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WELCOME SPEECH FROM THE CHAIRMAN

RISM 17th International Surveying Conference for Undergraduates (ISCU 2025)

بسم الله الرحمن الرحيم السلام

عليكم ورحمة الله وبركاته

Greetings to all,

It is with great pleasure that I welcome you to the 17th RISM International Surveying Conference for Undergraduates (ISCU 2025), themed *"Embracing Construction Revolution 4.0: Transforming Malaysia's Built Environment."* On behalf of the Royal Institution of Surveyors Malaysia (RISM), I also wish to express our sincere appreciation to Universiti Teknologi MARA (UiTM), Perak Campus, for graciously hosting this significant event.

As we navigate the era of the Fourth Industrial Revolution (IR4.0)—or in our context, Construction Revolution 4.0 (CR4.0)—we are witnessing transformative advancements across the global construction sector. Technologies such as Building Information Modelling (BIM), the Internet of Things (IoT), artificial intelligence (AI), robotics, big data analytics, and cloud computing are redefining the way we build, manage, and interact with our built environment. For Malaysia, embracing CR4.0 is a strategic imperative to achieve our socio-economic and environmental goals.

This conference serves as a vital platform to unite surveying undergraduates from various disciplines, fostering critical dialogue on industry challenges, enhancing professional networking, and preparing a new generation of talent for the rapidly evolving construction landscape. It is also an opportunity for employers to engage with and inspire our future professionals.

I would like to extend my heartfelt thanks to all industry speakers, paper presenters, judges, and participants for their time, contributions, and support in making ISCU 2025 a success. I also commend the organising committee for curating a meaningful and dynamic conference experience.

May the knowledge gained, connections formed, and ideas exchanged during this event inspire all participants to lead and innovate in their future endeavours.

Wishing everyone a productive and memorable conference.

Prof. Ts Sr Dr. Adi Irfan Bin Che Ani'
Chairman, Universities' Partnering Committee
RISM Session 2024/2025
May 2025

WELCOME SPEECH FROM CO-CHAIRMAN

RISM 17th International Surveying Conference for Undergraduates (ISCU 2025)

Bismillahirrahmanirrahim.

السلام عليكم ورحمة الله وبركاته and greetings to all.

It is my great pleasure to welcome everyone to the 17th International Surveyor Conference for Undergraduates (ISCU 2025), proudly hosted by Universiti Teknologi MARA (UiTM) Perak Branch in collaboration with the Royal Institution of Surveyors Malaysia (RISM). This event is a meaningful platform for students in the built environment to share ideas, showcase innovations, and build professional networks. We are honoured by your presence and enthusiastic participation, with 135 accepted papers and 78 poster presentations this year.

UiTM Perak, home to the College of Built Environment, has long been a hub for academic excellence in architecture, planning, and surveying. Our commitment remains strong in nurturing competent graduates who meet industry demands and contribute to nation-building.

While you're here, we invite you to experience the heritage and culture of Perak Tengah from the architectural richness of Rumah Kutai to the historical towns of Pasir Salak, Bota, and Kampung Gajah.

To all presenters and winners, congratulations on your achievements. Let your work today be a catalyst for future success and academic growth. We hope this conference will inspire you to explore new ideas, foster collaboration, and make lasting memories.

My deepest thanks to the Royal Institution of Surveyors Malaysia (RISM) and the organising committee for making this event a success.

We hope your experience here will be rewarding and unforgettable.

Thank you. Selamat datang dan selamat berjaya.

Associates Professor Dr. Nur Hisham Ibrahim, *PMP*
Co-Chairman, Universities' Partnering Committee
RISM Session 2024/2025
May 2025

WELCOME SPEECH FROM THE PROJECT DIRECTOR

RISM 17th International Surveying Conference for Undergraduates 2025

Alhamdulillah, all praise to Allah S.W.T. for His guidance and blessings in making the RISM 17th International Surveying Conference for Undergraduates (ISCU) 2025 a reality.

It is with great honour and gratitude that I welcome all participants, guests, academicians, and industry professionals to this prestigious event, proudly organized under the Royal Institution of Surveyors Malaysia (RISM). This 17th edition of ISCU stands as a proud testament to our collective dedication toward academic excellence, professional collaboration, and youth empowerment in the field of surveying.

I extend my heartfelt appreciation to RISM for its unwavering support, to the hardworking ISCU 2025 Organising Committee, and to all 16 partnering universities across Malaysia for their commitment and contributions. Your efforts have shaped this conference into a dynamic platform for knowledge exchange, innovation, and professional growth.

To the academicians and practitioners present, your insights are invaluable in bridging the gap between academic theory and real-world practice. To our undergraduate participants, your passion, curiosity, and commitment are the very foundation of our future. May this conference not only deepen your academic journey but also ignite a spirit of leadership, integrity, and sustainable thinking.

Let this gathering serve as more than an academic milestone. May it foster lifelong networks, inspire transformative ideas, and chart new directions in our shared professional journey.

Wishing everyone a rewarding and inspiring conference experience.

Sr Dr. Nurul Fadzila Zahari
Project Director
RISM 17th ISCU 2025

SOIL AND MINERAL CLASSIFICATION USING SATELLITE IMAGES IN BATANG PADANG, PERAK

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ABSTRACT

This research examines soil and mineral classification utilizing Landsat 8 multispectral satellite imagery in Batang Padang, Perak. This study aims to classify soil and minerals using remote sensing techniques. ERDAS IMAGINE software is utilized for preprocessing tasks, including the assessment of radiometric and geometric modifications to guarantee the accuracy of satellite data. Assessments of spectral signatures from the USGS Spectral Library with satellite data are conducted using the Spectral Angle Mapper (SAM) approach incorporated into ENVI 5.0 to enhance the precision of mineral identification. On the contrary, supervised classification in ERDAS IMAGINE utilizes training samples that highlight multiple spectral characteristics to distinguish soil categories. This study incorporates a temporal analysis to identify changes in soil and mineral distribution employing Landsat 8 data from 2016 to 2021. The change detection yields significant understanding in the temporal variations of soil and minerals, hence improving the comprehension of shifts in environmental geology throughout time. The study's results demonstrate that resource management and decision-making will be enhanced due to the reliability of geospatial information on mineral and soil dynamics.

Keywords: Remote Sensing, Soil Classification, Mineral Classification, Change Detection, Spectral Analysis.

I. INTRODUCTION

Batang Padang, located in southern Perak, has high agricultural potential and a rich history of tin mining. Although tin mining has declined, the area remains rich in minerals such as gold and iron ore, highlighting the need for geospatial studies in resource mapping. Its fertile soil supports crops like oil palm and rubber, while its hilly terrain and strong hydrology contribute to sustainable natural resource management (Gelagay & Minale, 2016). Sustainable soil and mineral resource management is crucial to balancing agricultural productivity and environmental conservation. Remote sensing technology, particularly multispectral imagery, helps identify high-density mineral areas (Peyghambari & Zhang, 2021). Understanding land-use changes is also essential for effective resource planning (Zhu et al., 2022). The integration of remote sensing and GIS has accelerated soil and mineral mapping, with Landsat 8 providing extensive coverage while reducing reliance on fieldwork, enabling better decision-making in resource exploration (Petropoulos et al., 2010). Techniques such as Spectral Angle Mapper (SAM) enhance classification accuracy, strengthening detection and mapping efforts (Cho et al., 2010; Kruse et al., 1993). This study contributes to sustainable land-use planning and efficient resource management in Batang Padang.

II. LITERATURE REVIEW

Advancements in remote sensing technology, particularly the use of multispectral imagery like Landsat 8, have significantly improved soil and mineral mapping. Gelagay and Minale (2016) demonstrated that integrating remote sensing with GIS is effective for estimating soil loss and monitoring landscape changes, supporting natural resource management. Landsat 8 offers broad spatial coverage and key spectral bands (visible, NIR, SWIR) essential for identifying soil and mineral compositions (Peyghambari & Zhang, 2021), aligning with Zhu et al. (2022) who stressed the importance of land-use change detection for effective planning. Techniques such as the Spectral Angle Mapper (SAM) enhance classification by comparing pixel spectral signatures with reference spectra, improving accuracy (Kruse et al., 1993; Cho et al., 2010). Similarly, supervised classification in ERDAS IMAGINE enables precise soil mapping using training samples (Petropoulos et al., 2010), particularly in heterogeneous areas like Batang Padang with its agricultural and mining background. Change detection methods also play a key role in monitoring environmental transformations over time (Zhu et al., 2022). Overall, the literature highlights that integrating remote sensing and GIS greatly improves classification accuracy and supports sustainable resource management.

III. METHODOLOGY

A. Data Collection

Landsat 8 satellite images for the years 2016 and 2021 were obtained from the United States Geological Survey (USGS) Earth Explorer. The spectral bands used included visible, near-infrared (NIR), and short-wave infrared (SWIR), which are essential for distinguishing soil and mineral compositions. Additionally, the USGS Spectral Library was used as a reference for mineral classification. The dataset selection ensured consistency and minimized external factors affecting image quality.

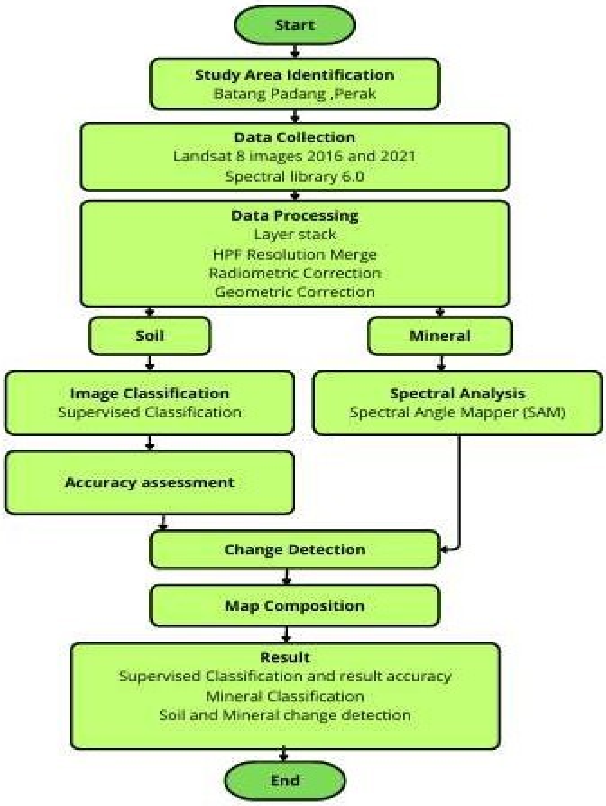


Figure 1.0 Research Flow

B. Data Preprocessing was carried out in ERDAS IMAGINE enhancing image quality and accuracy:

- Layer stacking was performed by combining different spectral bands into a single dataset to facilitate comprehensive analysis. Radiometric correction was applied to adjust sensor-induced errors and atmospheric distortions, ensuring accurate reflectance values. Additionally, geometric correction was conducted by aligning satellite images to real-world coordinates using control points, eliminating spatial distortions and improving georeferencing accuracy.

C. Data Preprocessing was carried out in ERDAS IMAGINE enhancing image quality and accuracy:

- Supervised classification was conducted for soil mapping by collecting training samples for different soil types and applying a classification algorithm to categorize pixels based on their spectral signatures, ensuring higher accuracy in distinguishing soil categories. For mineral identification, the Spectral Angle Mapper (SAM) method was used in ENVI 5.0 to compare pixel spectral signatures with reference spectra from the USGS Spectral Library, allowing for accurate classification by measuring spectral similarity.

D. Change Detection Analysis temporal changes in soil and mineral distribution were analyzed using:

- Post-classification comparison was conducted by analyzing classified maps from 2016 and 2021 to assess spatial and quantitative changes in soil and mineral composition. Additionally, matrix union analysis was performed to identify areas with significant shifts, providing insights into environmental changes and human impact

IV. RESULT AND DISCUSSION

A. Supervised Classification for Soil Types.

This study analyzes soil type changes in Batang Padang, Perak, using supervised classification for 2016 and 2021. In 2016, alluvial (pink) and podzol (dark purple) soils were dominant, while loamy (orange), mineral (yellow), and clay (brown) soils covered specific areas. Sandy soil (dark grey) and water bodies (blue) remained stable. By 2021, notable shifts in loamy and mineral soils indicated possible land-use changes, while clay soil slightly decreased due to erosion or replacement. Sandy soil remained stable, and minor changes in water bodies were linked to drainage shifts or reservoir construction. These changes highlight the impact of natural factors and human activities, necessitating further study for sustainable development planning.

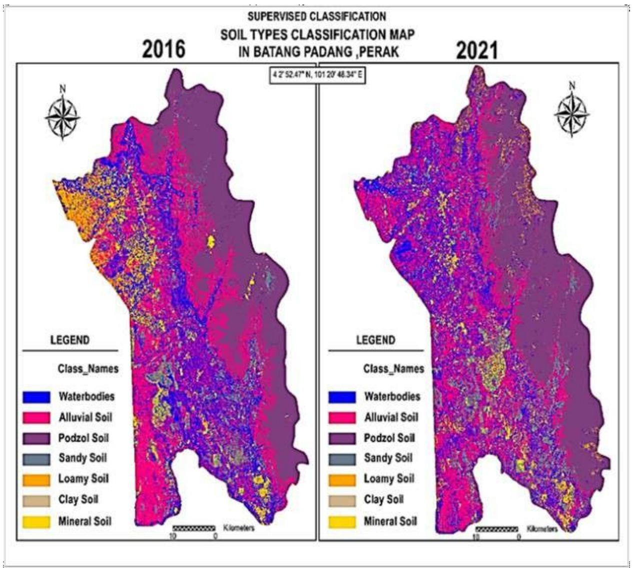


Figure 2.0 Soil classification map for 2016 and 2016.

Table 1.0 shows the percentage changes in soil types between 2016 and 2021. Waterbodies decreased from 18.63% to 17.75%, while alluvial (32.31% to 32.63%) and podzol (31.07% to 32.21%) soils slightly increased. Sandy soil saw a notable rise from 8.66% to 12.05%, whereas loamy soil dropped significantly from 6.25% to 2.93%. Clay and mineral soils also declined, from 0.83% to 0.75% and 2.25% to 1.68%, respectively. Despite these shifts, the total area remained largely unchanged, indicating a redistribution of soil types.

Table 1.0 Area percentage of supervised classification for soil types 2016 and 2021.

Class	Area 2016 hectares	Area 2021 hectares	Percentage (%) 2016	Percentage (%) 2021	Change
Waterbodies	51215.8	48813.5	18.63	17.75	Decrease
Alluvial Soil	88814.8	89735.0	32.31	32.63	Increase
Podzol Soil	85409.6	88577.3	31.07	32.21	Increase
Sandy Soil	23817.8	33138.8	8.66	12.05	Increase
Loamy Soil	17176.7	8041.71	6.25	2.93	Decrease
Clay Soil	2266.65	2047.77	0.83	0.75	Decrease
Mineral Soil	6174.81	4618.89	2.25	1.68	Decrease
Total	**274876.16**	**274972.97**	**100**	**100**	

B. Mineral Classification using SAM.

The SAM classification showed a significant increase in cassiterite and kaolinite, likely due to mining activities. Quartz and muscovite experienced reductions in some areas. The increase in cassiterite suggests higher tin ore extraction, while the decrease in quartz and muscovite may indicate mineral depletion in certain regions.

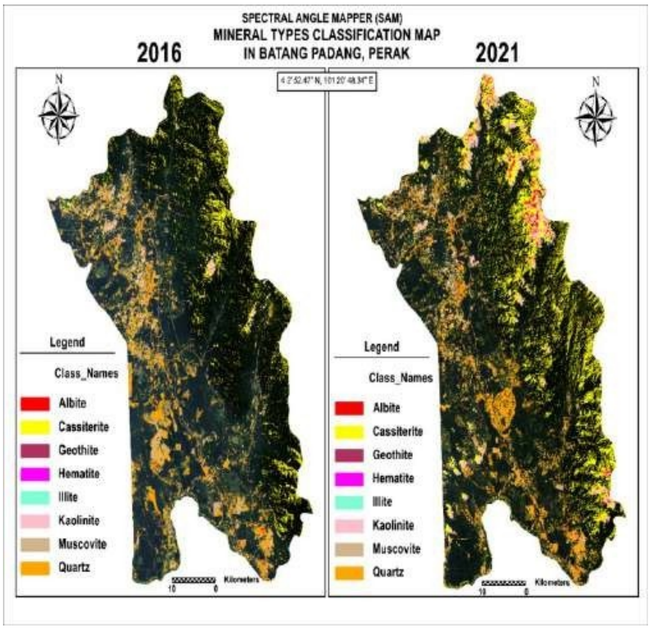


Figure 3.0 Mineral classification map for 2016 and 2021.

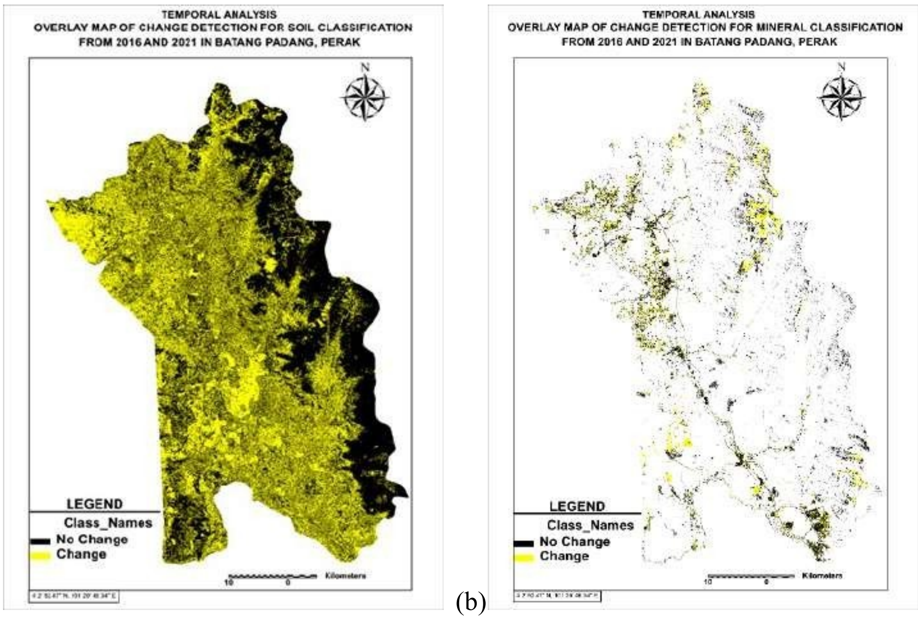
Table 2.0 highlights significant changes in mineral classification between 2016 and 2021. Albite (0.97% to 3.97%), Cassiterite (35.33% to 49.74%), and Kaolinite (11.79% to 16.22%) showed notable increases in area. Goethite remained unchanged, while Hematite and Illite slightly increased but saw percentage declines. Muscovite dropped from 5.53% to 1.65%, and Quartz experienced a major decline from 46.35% to 28.4%. Overall, Cassiterite, Albite, and Kaolinite saw significant growth, while Quartz lost its dominance despite remaining a primary mineral.

Table 2.0 Area percentage of (SAM) mineral types for 2016 and 2021.

Class	Area 2016 hectares	Area 2021 hectares	Percentage (%) 2016	Percentage (%) 2021	Change
Albite	467.01	2912.76	0.97	3.97	Increase
Cassiterite	16989.9	36440.7	35.33	49.74	Increase
Goethite	1	1	0.002	0.001	Unchanged
Hematite	6.3	7.11	0.013	0.009	Increase
Illite	7.11	9.27	0.015	0.01	Increase
Kaolinite	5669.55	11885.1	11.79	16.22	Increase
Muscovite	2659.59	1211.85	5.53	1.65	Decrease
Quartz	22287.9	20789.8	46.35	28.4	Decrease
Total	**48088.36**	**73257.59**	**100**	**100**	

C. Change Detection.

- **Soil Changes**: Based on Table 3.0, 49.27% of the total area exhibited changes in soil distribution, mainly due to agricultural expansion, deforestation, and natural soil erosion. The reduction of loamy soil and the expansion of alluvial soil suggest increased soil erosion and sedimentation in lowland areas as depicted in Figure 4 (a).
- **Mineral Changes**: According to Table 4, 68.56% of the total area showed mineral composition changes. The expansion of cassiterite deposits indicates intensified mining activities, while the reduction of quartz and muscovite suggests mining activities, while the reduction of quartz and muscovite suggests depletion in certain regions as shown in Figure 4 (b).



(a) (b)

Figure 4.0 (a) Change detection maps for soil classification and (b) Change detection maps for mineral classification.

Table 3.0 Area percentage of change detection for soil.

Class	**Area hectares**	**Percentage (%)**
No Changes	139444.3	50.73
Changes	135433.81	49.27
Total	**274878.11**	**100**

Table 4.0 Area percentage of change detection for mineral.

Class	**Area hectares**	**Percentage (%)**
No Changes	8811.57	31.44
Changes	19210.85	68.56
Total	**28022.42**	**100**

D. Verification for Change Detection Result.

Figure 5.0 the verification process for change detection in soil and mineral classifications between 2016 and 2021. The figure showcases satellite imagery comparisons of selected areas, such as Bidor and Tapah, highlighting changes in land cover and mineral distribution. Areas with significant changes are marked distinctly, allowing for an in-depth assessment of transformations in the region. The verification process confirmed that the detected changes in soil and mineral classifications between 2016 and 2021 were accurate and reliable. The use of multi-source validation, including spectral analysis, accuracy assessment, and field verification, strengthened the credibility of the change detection results. These findings contribute to a better understanding of environmental and human-induced changes in Batang Padang, Perak.

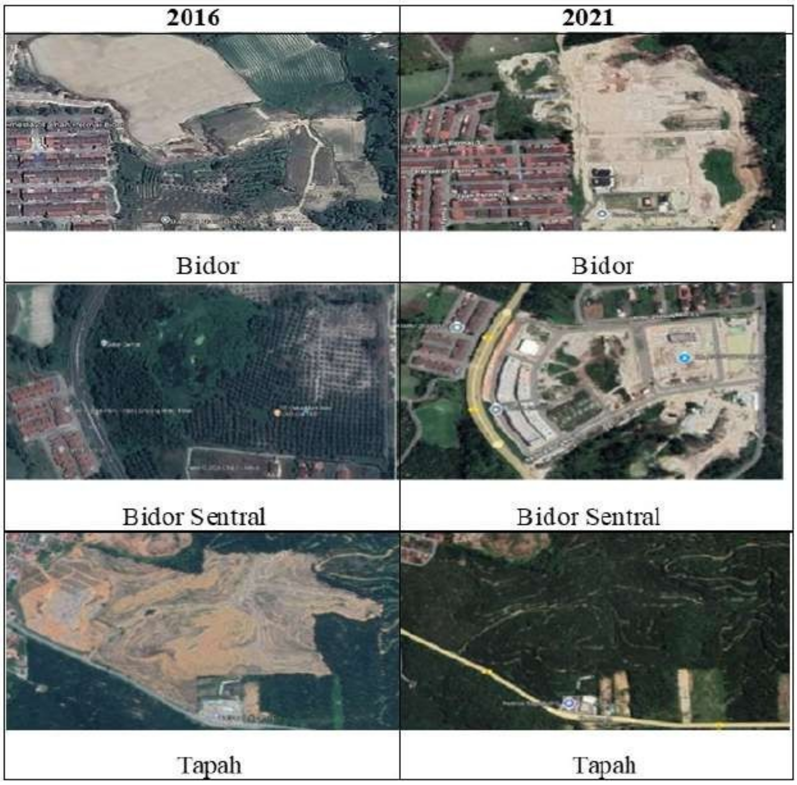


Figure 5.0 Verification for change detection results**.**

CONCLUSION

This study successfully classified soil types and identified mineral distributions in Batang Padang using remote sensing techniques. The findings can aid in sustainable land management and resource exploration. The observed changes in soil and mineral composition highlight the impact of land-use activities on environmental sustainability. To improve accuracy and extend research findings, future studies should be incorporated:

- Hyperspectral Data Analysis: More detailed spectral information will enhance the precision of soil and mineral classification.
- Field Verification: Ground truth data collection can validate remote sensing classification results.
- Long-Term Monitoring: Continuous satellite monitoring can track progressive environmental changes and inform sustainable policy decisions.

ACKNOWLEDGMENT

The authors would like to thank U.S Geological Survey for providing the Landsat 8 data.

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