Geophysical Research Abstracts
Vol. 20, EGU2018-3753-1, 2018
EGU General Assembly 2018

Using dynamic soil fertility model for analysis of agricultural ecosystems resilience

Nadezda Vasilyeva (1) and Artem Vladimirov (1,2)

(1) Dokuchaev Soil Science Institute, Interdisciplinary laboratory for mathematical modeling of soil systems, Moscow, Russian Federation (nadezda.vasilyeva@gmail.com), (2) Joint Institute for Nuclear Research, Dubna, Russian Federation (artem.a.vladimirov@gmail.com)

Soil fertility is estimated by its productivity after taking into account differences in weather and management factors: correction is based on difference in morphometric parameters of agricultural fields, fertilizers and other land treatments. Further, soil fertility is compared between the fields as a function of only physical, chemical and biological factors. Data on fields productivity allow to reveal effects of soil factors on the soil fertility function. The fields are grouped by their limiting fertility factor using a neural network.

We use the dynamic soil fertility modeling approach to assess agricultural ecosystems resilience. The model is comprised of integrated detailed physical and biological parts, that gives dynamics soil fertility factors. Model input is comprised of standard agrochemical and agrophysical laboratory monitoring data and additional frequent field monitoring data from moisture, temperature sensors and profiles of soil resistance to penetration.

Multi-dimensional dynamics of soil fertility factors gives a manifold of fertility factor increment relative rate as a function of all fertility factors. It is further analyzed for sets of equilibrium points and their stability.
Level of agricultural loading defines a plane section of this manifold allowing regulation of the position and type of stability of equilibrium points.

The model results allow to get insights into:
1. direction of changes in soil fertility; obtaining ranges of fertility factors in which soil fertility is growing or declining at a given agricultural loading; when a change in loading for a certain field is required to avoid regime shift
2. ordering the fields in priority for amelioration, agrotechnical, anti-erosion measures, exclusion from a crop rotation for recovery and reasonability of its duration
3. study of early warning signals of soil fertility collapse.

This work is supported by NordForsk, project #81513 (TerMARisk)