestration potential. These days, using LiDAR data, which provides better

structural images or characteristics, and hyperspectral data, which offers more spectral bands, So, separating one species from another.

So, that way, geoinformation helps in analyzing the forest cover and carbon sequestration. Now, let us move on to Target 15.3, which deals with combating desertification and restoring degraded land. So, mapping the process of desertification, and the dryland and degraded land can be very well done using satellite data. We can also integrate various other parameters, such as soil erosion, drought, and flood-affected areas, using satellite data or different sources.

Thereby, it helps in assessing the impact, which is valuable or ready for various land restoration efforts or activities. Now, let us move on to Target 15.4. It deals with the conservation of mountain ecosystems and their biodiversity. So, monitoring mountain biodiversity and ecosystem health is the first point as far as Target 15.4 is concerned. So, the ecosystems, particularly mountain ecosystems, are very fragile.

It is unique. It has its own characteristics as far as several, what you say, characteristics. Microclimate, we have variation in terms of altitude, elevation, slope and aspects. So importantly the mountain ecosystems and their biodiversity should be conjured and monitored. And also the glaciers, the snow cover and the vegetation changes.

So, this helps or this kind of assessment and monitoring helps in terms of providing or understanding the ecosystem services provided by the mountain regions including the biodiversity content within the mountain ecosystem. So, here particularly in our this case if the mining areas accommodate the mountains, the definitely the different types of biodiversity, different level of biodiversity richness or content. So, we need to conserve them, conserve the mountain ecosystem, we need to conserve its biodiversity content to the maximum possible extent within the mining ecosystems or mining area boundary. Now let us move on to target 15.5 that deals with reduction in terms of degradation of natural habitats and halt in biodiversity loss. So, identifying and monitoring biodiversity hotspots using spatial data, tracking habitat loss through high resolution satellite imagery, using geospatial models to predict biodiversity changes and extinction.

**Targets Achievable Using Geoinformation**

**Target 15.5: Reduce degradation of natural habitats and halt in biodiversity loss**

- Identifying and monitoring biodiversity hotspots using spatial data.
- Tracking habitat loss through high-resolution satellite imagery.
- Using geospatial models to predict biodiversity changes and extinction risks.

**Target 15.9: Prevent introduction and reduce the impact of invasive alien species**

- Monitoring the spread of invasive alien species using satellite imagery and field data.
- Mapping vulnerable areas for proactive management.
- Assessing the impact of invasive species on native ecosystems..

**Target 15.9: Integrate ecosystem and biodiversity values into planning and development processes**

- Developing spatial models for ecosystem valuation.
- Mapping ecosystem services and integrating them into development plans.
- Supporting decision-making by visualizing trade-offs between development and conservation

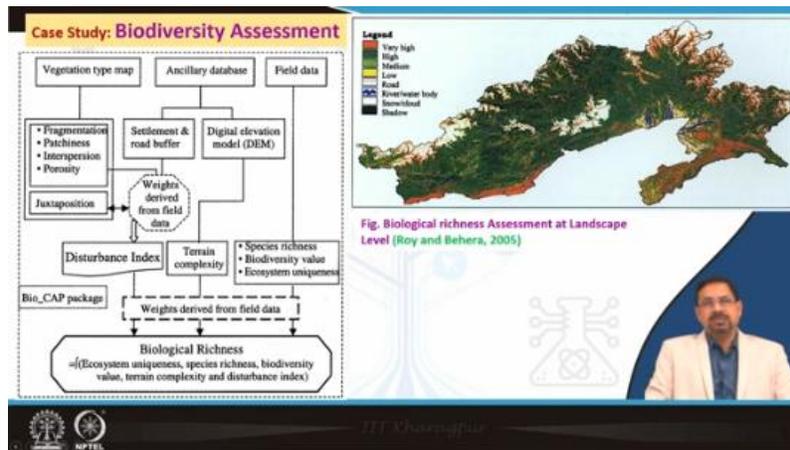
By leveraging these technologies, mining areas can be better managed to meet sustainability targets, reduce env.al degradation, and restore ecosystems impacted by mining activities..

So, let us talk about reduction in terms of the natural habitats, degradation of natural habitats and halt in biodiversity loss. So in all this high resolution data and also particularly the satellite data helps in biodiversity hotspot mapping. We will have a case study that will give more clarity how practical it has been done over some part of our northeast India. so the same approach can be uh can be imitated or can be extrapolated over any mining area or mining site so now moving to target 15.9 that deals with prevent preventing introduction and reduction of the impact of invasive alliance species This invasive alien species is a nuisance in terms of climate change because a lot of species which we do not want or which our ecosystem do not want are invading to our ecosystem so as to adapt and give a strong competition to the native species occurring over there.

So, mapping vulnerable areas for proactive management, assessing the impacts of invasive species on native ecosystems is greatly benefited from satellite data and also the geo-information tool-based modeling approaches. Now, let us move on to Target 15.9, which deals with integrating ecosystem and biodiversity values into planning and development processes. So, developing spatial models for ecosystem valuation, mapping ecosystem services, and integrating them into development plans. And also, geoinformation helps in supporting decision-making by visualizing trade-offs between development and conservation. So we have already discussed how to integrate ecosystem and biodiversity values in planning and development processes using geoinformation.

In some of our previous talks and using several model approaches and various types of satellite datasets, including the utility of IoT. So to sum up this part of the target or SDG number 15. By leveraging these technologies, particularly the generation technologies here, mining areas can be better managed to meet sustainability targets and help in reducing environmental degradation and restoration of ecosystems impacted by various

mining activities. A case study has been selected which was conducted in our lab. We published this long ago.



You can see 20 years back. It's the biological richness assessment at the landscape level. What has been done is that satellite data has been used to prepare a vegetation map. And the vegetation map has again been subjected to various analyses or landscape ecological analyses that have given us different layers such as fragmentation, patchiness, interspersion, porosity, juxtaposition—all these are there. So this talks about different landscape matrices.

And then we tried to integrate with other data, particularly the settlement and road buffers, using GIS, and also the digital elevation model to incorporate topographical variations. And we attributed different types of weights. And then finally, we came up with a disturbance index and various other attributes derived from the field survey, such as species richness, biodiversity value, and uniqueness in terms of the ecosystem. We tried to develop a prioritization framework for biological richness. So, the map on the top right shows various levels of biodiversity richness in one of the northeastern states of India, Arunachal Pradesh.

So, you can see the areas marked in red have the highest biological richness, followed by dark green, faint green, and yellow. This means that on the right-hand side, in the southern Tirap and Changlang districts, we observe very high levels of diversity as well as very low levels. This indicates that this particular area has a variety of intact biodiversity. This means that a kind of disturbance has already begun. What I mean to say is that this example of biological richness assessment at the landscape level is highly applicable to mining sites or locations.

This is an example of integrating satellite-derived vegetation maps with landscape-based indices and other ancillary data, such as settlements, roads, and physiognomy or topography. Such integration-based analyses are very useful for prioritizing or understanding the extent of biodiversity in a given area. Then, perhaps, we can implement appropriate measures to enhance biodiversity content or richness wherever possible. So, geoinformation is very useful in this regard. Now, let us move on to SDG Goal 17, which deals with partnerships for the goals.

**Goal 17 Partnerships for the Goals**

**STRENGTHEN THE MEANS OF IMPLEMENTATION AND REVITALIZE THE GLOBAL PARTNERSHIP FOR SUSTAINABLE DEVELOPMENT**

**MANY DEVELOPING COUNTRIES ARE FACING A DEBT CRISIS**  
AS OF MID-2022  
 27 OUT OF 69 OF THE WORLD'S POOREST COUNTRIES WERE IN DEBT DISTRESS OR AT RISK OF BEING SO

**THE SHARE OF EXPORTS FOR LOW- AND MIDDLE-INCOME TRADE HAS CONTRACTED AT AROUND 15% SINCE 2017**

**NET ODA REACHED \$206 BILLION IN 2022, UP 15.2% FROM 2021**  
OF WHICH \$100.5 BILLION WAS IN THE FORM OF GRANTS

**2.8 B PEOPLE USED THE INTERNET IN 2022**  
250 MILLION MORE WERE ONLINE THAN FEMALE USERS  
 (SDG, 2023)

**ODA FUNDING FOR DATA**  
INCREASED BY MORE THAN 40% SINCE 2017

**Overview of SDG 17:**

- Strengthen global partnerships by improving finance, technology, capacity-building, fair trade, policy coherence, and data systems
- Strengthen North-South, South-South, and triangular cooperation to implement SDGs

**Capacity Building Approach:**

- Ongoing process involving technical knowledge transfer and skill development
- Focuses on participation, knowledge exchange & ownership

**Role of Geoinformation:**

- Enables technical capacity-building at individual & institutional levels
- Supports integrated resource management in spatio-temporal contexts
- Applications:** Disaster management, urban planning, agriculture, and resource optimization.

In totality, this particular SDG goal number 17, or the last one as far as the SDG series of 17 is concerned. It deals with strengthening partnerships by improving finance, technology, capacity building, fair trade, policy coherence, and data systems. It also deals with strengthening what you may call north-south, south-south, and all such triangular cooperation to implement SDGs. So, essentially, this particular goal number 17 deals with improving partnerships. Finance, technology, capacity building, fair trade, policy coherence, and data systems—the same is also valid for a mining region where many of these systems are useful or valid. In terms of capacity building, approaches involve an ongoing process of technical knowledge transfer and skill development, focusing on participation, knowledge exchange, and ownership. This is very well validated and can be enhanced using geo-information tools. So, what role does geo-information play here? It helps in capacity building at individual and institutional levels and supports integrated resource management in spatio-temporal contexts. The applications could include disaster management, urban planning, agriculture, and resource optimization. We have already discussed various ways geo-information, and importantly GIS, helps integrate this and provide useful information for achieving SDG goal number 17. So, what could these be in terms of different subsections? Target 17.1 deals with strengthening domestic resource mobilization, including through improved tax and revenue collection. It can assist

governments in identifying taxable assets such as land use, infrastructure, and property through cadastral mapping.

**Targets Achievable Using Geoinformation**

**Target 17.1: Strengthen domestic resource mobilization, including through improved tax & revenue collection**

- Can assist governments in identifying taxable assets such as land use, infrastructure, and property through cadastral mapping
- Can improve the identification of economic activities and resource allocation efficiency

**Target 17.3: Mobilize additional financial resources for developing countries from multiple sources**

- Demonstration of resource availability or environmental assets (e.g., forests, carbon sequestration) using geospatial evidence can help attract international funding

**Target 17.4: Assist developing countries in attaining long-term debt sustainability through debt financing, relief, and restructuring**

- Geospatial analysis can showcase the economic potential of natural resources, infrastructure, and development progress, which can support negotiations

**Target 17.6: Enhance international cooperation on science, technology, and innovation, including through improved coordination**

- Geospatial platforms such as Earth observation systems provide a global mechanism for collaboration and information sharing

UNEP, UNCTAD, UN Women, UNFPA, UNHCR, UNICEF, UN Women, UNFPA, UNHCR, UNICEF

UNEP, UNCTAD, UN Women, UNFPA, UNHCR, UNICEF

It can improve the identification of economic activities and resource allocation efficiency. Coming to SDG goal number 17.3, it deals with mobilizing additional financial resources. SDG goal subsection 17.4 deals with assisting developing countries in attaining long-term debt sustainability. And 17.6 deals with enhancing international cooperation on science, technology, and innovation. Similarly, we have several other targets: target 17.7, target 17.8.

**Targets Achievable Using Geoinformation**

**Target 17.7: Promote environmentally sound technologies to developing countries**

- Remote sensing and GIS are key tools for monitoring, assessing, and managing environmentally sound technologies (e.g., renewable energy site selection, deforestation tracking).

**Target 17.8: Fully operationalize the technology bank and enhance ICT in least developed countries.**

- Geospatial platforms can facilitate ICT-based decision-making, especially in resource management, agriculture, and disaster risk reduction.

**Target 17.9: Enhance capacity-building in developing countries to support national plans**

- GIS-based training & capacity-building programs can empower nations to monitor progress toward SDGs

**Target 17.10: Promote a universal, rules-based, open, non-discriminatory multilateral trading system**

- Geospatial data can help identify trade corridors, infrastructure needs, and environmental impacts of trade policies.

**Target 17.11: Increase the exports of developing countries, particularly least developed countries.**

- GIS can be used to map agricultural productivity, mineral resources, or other export potential areas to boost trade.

**Target 17.12: Realize duty-free and quota-free market access for least developed countries**

- Mapping and analysis of logistics and supply chain networks can support efficient trade processes.

UNEP, UNCTAD, UN Women, UNFPA, UNHCR, UNICEF

UNEP, UNCTAD, UN Women, UNFPA, UNHCR, UNICEF

17.8 particularly deals with fully operationalize the technology bank and enhance ICT in least developed countries. So this is a very important subsection that we have already discussed and is applicable in our mining sector. The 17.9 that deals with supporting the national plans in terms of monitoring the progress. Target 17.10 deals with promoting universal rule-based training open and non-discriminatory multilateral trading options. And

moving on 17.11 and 17.12, all them do partially benefit from the utility of geo-information tools.

So, let us see these are some of the government of India schemes that are aligned with SDG goal number 14, 15 and 17. We are not considering 16 here. We could not see that it could be related to the benefit of more to the benefit of geoinformation. So, as far as the goal number 14 is concerned, we have a good program named as Sagarmala. So, it is a national plan for the conservation of aquatic ecosystems, national fisheries policy.



Also, we have and also coastal regulation zone CRJ. So, all these four fall under or adder to the goal number 14 SDG. Now, goal number 15, life on land. We have several missions, let us say National Afforestation Program, NAP, the GIM, Green India Mission, National Mission for Sustainable Himalayan Ecosystem, NMSHE. All these adhere to the SDG goal number 4 as far as Government of India schemes are concerned.

The last one, goal number 17, we have Digital India that aims at empowering to empower. And then we also have NRDMS, the Natural Resources Data Management System. So all these different Government of India schemes are aligned to SDG goals number 14, 15, and 17 respectively. These are the references that have been used to frame or prepare these sites. So, let us conclude.

## REFERENCES

- Monteiro, N. B. R., Silva, E. A., & Moita Neto, J. M. (2019). Sustainable development goals in mining. *Journal of Cleaner Production*, 228, 509–520.
- Kumar, D., Singh, R.B., Kaur, R. (2019). Spatial Information Technology Applications in Other SDGs. In: *Spatial Information Technology for Sustainable Development Goals*. Sustainable Development Goals Series. Springer, Cham.
- SDG (Sustainable Development Goals Report) 2023: Special edition – source: <https://unstats.un.org/sdgs/report/2023/>
- Roy PS and Behera MD. 2005. Rapid assessment of biological richness in a part of Eastern Himalaya: an integrated three-tier approach. *Current Science* 88(2): 250-257



Dr. Pradyumn

## CONCLUSION

- The integration of geospatial tools significantly supports achieving SDGs, particularly Goals 14, 15, and 17, by enabling efficient monitoring, planning, and decision-making
- GeoINFO aids in reducing marine pollution, protecting ecosystems, addressing overfishing, and conserving marine biodiversity through Marine Protected Areas (MPAs)
- GeoINFO facilitates land-use planning, deforestation monitoring, and the restoration of degraded ecosystems, promoting sustainable terrestrial resource management
- Collaboration and technology sharing through geospatial platforms strengthen international efforts in science, trade, and resource management
- National programs like the Sagarmala Project, Green India Mission, Digital India, and others are effectively aligned with SDG objectives through geospatial integration.



Dr. Pradyumn

The integration of geoinformation significantly supports achieving all the Sustainable Development Goals. And here, particularly in this lecture, we discussed goals number 14, 15, and 17. And that is how it helps in efficient monitoring, planning, and decision-making, very well applicable to the mining area or the mining sector. Geoinformation helps in reducing marine pollution, protecting ecosystems, addressing overfishing, and conserving marine biodiversity through marine protected areas or MPAs. Geoinformation facilitates land-use planning, deforestation monitoring, and the restoration of degraded ecosystems, thereby promoting sustainable terrestrial resource management.

Any kind of collaboration in terms of technology sharing using geoinformation or geospatial platforms is useful and strengthens the core collaboration activities in terms of science, trade, and resource management, thereby helping in terms of better and efficient management, or you could say sustainable management of the mining sector. So, various national programs also cater to or add to all these Sustainable Development Goals and benefit from the utilization of geoinformation technologies. Thank you very much, and I look forward to seeing you again. Thank you.