for SNNM by interacting with other factors. Conclusions PaD Sensitivity Analysis of LS-SVM was a stable and reliable data mining method. In the SNNM model, initial nitrogen, time, precipitation and relative humidity were main control factors of SNNM model. Biochar did not directly influence SNNM, however it could greatly enhance the tendency for SNNM by interactions with other factors by decreasing the inhibitory effect of initial nitrogen on SNNM and modifying soil condition to change the effect of other factors on SNNM.

Keywords: Artificial intelligence; Biochar; Model; Partial derivatives sensitivity analysis; Soil nitrogen
Financial support:

(4784 - 2069) Machine learning applied to the mapping of mountain coffe from terrain atribute.

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The state of Minas Gerais is the main producer of coffee in the country, responsible for much of the national production. Because of the importance of coffee, we had intended to work with this map the Mountain coffee from the spectral data and terrain attributes. For the study were developed methodologies of classification of coffee areas in three municipalities of the state of Minas Gerais. The database consisted of 59 variables, including a Sentinel 2A image, vegetation indexes and attributes derived from the ALOS / Palsar digital elevation model (MDE). The sample set was separated in training and validation in the proportion 0,90: 0,10. In order to reduce the dimensionality of the model, the Recursive Feature Elimination variable selection method was applied to the data. Two areas had their crops validated in a high resolution image. The selected variables were submitted to the Random Forest (RF), Stochastic Gradient Boosting (GBM), Logistic Model Tree (LMT) and CTREE algorithms, where the performance evaluation of each classifier was performed. The most important variables for the classification of mountain coffee were the NDVI index, band 12, band 2, band 8 and MDE with 0.86 correlation. The CTREE and LMT were not satisfactory for classification of coffee areas in mountainous terrains, not being able to separate coffee from other tree coverings such as forest and eucalyptus areas, with great confusion among these classes. The GBM and RF algorithms had a Kappa index of 0.86 and 0.88, with the accuracy of the user and producer with values above 0.90 for the entire area with the insertion of the terrain attributes. In the validation area I, the user accuracy was 0.66 for RF and GBM and in area II, the user accuracy was 0.79 and 0.81. The area II presents a diversity of coverings with spectral patterns similar to coffee larger than area I and the busiest relief, and the RF and GBM algorithms were efficient in separating the coffee areas from the others. Both GBM and RF are good classification algorithms for coffee areas in mountainous relief.

Keywords: machine learning; coffe classification, classification
Financial support: Fapemig

(5217 - 1736) Modeling Evapotranspiration and Crop Growth of Irrigated and Non-irrigated Corn under Warm Climate

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Accurate quantification and management of crop evapotranspiration (ET) are critical to optimizing crop water productivity for both dryland and irrigated agriculture, especially in the semiarid regions of the world. In this study, four weighing lysimeters were planted to maize in 1994 with two fully irrigated and two non-irrigated for measuring crop ET in Bushland, Texas. The two fully irrigated lysimeters were used for calibrating the Root Zone Water Quality Model (RZWQM2) and the non-irrigated ones were reserved for model evaluation, in terms of leaf area index, biomass, soil water contents, and daily ET. The Nimah-Hanks approach in RZWQM2 was used for calculating actual crop water update (AT), and the Richards' equation was used for actual soil evaporation (AE). The Shuttleworth and Wallace method (S-W) and ASCE Standardized alfalfa Reference ET plus crop coefficients (ASCE) were used to calculate potential ET (PET), which were partitioned into potential evaporation (PE) and potential transpiration (PT) based on leaf area index. As a result, four water stress factors were tested in the model against the lysimeter data, i.e., AT/SW-PT, AT/ASCE-PT, (AT+AE)/SW-PET, and (AT+AE)/ASCE-PET. Root Mean Squared Deviations (RMSDs) and relative RMSDs (RMSD/observed mean) values for leaf area index, biomass, soil water contents, and daily ET were within simulation errors reported earlier in the literature. For the two non-irrigated lysimeters, the simulated daily ET values were also reasonably close to the measured values, but were under-estimated during mid-growth stage. In general, water stress factor defined by (AT+AE)/SW-PET was better than other stress factors in simulations of non-irrigated corn biomass and grain yield. Additional studies of crops grown under dryland conditions using weighing lysimeters are needed to corroborate these findings and aid in the development of new water stress algorithms.

Keywords: RZWQM, ET, Yield, Leaf Area Index, Lysimeter
Financial support:

(2738 - 908) Modeling for fertilization and liming for sugarcane in low fertility soils

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Currently fertilizers recommendation for the sugar cane culture in Brazil are based on growth curves, obtained from the relationship between fertilizer rates and yield increment. Predictive recommendation systems are desirable and of wider application. This work was carried out aiming to structure and develop a System to estimate the nutritional balance and recommend lime and fertilizers to sugar cane plants (SBNR-C) based on the nutritional demand (ND) and expected yield (EY). The input information required by the System is the expected yield and the nutrient use efficiency (NUE). The nutrient demand is estimated dividing EY by NUE. Specifically for P, S and Zn, besides the EY and NUE values, the System requires information related to soil's buffer capacity. This way, the System estimates the critical level for each nutrient for the EY and compares this value with the nutrient availabilit y in the soil, indicating the need or not for lime and, or, fertilizer application. The recommended fertilizer rate may be multiplied by a factor that increases the amount of nutrient added in order to avoid soil nutrient depletion and to assure yield sustainability. The proposed model for lime recommendation showed itself consistent for being possible variable recommendations depending on the EY, allowing a wider inter-relationship with the plant-soil system and estimating the final pH value for any lime dose. The estimate of the critical level and K doses for ratoon were coherent with the nutrient recommendation for sugar cane plants and ratoon, specially for the last cultivation since it's not contemplated in any recommendation tables in Brazil. The estimate of the residual effect of P in first and second ratoon was consistent, allowing to infer that shorter cultivation periods, for example with early cultivars, results in more pronounced residual effects. The adjustment of a predictive model for quantification of the mineralizable N in Sugar

cane plants, first and second ratoon, using organic matter and clay content in the soil allowed the th estimation of this nutrient's necessity. The simulations for Zn, B and Cu resulted in compatible critical values when compared with critical levels in the literature. The little information existing for Fe and Mn didn't allow the complete modeling for these elements. The SBNR-C represents na efficient tool for the recommendation of lime and fertilizers for sugar cane plants.

Keywords: soil fertility modeling, efficient use, sugarcane nutrition
Financial support: UFRPE / EMBRAPA.

(2559 - 1706) Modelling soil respiration and net ecosystem exchange in agrolandscapes

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The goal of the research was to evaluate the possibilities and quality of different modelling approaches to estimate major CO_2 fluxes in agroecosystems. The regression method and simulation biogeochemical model DNDC (DeNitrification-DeComposition) were applied to the following field objects and data sets: (a) soil respiration (SR) of the arable Haplic Chernozem under crop rotation in Kursk region, Russia, 51°54'N, 36°10'E, 2017; (b) SR of the arable Luvic Phaeozems under unfertilized cereal-fallow rotation in Moscow region, Russia, 54°49'N, 37°34'E, 1997-2009 (field data by I.N. Kurganova, Institute of Physical-chemical and Biological problems of Soil science RAS); (c) net ecosystem exchange (NEE) of semidesert sagebrush pasture in Uzbekistan, 39°40'N, 65°46'E, 1998-2001 (field data by M.G. Nasirov, Samarkand State University). The quality of modelling was estimated by use of Nash and Thail coefficients, and ANOVA. In Kursk region mean seasonal (April - October) SR was equal to 0.138 ± 0.068 (barley), 0.143 ± 0.075 (potato), 0.146 ± 0.095 (sunflower), 0.173 ± 0.114 (winter wheat) g C m^{-2} h^{-1}. Measured and modelled estimates don't differ significantly; for all crops Thail coefficients were less than 0.30 (good quality). DNDC predicts that during the next 50 years SR will increase by 19 (potato) – 50 (wheat) kg C ha^{-1} yr^{-1}, if the CO_2 concentration in the atmosphere will follow the current trend (+3 ppm/yr). In Moscow region the observed mean SR was equal to 0.038 ± 0.046 (fallow) and 0.050 ± 0.048 g C m^{-2} h^{-1} (winter wheat), whereas the corresponding modelled estimates were 0.040 ± 0.033 and 0.035 ± 0.031 g C m^{-2} h^{-1}, respectively. The modelling was particularly effective for fallow: Nash coefficients were higher than 0.50. Proportion between root and microbial respiration was estimated by DNDC at 33.2/66.8%, accordingly. Regression modeling based on shallow soil temperature and moisture explains 31-41% of soil respiration variance. In Uzbekistan experimental site NEE was estimated at +0.129 ± 0.046 g C m^{-2} h^{-1} (source of carbon to the atmosphere). The results of DNDC also prove this region to be the annual net source of CO_2. Intensity of NEE was correlated to air temperature and heat flux, whereas it was negatively correlated to relative humidity and amount of precipitation. These controls were able to change the sigh of the net CO_2 flux from source to sink in a short time. Nevertheless only 16% of net CO_2 flux variation was due to weather conditions.

Keywords: soil respiration, CO_2 emission, simulation modelling, agrolandscapes
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(4297 - 273) Redox potential and nitrous oxide emissions in response to flood irrigation with waste water in central Mexico

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Irrigation with untreated sewage water is becoming a common practice in the arid and semiarid regions around the world. Waste water adds labile carbon and nitrogen compounds to the soil, and when applied by flooding it rapidly changes the redox potential and soil's atmosphere, as consequence of temporarily waterlogged and depleted oxygen, generating nitrous oxide (N_2O) emissions. We monitored the redox potential, E_h, in the soil and the nitrous oxide emissions at two sites in the Mezquital Valley to discover whether the short-term gas emissions matched the changes in *E*h. One site is irrigated periodically by flooding with waste water and has alfalfa, rye grass and maize grown in succession; the other site grows rain-fed maize only in summer. At each site we buried platinum electrodes at different depths in the soil and around them, on the surface, we installed static chambers to measured the N_2O emissions simultaneously. Measurements were made all along 21 months considering the time before, during and after each irrigation event. We also measured both variables in the rain-fed maize before and shortly after two rain events. The data from repeated measurements from the same chambers and electrodes were correlated in time, so we modelled the correlation and took it into account to analyse the effects of the irrigation by residual maximum likelihood (REML). After each flooding, the redox potential under alfalfa and rye grass decreased by 150–200mV from a norm of about 450mV for 2 days, after which it returned to its norm. The short-term response to flooding under maize was similar, but the redox potential did not recover completely; instead there was a decrease from one irrigation event to another, in particular as a result of heavy rain in September that saturated the soil. The soil under rain-fed maize was slower to respond, partly, we believe, because infiltration into the less aggregated clay soil and drainage from it were also slow. Irrigation with untreated sewage water caused a sharp decrease in E_h lasting 1–2 days. The emissions of N_2O increased dramatically during the next few days after irrigation and then declined. It seems to be related with the water infiltration that replace the gas from air-filled pores and with the soil oxygen depletion, causing reduction in microhabitats rich in carbon and nitrogen and generating N_2O, which was captured in the closed chambers that we had installed.

Keywords: Redox potential, Nitrous oxide, REML, Waste water irrigation.
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(2119 - 1064) Simulating the effects of soil heterogeneity on grazing management strategies in semi-arid rangelands of the western North American Great Plains

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Aspirational management strategies for semi-arid rangelands in the western North American Great Plains are needed to collectively sustain livestock production, improve profitability for ranchers, reduce adverse environmental impacts, and enhance vegetation structure and composition heterogeneity for wildlife habitat, all of which will occur under a changing climate. We compared traditional grazing management (TGM, mid-May to October grazing at moderate stocking rate with low stocking density and cattle remaining in the same pasture for the full grazing season) to an adaptive grazing management (AGM, at ten-fold higher stocking density but grazing pastures for short periods – weeks – and rotated among 10 pastures) strategy using the APEX model. Primary emphasis here was to simulate effects of soil heterogeneity on grazing management. 5 years (2013-2017) of