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## The possibility of using spectrographic data to assess soils fertility

Sirotkin V., Vasyukov S., Usmanov B.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

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### Abstract

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### Keywords

Erosion, Soil fertility, Spectrographic analysis, Zonal soils

### References

- [1] Idowu O.J., van Es H.M., Abawi G.S., Wolfe D.W., Ball J.I., Gugino B.K., Moebius B.N., Schindelbeck, R.R., Bilgili, A.V., Farmer-oriented assessment of soil quality using field, laboratory, and VNIR spectroscopy methods, *Plant and Soil*, vol. 307/issue 1, pp 243-253, 2008.
- [2] Usmanov B., Yermolaev O., Gafurov A., Estimates of slope erosion intensity utilizing terrestrial laser scanning, *Sediment Dynamics: From the Summit to the Sea*, IAHS Publication, vol. 367, pp 59-65, 2014.
- [3] Cécillon L., Barthès B.G., Gomez C., Ertlen D., Genot V., Hedde M., Stevens A., Brun J.J., Assessment and monitoring of soil quality using near infrared reflectance spectroscopy (NIRS), *European Journal of Soil Science*, Wiley, vol. 60/issue 5, pp 770-784, 2009.
- [4] Rossel R.A.V., Walvoort D.J.J., McBratney A.B., Janik L.J., Skjemstad J.O., Visible, near infrared, mid infrared or combined diffuse reflectance spectroscopy for simultaneous assessment of various soil properties, *Geoderma*, vol. 131/issue 1, pp 59-75, 2006.
- [5] Borenstein A., Linker R., Shmulevich I., Shaviv A., Determination of soil nitrate and water content using attenuated total reflectance spectroscopy, *Applied Spectroscopy*, vol. 60/number 11, pp 1267-1272, 2006.
- [6] Jahn B. R., Linker R., Upadhyaya S.K., Shaviv A., Slaughter D.C., Shmulevich I., Mid-infrared spectroscopic determination of soil nitrate content, *Biosystems Engineering*, vol. 94/issue 4, pp 505-515, 2006.

- [7] Bertrand I., Janik L.J., Holloway R.E., Armstrong R.D., McLaughlin M.J., The rapid assessment of concentrations and solid phase associations of macro- and micronutrients in alkaline soils by mid-infrared diffuse reflectance spectroscopy, *Australian Journal of Soil Research*, vol. 40/issue 8, pp 1339-1356, 2002.
- [8] McCarty G.W., Reeves J.B., Comparison of NFAR infrared and mid infrared diffuse reflectance spectroscopy for field-scale measurement of soil fertility parameters, *Soil Science*, vol. 171/issue 2, pp 94-102, 2006.
- [9] Reeves J.B., Smith D.B., The potential of mid- and near-infrared diffuse reflectance spectroscopy for determining major- and trace-element concentrations in soils from a geochemical survey of North America, *Applied Geochemistry*, vol. 24/issue 8, pp 1472-1481, 2009.
- [10] Janik L.J., Forrester S.T., Rawson A., The prediction of soil chemical and physical properties from mid-infrared spectroscopy and combined partial least-squares regression and neural networks (PLS-NN) analysis, *Chemometrics and Intelligent Laboratory Systems*, vol. 97/issue 2, pp 179-188, 2009.
- [11] Du C.W., Zhou J.M., Wang H.Y., Chen X.Q., Zhu A.N., Zhang J.B., Determination of soil properties using Fourier transform mid-infrared photoacoustic spectroscopy, *Vibrational Spectroscopy*, vol. 49/issue 1, pp 32-37, 2009.
- [12] Canasveras J.C., Barron V., del Campillo M.C., Torrent J., Gomez J.A., Estimation of aggregate stability indices in Mediterranean soils by diffuse reflectance spectroscopy, *Geoderma*, vol. 158/issue 1-2, pp 78-84, 2010.
- [13] Sirotkin V., Vasyukov S., Usmanov B., Spectrographic characteristics of Chuvash Republic zonal soils with different erosion degrees, *Water resources, forest, marine and ocean ecosystems, 16th International Multidisciplinary Scientific Geoconference SGEM 2016 proceedings, book 3/ vol II*, pp 357-362, 2016.
- [14] Vasyukov S., Sirotkin V., An aerodynamic approach in soil hydraulic conductivity estimation for investigating soil erosion degree, *Sediment Dynamics: From the Summit to the Sea, IAHS Publication*, vol. 367, pp 66-71, 2014.
- [15] Government Decree № 612, Concerning approval of criteria of essential decrease of agricultural lands fertility, 22.07.2011.