

4.7 Field survey

Several photographs were taken during the field survey to validate the land use present shown in Figure 5.



Figure 5: Field survey photographs to validate present land use categories In Langkawi Island. (A) Urban class: Business - Langkawi Craft Complex; (B) Urban class: Industrial - Lafarge Cement Sdn Bhd; (C) Urban class: Business - Art in Paradise Langkawi; (D) Vegetation class: Crop - Coconut trees; (E) Vegetation class: Crop - Rubber trees; (F) Vegetation class: Crop - Banana trees; (G, H, I) Vegetation class: Paddy; (J, K, L) Vegetation class: Forest - Gunung Raya Reserve forest.

4.8 Functionality test

Through the designation of the SWAT land use classification codes to the respective land use, the functionality of the land use map derived was tested into the HRU analysis in the SWAT model. It was found that the designation of SWAT land-use code was functional with the percentage of overlap 95.94 %.

5. CONCLUSION

The area of each land use was computed, and it was found that Langkawi Island is mostly represented by the forest, vegetation and mangroves. The land use class in Langkawi Island classified as business, housing, recreation, industrial, institution, infrastructure, transportation, paddy, crop and forest. These land use categories are then assigned with the SWAT land use classification code. Thus the designation of SWAT land use classification code to the respective land use can serve as the functional land use database of the Langkawi Island. The land use map can be used to consider the planning of land use in the future. For the future work, it is recommended to use higher spatial resolution of satellite imageries for the study the land use in Langkawi Island in order to produce a large scale map of land use.

ACKNOWLEDGEMENT

This research has been fully funded by a private organisation, Bayu Tinggi,

in collaboration with International Islamic University Malaysia (IIUM).

REFERENCES

- Anderson, J.R., Hardy, E.E., Roach, J.T., Witmer, R.E., 2001. A Land use and Land Cover Classification System for Use with Remote Sensor Data. Geological Survey Professional Paper 964. Retrieved from <https://www.nrc.gov/docs/ML1409/ML14097A516.pdf>
- Australian Collaborative Land Use and Management Program (ACLUMP). 2016. Land Use in Australia -At a Glance, 4. Retrieved from www.abares.gov.au/landuse.%0Ahttp://www.agriculture.gov.au/abar es/aclump/land-use/publications#land-use
- Carrion, D., Maffei, A., Migliaccio, F., 2009. A database-oriented approach to GIS designing. *Applied Geomatics*, 1(3), Pp. 75-84. doi.org/10.1007/s12518-009-0008-y
- Federal Department of Town and Country Planning. 2016. Integrated Land Use Planning Information System (i-Plan). Retrieved from http://iplan.townplan.gov.my/l4/web/landuse/statistics?negeri_id=04 &tahun=2014
- Halimaton, S.H., Sarah, A., Rahimah, A.A., 2011. Conservation with development: Showcasing Langkawi Geopark-an introduction. *Planning Malaysia*, 9, vi-x.
- Hifzudin, I., Hamzah, O., 2019. Langkawi jadi pengeluar beras pulut. Retrieved from <https://www.bharian.com.my/berita/nasional/2019/05/567854/lang kawi-jadipengeluar-beras-pulut>
- Langkawi Development Authority. 2014. Naturally Langkawi. Retrieved from <https://naturallylangkawi.my/wp-content/uploads/pdf/MICE.pdf>
- Langkawi Development Authority. 2019. Tourist Arrival Statistic. Retrieved from <https://www.lada.gov.my/en/information/statistics/tourist-arrival-statistics?style=blue>
- Leman, N., Ramli, M.F., Khierodin, R.P.K., 2015. GIS-based integrated evaluation of environmentally sensitive areas (ESAs) for land use planning in Langkawi, Malaysia. *Ecological Indicators*, 61, Pp. 293-308. <https://doi.org/10.1016/j.ecolind.2015.09.029>
- Othman, P.P., 2011. The Impact of Tourism on Small Business Performance: Empirical Evidence from Malaysian Islands. *International Journal of Business and Social Science*, 2(1), Pp. 11-21.
- Samat, N., 2010. Assessing land use land cover changes in Langkawi island: Towards sustainable urban living. *Malaysian Journal of Environmental Management*. 11. Retrieved from <https://core.ac.uk/download/pdf/11491416.pdf>
- Villamizar, S.R., Pineda, S.M., Carrillo, G.A., 2019. The effects of land use and climate change on the water yield of a watershed in Colombia. *Water (Switzerland)*, 11(2). <https://doi.org/10.3390/w11020285>
- Xie, X., Gu, X., Yao, Y., Li, B., Wei, X., Jia, K., 2014. Land cover classification using Landsat 8 Operational Land Imager data in Beijing, China. *Geocarto International*, 29(8), Pp. 941-951. doi.org/10.1080/10106049.2014.894586.

