

ANALYSIS OF ENVIRONMENTAL PROBLEMS AND DEVELOPMENT OF DESIGN SOLUTIONS USING A THREE-DIMENSIONAL MAP OF THE TERRITORY

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In the modern world, the ecological situation remains very tense. In this regard, solving the environmental problems of individual territories is an urgent task. The work is devoted to the application of the cartographic method for studying the ecological situation in the territory of the municipal district of the Altai Region. One of the most effective methods of research is the cartographic representation of the terrain in three-dimensional form, providing ease of perception, facilitating the processes of analysis, planning and design. Some environmental problems in the territory are highlighted, the state of protective forest strips is studied in detail. A 3D map of the actual state of the problem situation has been compiled, solutions have been proposed, and the planned results of project activities are visually displayed. The features of using the map are described; the possibility and necessity of interaction of various spheres and branches of activity in matters of environmental safety are noted.

Keywords: rural area, three-dimensional map, environmental problems, protective forest strips, dry steppe, actual state, solutions, project activities, database, areas of use

REFERENCES

1. Maslov, A. A. (2019). Methodology for constructing three-dimensional maps of the area. *Innovatsii i investitsii [Innovation & Investment]*, 4, 252–256 [in Russian].
2. Latkin, V. A. (2021). Three-Dimensional Terrain Mapping. *Vestnik SGUGiT [Vestnik SSUGT]*, 26(2), 133–144 [in Russian].
3. Goralski, R. (2009). *Three-dimensional interactive maps: Theory and practice*. Glamorgan/Morgannwg: University of Glamorgan/Prifysgol Morgannwg, 313 p.
4. D'Urban Jackson, T., Williams, G. J., Walker-Springett, G., & Davies, A. J. (2020). Three-dimensional digital mapping of ecosystems: a new era in spatial ecology. In *Proceedings of the Royal Society B: Biological Sciences*, 287(1920).
5. Calders, K., Phinn, S., Ferrari, R., Leon, J., Armston, J., Asner, G. P. & Disney, M. (2020). 3D Imaging Insights into Forests and Coral Reefs. In *Trends in Ecology and Evolution*, 35(1), 6–9.
6. Guo, Q., Su, Y., Hu, T., Zhao, X., Wu, F., Li, Y., Liu, J., Chen, L., Xu, G., Lin, G., Zheng, Y. & Lin, Y. (2017). An integrated UAV-borne lidar system for 3D habitat mapping in three forest ecosystems across China. In *International Journal of Remote Sensing*, 38(8-10), 2954-2972.
7. Soulignac, F., Danis, P.-A., Bouffard, D., Chanudet, V., Dambrine, E., Guenand, Y., Harmel, T., Ibelings, B.W., Trevisan, D., Uittenbogaard, R. & Anneville, O. (2018). Using 3D modeling and remote sensing capabilities for a better understanding of spatio-temporal heterogeneities of phytoplankton abundance in large lakes. In *Journal of Great Lakes Research*, 44(4), 756-764.
8. Domingo, G. A., Claridades, A. R. C., & Tupas, M. E. A. (2018). Unmanned aerial vehicle (UAV) survey-assisted 3D mangrove tree modeling. In *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences – ISPRS Archives*, 42(4/W9), 123–127.
9. Chen, Z., Xu, B., & Devereux, B. (2014). Urban landscape pattern analysis based on 3D landscape models. In *Applied Geography*, 55, 82–91.
10. Gainutdinova, G. F. (2015). *Sovremennye problemy zemleustroistva i kadastrov [Modern problems of land management and cadastres]*. Kazan: University of Kazan, 26 p. [in Russian].
11. Smolyanskii, I (2012). How many fallow lands in the steppe region of Russia? *Stepnoi byulleten'*[Steppe bulletin], 36, 4–7 [in Russian].
12. Mordkovich, V. G., Gilyarov, A. M., Tishkov, A. A., & Balandin, S. A. (1997). *Sud'ba stepei [The fate of the steppes]*. Novosibirsk, 208 p. [in Russian].

13. Paramonov, E. G. (2016). The creation of forest as agrarian landscapes for ensuring sustainable management in Kulunda steppe. *Izvestiya AO RGO [Bulletin of the Altai Branch of the Russian Geographical Society]*, 1(40), 57–63 [in Russian].
14. Protective forest plantations. (n. d.). Retrieved from <https://ru.wikipedia.org/wiki/> [in Russian].
15. Dolgilevich, M. I. (1982). Protective forest plantations in western siberia. *Agrolesomelioratsiya v Zapadnoi Sibiri [Agroforestry in Western Siberia]* (pp. 3–11). Novosibirsk [in Russian].
16. Simonenko, A. P. (2001). Protective forest belts – the basis of the ecological framework in the dry steppe zone of Altai. *Agrolesomelioratsiya: problemy, puti ikh resheniya, perspektivy [Agroforestry: problems, solutions, prospects]* (pp. 26–28). Volgograd [in Russian].
17. Ishutin, Ya. N. (2005). Shelter belts as a factor of ecological improvement in steppes of Kulunda. *Sibirskii ekologicheskii zhurnal [Contemporary Problems of Ecology]*, 12(6), 1091–1094 [in Russian].
18. Bezformata. On damage to the shelter belt. (n. d.). Retrieved from <https://voronej.bezformata.com/listnews/povrezhdenii-polezashitnoj-lesopolesii/65149110/> [in Russian].
19. Russian agrarian portal. Forest shelter belts have become ineffective. (n. d.). Retrieved from <https://agroportal-ziz.ru/articles/polezashchitnye-lesnye-polosy-stali-neeffektivny> [in Russian].
20. Paramonov, E. G., & Zanosova, V. I. (2007). Influence of groundwater depth on the growth of forest belts in steppe conditions. *Vestnik AGAU [Vestnik ASAU]*, 6(32), 18–24 [in Russian].
21. Paramonov, E. G. (2014). The current state of soil-protective afforestation in the Altai Region. *Stepnoi byulleten' [Steppe Bulletin]*, 40, 34–39 [in Russian].
22. Impact of thinning of forest belts on species diversity and physical parameters of the environment(n. d.). Retrieved from https://docs.yandex.ru/docs/view?tm=1636553121&tld=ru&lang=ru&name=vlijanie_rubok_ukhoda_lesopolos.pdf&text [in Russian].
23. Resolution of the Altai Territory Administration of April 27, 2009 No. 188 (ed.ofJanuary 21, 2019). On approval of the list of public roads of regional or intermunicipal importance. Retrieved from <https://www.altdor.ru/dokumenty/postanovlenie-pravitelstva-altajskogo-kraya-8-ot-21-01-2019-ob-utverzhdenii-perechnya-avtomobilnyx-dorog-obshhego-polzovaniya-regionalnogo-ili-mezhmunicipalnogo-znacheniya.html> [in Russian].
24. Official site of the Altai Territory. In the Mikhailovsky district of the Altai Territory, the planting of shelterbelts began (n. d.). Retrieved from https://www.altairegion22.ru/region_news/e192335.html [in Russian].
25. Official site of the KGBU Agricultural Consulting Center».The Gorizont farm in the Mikhailovsky District continues to plant shelterbelts (n. d.). Retrieved from http://csh.sibagro.ru/news/v_hozjaystve_gorizont_mih/ [in Russian].
26. Ecology, forest and soil. Cultivation of forest plantations. (n. d.). Retrieved from <http://eko-forest.ru/vyrashhivanie-lesnyx-nasazhdenij/> [in Russian].
27. Suchkov, D. K. (2019)Technology of cultivation of protective forest strips in dry-steppe and semi-desert zones. *Nauchno-agronomiceskii zhurnal [Scientific Agronomy Journal]*, 3(106), 7–10 [in Russian].
28. Departmental Building Standards of the Ministry of Highways of the RSFSR of 2006. Technical rules for repair and maintenance of roads. DBS 24-88, 237 p.
29. Methodical recommendations for the protection and cleaning of roads from snowof the Federal Road Agency of 2008. IRM 218.5.001-2008, 80 p

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