**PSUSTAINABLE MINING AND GEOINFORMATION**

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**Lecture 32: SDG 1 & 2 [No Poverty & Zero Hunger]**

Welcome, let us move on to the lecture number 32 that talks about sustainable development goal number 1 and number 2. So, sustainable development goal 1 talks about 'No Poverty' whereas the second sustainable development goal talks about 'Zero Hunger'. these two are very very important as far as the humanity is concerned we should not have poverty and our bellies should be filled that means there should not be any hunger so these are two very important sustainable development goal targets that all of us as far as the humanity is concerned needs to be achieved needs to be contained So, let us see how these two sustainable development goals benefit from the geo information technology and as far as the mining industry sector is concerned. So, we will be covering the concepts particularly using geospatial data to reduce poverty in mining affected regions which fall under the sustainable development target number 1.
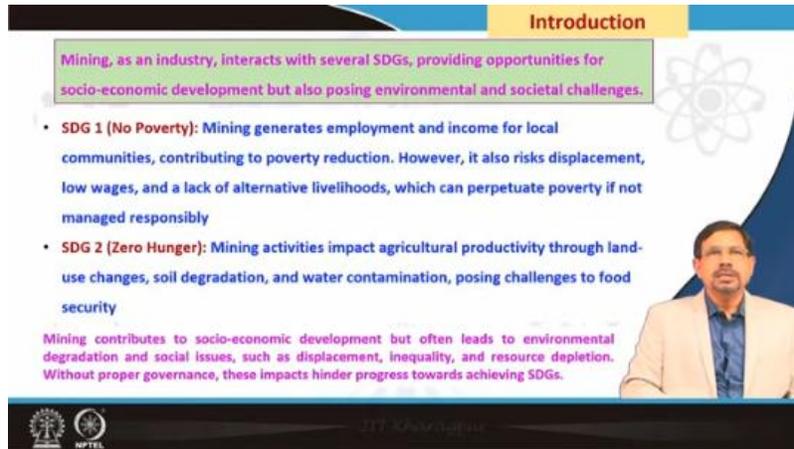


And, geo information for improving food security by monitoring land use conflicts between mining area and adjoining forest and agriculture land. So, sustainable development goal number 2 and also, we will take a few case studies as far as the poverty mapping and sustainable land management is concerned. So, mining all of us know is an

industry that interacts with several sustainable development goals. Thereby provides opportunities for socio-economic development but also poses lot of environmental and social challenges and risks. As far as sustainable development goal number one is concerned that is no poverty.



So, how it is useful or how it can be executed under the unit in terms of the mining industry. So, mining industry generates employment and income for local communities that is first thing because of lot of because of these activities mining industry generates employment and also thereby income for the local community as well as others also. So, thereby it contributed contributes to poverty reduction. So, first thing is sustainable mining through its various operations or mining industry operations generates employment thereby contributes to poverty reduction as far as that locality is concerned directly or indirectly. However, it also risks the displacement, low wages and a lack of alternative livelihood which can perpetuate poverty if not managed responsibly.

So, the other side of this which are very critical and sensitive is there is also the risk of displacement where the mining activities has to is undergoing. So, the authorities would like to move the people who are located within or around that area because that area has to be mined if it is open mined then it still become a difficult thing. And sometime low wage if it is not means defined or you are giving low wages that then that also needs to be handled. A lack of alternative livelihood. So, all these are different challenges which comes or which are attached to the mining industry as far as and fall under the broad category of sustainable development goal number 1.

As far as the sustainable development goal number 2 is concerned, it means the zero hunger. Mining activities impact agriculture productivity through land use changes, soil degradation and water contamination. So, thereby pose challenges to food security. So,

various challenges they put which which are indirectly which are indirectly gives rise to challenges that that lead to or that affect the food security. So, in a sense mining contributes to socio-economic development but often leads to environmental degradation and social issues such as displacement, inequality and resource depletion.

Without proper governance, these impacts hinder progress towards achieving SDGs. So, they need to be addressed properly. Now, as far as the geospatial or say geo information is concerned in terms of benefiting the sustainable development goal number 1 and 2 are concerned. So, the geospatial data helps in identifying vulnerable population and assessing the environmental impacts of mining. So, application include mapping areas with limited access to basic services such as healthcare, education and detecting regions affected by mining induced soil or water contamination.



So, when we have the data in terms of a geospatial platform, we can benefit in terms of healthcare, education and many other things that directly or indirectly has an element as far as the sustainable development goal 1 and 2 is concerned. Practical applications in poverty reduction and food security as far as the poverty reduction is concerned. So, the geo information helps in mapping in terms of the employment pattern. So, thereby it can identify the shift caused by the mining activities. In terms of food security, the geospatial tools can help in terms of monitoring the agriculture land encroachment, the water quality affected or because of that if there are some risk in terms of the food production or food contamination and and food management is concerned. So, the let us take goal number 1 first the end of poverty in all its forms and everywhere. So, SDG broadly talks SDG goal number 1 broadly talk that let us by 2030 the agenda 2030 how it is named by United Nations. So, it has the target to end poverty in all its forms everywhere from the surface

of the earth. So, that means we have to act at each individual each household level as far as poverty is concerned.



So, it aims to eradicate extreme poverty and reduce all forms of poverty by ensuring economic inclusion access to basic services and resilience against the shocks achieving this goal requires targeted interventions in resource scare environment so to achieve this target it requires it it requires very targeted interventions where the the resource is deficit its scarcity is there ok. So, application of geospatial data near mining areas provide transformative tools for mapping poverty. So, geospatial data helps in in mapping the poverty in terms of 3D or 2D kind of database and also once it is mapped it can help in terms of monitoring the vulnerable population and also it can map the resources which are accessible or which are available.

So, the mining sector, often associated with economic opportunities, can also contribute to poverty alleviation if managed sustainably. So, together, these technologies—the geoinformation technologies. So, together, this geoinformation technology in the mining industry can enable data-driven solutions that can help in poverty reduction. So, geospatial tools, or you may say geoinformation tools, are used for identifying various things such as the population at risk, the resources which have no access or insufficient access, or many of the essential services that are linked to poverty eradication. So, for example, mapping healthcare and education gaps in mining-impacted regions can be very well done using geospatial technology, which has the power of integrating spatial and non-spatial data.

So, the point number one, the SDG goal number one, talks about the reduction or end of poverty, where action needs to be taken at the individual level, at every household level where resource scarcity exists. Geo-information has a definite role to play. So, let us see

the role of remote sensing and GIS in Sustainable Development Goal 1. Poverty mapping: high-resolution satellite imagery combined with machine learning can predict poverty levels by analyzing physical infrastructure, land use, and socio-economic indicators. Whereas, in terms of resource allocation, GIS tools can identify underserved areas—the areas which are not under exploitation or not under service. Also, it helps in guiding the government, local people, local communities, and organizations in deploying social protection systems and infrastructure.



Climate resilience: remote sensing supports vulnerability assessment to climate-related disasters, thereby aligning with Target 1.5 of the Sustainable Development Goals. So, in terms of building resilience. So, mining and economic development: sustainable mining practices provide employment opportunities and drive local development, reducing poverty. Here also, geoinformatics is used to map mineral resources and monitor mining activities for environmental and economic sustainability. So, as far as the various components of Sustainable Development Goal 1 are concerned—poverty mapping, resource allocation, climate resilience, and mining and economic development—they have benefited from geo-information technologies.

Some specific applications include identifying informal settlements, monitoring agricultural productivity, and disaster impact assessment. These also have elements as far as various sub-themes of the Sustainable Development Goal One are concerned. So, by 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on a very low income per day. So, geospatial technology enables mapping and monitoring poverty indicators, thereby providing access to various resources, socio-economic disparities, and supporting data-driven policy-making or policy decisions that

lead to poverty reduction or poverty removal, you can say. So, this particular map was given by Kumar et al. in 2019.





So, in this, you can see the mining regions. The geospatial tools can assess many things in terms of land degradation, monitor and model impacts, and map the livelihood resources, thereby contributing to sustainable land use, equitable resource distribution, and the creation of alternative employment opportunities to uplift the impoverished communities. So, let us go with respect to the sub-targets within SDG 1. So, Target 1.2, which is applicable and has a component as far as the geo-information technology is concerned in the mining sector. So, it aims to reduce—Target 1.2 aims at reduction by at least half—the proportion of men, women, and children of all ages living in poverty in all its dimensions according to the national definition by 2030. So, this target has to be achieved by 2030.

Figure: Distribution of weighted relative wealth index values among 238 households in Xilinhot City, Inner Mongolia, China, using high-resolution remote sensing data. (... al., 2021)

So, if it is, then what is the role of GIS or geospatial technologies? Using geospatial technologies, policymakers can map and monitor poverty hotspots. So, using this, they can say that, okay, here is the poverty level, and based on that, different kinds of quality gradations can be put in terms of hotspots or cold spots. And analyze spatial patterns of resource allocation, thereby improving the efficiency of poverty reduction programs through targeted interventions. In mining regions, geospatial technologies can be used to assess the socio-economic impacts of mining and identify communities vulnerable to displacement or resource depletion.

So, let us go to target number 1.3. So, target number 1.3: this subsection deals with implementing nationally appropriate social protection systems and measures for all, including social protection floors, and achieves substantial coverage of the poor and vulnerable by the end of this decade. So, if this is the case, then how do geospatial technologies benefit this? So, geospatial technology can be used to map the vulnerable population, analyze spatial inequalities, and help monitor the effectiveness of these social protection programs. So, basically, it integrates all this data—environmental and social—as far as poverty is concerned.

It gives us the required information, which is useful or can be helpful for policy implications in mining regions. So, geospatial tools can identify and monitor the impact of mining activities on local communities, track displacement, and assess environmental degradation, thereby enabling policymakers to design targeted social protection measures for displaced and affected populations. You can see the histogram on the upper right. It talks about the distribution of the weighted relative wealth index values among 238 households in an area in Mongolia, China, using high-resolution remote sensing data.

So, remote sensing data can also provide indications or be linked to ground household surveys, and we can derive information that helps in management or policy environments. Now, let us talk about target number 1.4, which ensures the Sustainable Development Goal Target 1, Section 4. So, 1.4 ensures equitable access for all by 2030, especially the poor and vulnerable, to economic resources, land ownership, property rights, natural resources, technology, and financial services, fostering economic security and resilience. On the right-hand side, you can see two graphics that show estimated poverty scores at the cell level and in two different cities of a region. So, here we see a graphic in the form of a map that integrates different datasets, combining satellite data with ground-based surveys, allowing us to visualize poverty levels in terms of poverty scores.



Coming to target 1.5, which aims to enhance resilience and reduce the vulnerability of poor and marginalized communities to climate-related extreme events, as well as economic, social, and environmental shocks by 2030, contributing to sustainable development and disaster risk reduction. Now, poverty due to climate risk is increasing because we are all living in a warming world where climate change activities are occurring. So, climate-related or climate-induced risks that contribute to poverty fall under SDG target number 1.5. This benefits from geospatial technologies, which help in mapping, monitoring, and analyzing climate risks. Thereby, it can also map disaster-prone areas and social vulnerability to enhance preparedness.

In any kind of adaptation to climate change or climate risk, we can also be pre-informed in terms of decision-making, allowing us to develop resilience to mitigate such climate risks. Thus, target 1.5 greatly benefits from geospatial technologies. Now, let us move to the next target, SDG 2, which is zero hunger. So, target 2 of the SDG, or Sustainable

Development Goal target number 2, emphasizes ensuring food security, ending malnutrition, and advancing sustainable agricultural practices. Geoinformation technologies are pivotal in achieving this goal by providing precise datasets for agricultural management, monitoring food security, and biodiversity conservation. Mining industries play an indirect role in Sustainable Development Goal number 2, particularly through their impact on land use, water resources, rural development, and local communities.



Geoinformation helps in tracking land-use changes due to mining activities. It helps in mapping and analyzing deforestation, encroachment on agricultural areas, or deforestation caused by mining activities. Thereby, the applications include monitoring impacts on ecosystems and supporting sustainable land management. Examples include agroforestry and skill development initiatives for displaced communities. Geospatial tools help in identifying areas suitable for such programs that align with the goal of zero hunger.

So, friends, in terms of the role of remote sensing and GIS, which are geo-information broadly, as far as sustainable development goal target 1 and target 2 are concerned, the zero hunger. So, agriculture monitoring is well linked as an element that is linked to sustainable development goal target 2, drought and flood prediction, genetic diversity conservation, food security analysis, and sustainable mining practices. So, all these four or five have already been practiced and demonstrated using the satellite data or, you could say, the geoinformation tools. So, they all have elements as far as SDG 2 is concerned, and target 2.1 says that by 2030, the end of this decade, we must end hunger and ensure access to safe, nutritious, and sufficient food for all. So, three things we

have—we need not only to end hunger but also to ensure access to safe, nutritious, and sufficient food for all.



So, that is target number 2.1, particularly for the poor and vulnerable populations, including infants. It has to be done all through the year, all across the time frame. So, if it has to be achieved, what is the role and benefits that geospatial technology can provide in terms of geospatial technology? Technological help is concerned; it helps in monitoring agriculture productivity, mapping vulnerable populations, tracking food distribution systems, and analyzing environmental conditions to ensure equitable and efficient access to food resources. This technology can identify and mitigate the impact of mining activities on nearby agricultural lands, thereby monitoring soil degradation and supporting reclamation efforts. So, this is why and how target 2.1 can have greater benefits as far as geospatial technology is concerned.



Let us move to the next target, 2.2 subsection. So, by 2030, as far as SDG target 2.2 is concerned, it has been provisioned to eradicate all forms of malnutrition, with a focus on

meeting internationally agreed targets for reducing stunting and wasting in children under five by 2025, by this year. while addressing the nutritional needs of vulnerable groups such as adults and girls, pregnant and lactating women, and elderly people. So, different sections of the population class have been separated and earmarked for different kinds of goals as far as poverty reduction and malnutrition are concerned.



So, geospatial technology enables the identification of malnutrition hotspots through spatial analysis, monitoring agriculture productivity and it can also map the access to food and healthcare services thereby help in targeted intervention for vulnerable population. So, the data in terms of different sections their status coming from the healthcare sectors can be integrated merged and it can it can be used to to eradicate malnutrition which is the target as far as which is the target 2.2 of SDG. So, this also has is applicable to mining sector because we have different kind of for different class of population as far as mining area is concerned. By 2030 as far as the target 2.3 is concerned by 2030 the goal is to double the agriculture productivity and income for small scale food producers. particularly vulnerable groups like women, indigenous people, family farmers, pastoralists and fishers.

This involves equitable access to land, resources, knowledge, financial services and opportunities for value addition and non-farm employments. So, this can be can have means your information technology can have a vital role to play here by enabling precision agriculture, precision farming, resources mapping, land use monitoring and market access improvement. So, that is how this geospatial technology can provide insights to optimize productivity, ensure sustainability and address challenges that are faced by small scale producers. So, target 2.3 is very well benefited from utilization of geospatial tools and have been increasingly utilized. Let us come to target 2.4, it says that

by 2030, promote sustainable food production system and adopt resilient agricultural practices that enhance productivity, maintain ecosystems, strengthen adaptation to climate change and improve land and soil quality.



So, geospatial technology plays important role to achieve this target by enabling precision agriculture, monitoring crop health. Assessing soil quality and forecasting climate risk to optimize agricultural practices in a sustainable way. As far as the next one, target 2.5 is concerned, it has mandated to ensure the preservation of genetic resources in seeds, cultivated plants, domesticated animals and related wild species by maintaining well managed seed and plant banks at various levels and promoting equitable sharing benefits that could arise from genetic resources and traditional knowledge. So, friends in this target 2.5, we basically talk about preservation of the genetic diversity in different forms.

So, geospatial technology helps in terms of mapping and monitoring biodiversity, mapping the distribution of genetic resources, and thereby assessing threats such as habitat loss and climate change. In that way, it aids in conservation planning and the establishment of seed and plant banks. So, if you have different levels of diversity—alpha, beta, gamma—here we are specifically discussing genetic diversity. So, if the entire landscape is protected or needs protection within different systems, mapping it allows us to understand what exists and then develop conservation implications or plans. So, that is how geospatial technology plays a very important role. Let us now examine one or two case studies.

Yes, we have many instances in terms of poverty eradication, poverty reduction, and no poverty. This particular study by Ahmad and Goparaju in 2017 discusses land evaluation for agroforestry suitability using geoinformation to enhance livelihoods, reduce poverty,

and promote sustainable agriculture. Here, you can see a suitability map prepared for agroforestry by considering different analyses and weighted criteria. Finally, the data were processed, agroforestry suitability mapping was completed, and spatial analysis was conducted. The key findings are that high, medium, and low suitability areas were identified and displayed in different colors.
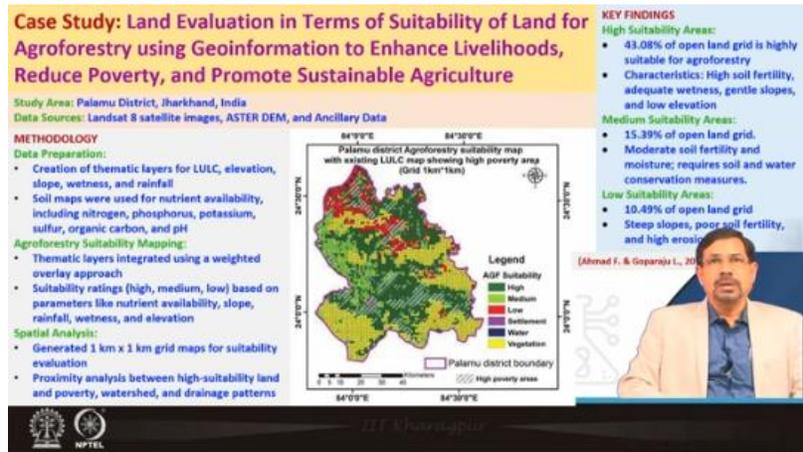


Such maps in mining sectors or areas are very helpful in determining suitability levels, linking them to poverty levels, and promoting sustainable activities. The next case, concerning SDG number 2, involves identifying poverty areas using machine learning and satellite imagery. Here, you can see the map for poverty area identification. Methodologies such as segmentation and classification were implemented, and classification accuracy was calculated. Finally, the poverty indicator map is displayed.



So, the poorer areas exhibited smaller houses, whereas narrower roads, fewer trees, while wealthier areas had large houses, wider roads, and more vegetation. This is a kind of interpretation that has been shown in terms of a case study. So, over mining areas, we can

have similar kinds of geoinformation-based maps or assessments that give us an impression about the poverty status, the poverty characteristics, and if we have that in terms of a spatial map, it helps us in addressing and properly managing that. So, these are the references which have been used for this particular lecture. So, let us conclude: geospatial technology plays a crucial role in terms of addressing the dual challenges of poverty alleviation and food security in mining-affected or, you may say, mining regions, so as to achieve sustainable mining.





So, this aligns with Sustainable Development Goals 1 and 2. So, the geospatial tools enable precise mapping and monitoring of vulnerable populations, environmental degradation, and socio-economic disparities, thereby facilitating data-driven policymaking and sustainable resource management. By integrating all these, the stakeholders can access various resources, various qualities of the environment, and thereby it can help in terms of ensuring sustainable agricultural practices. and equitable resource distribution, which is very important because we talk about the constraints; also,

we need to ensure the food. So, equitable resource distribution is very important, which can also benefit from geoinformation technology-based analysis.

So, this approach helps in terms of resilience building, enhancing livelihoods, and promoting environmental sustainability. So, thereby, it offers a kind of transformative pathway to achieving socio-economic inclusion and progress towards global sustainability goals. So, friends, we discussed the first two goals, that is, no poverty and zero hunger; you can very well understand that both are linked. and GIS, the broader family of geoinformation technology, has a definite role to play because it gives you a map; it has the power to integrate different information. Thank you very much.