Far Eastern Federal University
Botanical Garden-Institute FEB RAS

ABSTRACTS

of the conference "Climate Change Constraints and Opportunities in the Asia-Pacific Region: Human-Biosphere-Atmosphere Interactions and Green Growth"

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Soil CO_2 emission and organic C dynamics in the lawn constructed soils at the RTSAU field experiment

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One of principal soil environmental functions is regulation of greenhouse gases fluxes in the terrestrial ecosystems where 60-80 % of CO_2 emission usually have soil origin. This soil function is especially crucial in case of urban lawn ecosystems with increased dynamics and spatial variability of soil organic C and CO_2 fluxes. We analyzed them in the key objects of 5-year (2012-2017) field container experiment with different composition and construction of the man-made lawn topsoil, developed in the Field Experimental Station of the Russian Timiryazev State Agrarian University. Maximum CO_2 emissions have been observed in the versions with 20-cm peat horizons in the first year of monitoring (up to 7.7 kg/m^2 of CO_2). After 2 years of field experiment the lawn topsoil versions with original peat horizons lost up to 70.9 % of the primary organic C with close correlation between soil CO_2 fluxes seasonal dynamics and soil temperature (R^2 up to 0,89) and/or soil moisture (R^2 up to 0,82). After 3 years of experiment there is observed more or less gradual stabilization of the organic C stocks – with maintenance of statistically significant differentiation in C content, grass productivity and bulk density between originally contrast versions of the experiment. At the fifth year of the field experiment higher values of grass productivity are usually well correlated with topsoil better quality and more intensive biogeochemical cycles of C evaluated by soil CO_2 fluxes. Comparative analysis of the principal soil environmental functions in the field container experiment showed best results for the man-made lawn soils with 10-cm and 5-cm peat-sandy horizons. Additional investigations need to evaluate the real possibility of sustainable lawn soil development based on 5-cm layer of peat compounded with sand or sandy loam.

Regional climate changes and marine biodiversity in the Sea of Japan/East Sea

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Meteorological observations show that the average surface water temperature of the Sea of Japan/East Sea has increased over the past 30 years by more than 1°C; this is the highest value for the indicator over all the seas of the Russian Federation under conditions of pronounced climatic changes on the planet. Among the economic and environmental problems of our region related to these events, we can note changes in the fishing potential of some water areas; a significant growth of biological invasions, including invasions of harmful species (producers of toxins, foulings of hydrotechnical construction, etc.); and the need to strengthen the control and to ensure toxicological safety of marine areas and products of marine origin. Climatic changes lead to an increase in the dynamics of coastal marine ecosystems and marine biological diversity. So, for example, of the 316 fish species recorded in the Peter the Great Bay, 110 species are so-called southern migrants – they visit our waters only in the warm season; about 20 % of them were recorded in the water area during the last 20 years. Presently, about 70 invader species have been identified in the Far Eastern seas of Russia, which have already passed the stages of acclimatization and naturalization and have become a part of the local coastal ecosystems. About 60 of these species are found in the area of the Peter the Great Bay, of which 35 invader species have been identified in the Far Eastern Marine Reserve. Among the introduced species found in the bay, 17 are foulings of hydrotechnical structures.

Cutting-edge computational research to investigate and address the climate change challenge

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Modelling the climate system is a big challenge, requiring the simulation of several interacting and complex processes, as well as their analysis at different time and spatial scales. Climate system modelling also requires sophisticated numerical models, due to the inherently non-linear governing equations and huge computational resources are needed to solve billions of individual equations describing the physical processes at different scales. Moreover, one of the main issues in climate science is the quantification of uncertainty and its reduction. This requires increases in model resolution and large-scale ensemble runs to generate accurate statistical information. Access to large computational capabilities for climate modelling is then required to meet the need for higher spatial and temporal resolution, better physical process representation, explicit modelling of more biogeochemical processes, much longer runs and larger ensembles. Clearly, as the resolution increases, extreme data issues also arise, since a larger amount of data needs to be managed at and moved across the different memory hierarchy levels of the computing system. However, the climate modelling community is struggling to exploit the current generation of computing systems efficiently, as most of the climate codes have not been designed to efficiently use the available cores, which are already heading towards tens and hundreds of thousands. Indeed, the achieved efficiencies are currently well below 10% of peak performance for most climate codes. The situation is likely to get worse over the next years, as the memory per core and memory bandwidth per core fall causing inter-processor communication overheads to increase even further. It seems clear that to contend with the challenges posed by current and expected architectures, many of the algorithms and numeric approaches currently in use need re-designing. A co-design approach, involving mathematicians, climate and computational scientists and technology providers, is required to solve these scientific and computational grand challenges.

Soil greenhouse gas fluxes of natural and artificial land cover types within the FEFU campus area on Russky Island (Vladivostok, Russia)

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The commitment to reduce greenhouse gas (GHG) emissions to the atmosphere is currently a priority in the global environmental policy agenda. Gaining knowledge on the effect of land management over land–atmosphere GHG fluxes and individuating the most suitable strategies for the preservation of existing carbon pools in managed ecosystems is therefore of utmost importance. In this respect studies about GHG fluxes over urbanized areas are still a minority despite the plethora of existing initiatives aiming at helping society to reach carbon neutrality. Here we present the first step towards the assessment of the GHG budget of the campus area of the Far Eastern Federal University, focusing on biogenic fluxes of CO_2 and CH_4 from soils. Soil fluxes were monitored since spring 2017 through replicated measurements over five different land cover/management types including both pre-existing and transformed areas within the campus territory of the FEFU (natural forest, natural meadow, artificial pond, urban forest park, artificial meadow). Laser spectroscopy based measurements were carried out with a state of the art portable analyzer and a chamber set-up allowing mean uncertainty levels of 0.7 % (std.err.) on CO_2 fluxes computation and 2 % on CH_4 fluxes, the latter conditional to fluxes larger than 0.5 nmolCH_4 m^{-2} s^{-1}. Meadow soils showed the largest CO_2 emission rates, with maximum values up to 7–8 µmolCO_2 m^{-2} s^{-1}, partly due to systematically warmer soil conditions. Soil temperature was indeed found the most important driver of soil respiration and together with soil organic carbon pools and fine root biomass best explained the observed spatial and temporal variability (R^2=0.67). A temperature independent comparison of soil respiration fluxes determined the meadows and ponds as the highest and lowest CO_2 emitters, although soil CO_2 fluxes in the natural forest exhibited a larger temperature sensitivity (Q10=2.29 – natural forest; 1.48 – natural meadow; 1.61 – pond). Methanotrophic activity in soils was observed widely and it was most intense in the natural forest, generating fluxes up to -1.7 nmol CH_4 m^{-2} s^{-1}, twofold larger than in the natural meadow. Significant methane emissions (0.5 nmol CH_4 m^{-2} s^{-1}) were observed only along the pond banks after the start of the summer monsoon.

Climate change impacts on tourism in Europe and research ideas for the Russian Far East

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We draw upon recent assessments of the vulnerabilities in the EU to highlight the main categories of impacts that can be expected for tourist activities in the boreal temperate regions. We discuss the main approaches to gauge climate change impacts on tourism and we pinpoint the relevance of differences across regions and types of tourist activities. In the coming decades , tourists will increasingly find that the most favorable climatic conditions for their summer holidays will shift northwards in Europe due to climate change. The attractiveness in northern and central Europe for such holidays is projected to increase in most seasons. Conversely the suitability of climatic conditions for tourism in southern Europe will decline strongly during the key summer months, although they are expected to improve in other seasons. For winter mountain tourism, the dependence of the majority of destinations from the availability of snow for winter sports, and the projected increase in the altitude at which snow cover will still be present, will imply severe consequences for the viability of tourist activities, particularly on the southern Alpine slopes. The projected climatic changes are expected to shift the major flows of tourism in Europe and can have substantial consequences for regions where tourism is an important economic sector. The magnitude of the economic impacts depends from non-climatic factors, such as the ability of tourists to adjust the timing of their holidays. We highlight and discuss and the main adaptation options that tourists and tourism operators can put in place in order to cope with changing climate conditions. We conclude by building upon the lessons leant in Europe to suggest possible research topics in this field that can be of relevance for the Far East Russian region.

Macroeconomic implications of climate change: challenges, methodologies and latest findings

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Determining the impact of climate change on the economic performances of the global economic system, countries and regions remains one of the more challenging and controversial issues within the economic discipline. Two broad approaches are used to provide these macro-economic assessments. The first is based on the use of integrated assessment models IAMs, the second on econometric techniques. IAMs aim to represent as comprehensively as possible the interactions between climate, environmental and social economic systems. Two approaches to integration are available. In the first (hard link), the causal chain from climate drivers to the socio-economic impacts is described by linking simplified climate and economic modules in the same mathematical structure. In the second (soft link), climate, process-based, and macroeconomic models are chained sequentially in an output-input-output flow. The two methodologies are very different, however they produce results roughly comparable. Summarizing: damages are increasing in temperature with usually a quadratic trend; for temperature increases below 2°C, the net loss at the world level is moderate (reaching at the maximum the 2 % of GDP) or even slightly negative. It becomes unambiguously negative for higher temperature levels. However, the range of estimates remains large, spanning from the 5 % to the 20 % of GDP. Differently, econometric approaches analyze historical data to identify and estimate the relationship between impact endpoint indicators and observed changes in climate or weather. These econometrically estimated relationships can then be combined with future projections of climate variables from climate models to evaluate the potential economic implications of future climatic conditions. The "traditional" investigations of the relation between climate change and agriculture or energy demand, have been flanked by analysis of climate change determinants on health and labour productivity, migration, conflict and GDP. Econometric estimates of macroeconomic impact of climate change agree with IAMs on their uneven distribution and non-linear pattern. However actual estimates point to much greater impacts (see as an example the roughly 20 % of global GDP loss by Burke et al (2015) also for the "low" temperature increase of 2°C). Being based on historical records, econometric models may capture more realistically the role of adaptation, and of major climate shocks that economic models and IAMs.

Anti-erosion properties of carbonate soils in the climatic conditions of the Primorsky region

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The territory of the Primorsky region is a specific transit zone from continent to ocean. Therefore, the soils of this territory are intensely susceptible to the influence of the monsoon climate and erosive processes begin to occur in them, which negatively affect the soil cover. In these case it is very important to study the anti-erosion properties of soils. The soil catena "Golubinogrskaya" was laid within the Golubinogorsk limestone deposit. The first component of the catena: cambisoil (burozem) are residual-carbonate extremely small, the incision is laid on top of the hill. The second component of the catena: cambisoil remnants of residual-carbonate small, slightly skeletal, the incision is located in the lower part of the southern slope of the hill. To determine the anti-erosion properties of the studied soils, the results of granulometric and microaggregate analyzes were obtained, which showed that the first component of the catena is characterized throughout the profile as loams of light coarse dusty-sandy soil, and the soils of the 2nd component of the catena are represented by loam light sandy-coarse silty dark humus horizon with its weighting up to loam of heavy sandy-silty. Based on the results of granulometric and microaggregate analyzes, the structure of the soil profile was assessed. In the first component of the catena, the water-resistant structure of all horizons was identified (up to 9). The ability of soils to be structured was assessed as insignificant (up to 18). Also, the profile is characterized by low microaggregation and very low (0.1 to 1.5) anti-erosion resistance. The soils of the second component of the catena have a low capacity for structuring (up to 27) nd a sufficiently water-resistant structure and low erosion resistance (from 1.0 to 2.1). Studies have shown that soils of naturally technogenic catena of the Primorsky region that are susceptible to monsoon climate influence have low erosion resistance.

The interaction of plant derived charcoal with biogeochemical cycles in natural and agricultural ecosystems

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Charcoal is a product generated by the combustion of plant material at high temperatures in limited conditions of oxygenation. Production of charcoal might occur in natural ecosystems following strong fires or is accomplished via pyrolysis to produce the so-called biochar, which has been proposed as an agricultural amendment. The impact of the char molecule on biogeochemical cycles and in particular on C and N cycles is strongly dependant on the ecosystem, as it can either stimulate or reduce nutrient losses and GHG emissions. Fire-charcoal interactions of the plant-soil system in boreal forests might have a significant acceleration effect on organic matter decomposition and subsequent mineral and gaseous losses, due not only the direct effect of fire but also to the chemical properties of charcoal, which can interact with phenolic compounds which contribute to tight the C and N cycle in boreal ecosystems. On the other hand, biochar application in agriculture might significantly improve several soil characteristics leading to a reduction in GHG emissions, increased retention of nutrients and lower C footprint of the agroproducts. The overall impact on agroecosystems depends on many factors, including biochar material, soil characteristics, redox conditions, climatic parameters. Biochar application has been demonstrated to improve soil conditions for microbial and plant growth in water limited ecosystems, however, biochar might also prove an interesting amendment in water saturated and poorly oxygenated soils like those occurring under boreal climate, although more research is needed to test this hypothesis.

Habitat, distribution and prospects for the use of *Heracleum moellendorffii*

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The medicinal plant species have been thoroughly studied in the Far East. But some questions of resource characteristics, biochemical composition and the possibility of using of the medicinal plants remained unclear. This study focuses at *Heracleum moellendorffii*, a perennial polycarpic megaforb plant, representative of native flora of the Russian Far East. In the native habitats *H. moellendorffii* grows mostly in the forest clearings, at forest edges, among shrubs and in tall grasses (mixed herbs) within herb layer. Its natural distribution area covers Transbaikalia, Northeast China, Korea and Japan and the southern part of the Russian Far East. *H. moellendorffii* has long been used as a medicinal plant by the indigenous inhabitants of Primorye and the Amur region. In traditional medicine, the roots of plants are used for treatment both gastrointestinal (colitis, gastritis) and skin diseases. The valuable properties of *H. moellendorffii* are determined by the presence of biologically active substances, flavonoids, coumarinic compounds as well as essential oils, which possess useful pharmacological qualities in the plant. As reported by some authors, *H. moellendorffii*, unlike the other representatives of the genus *Heracleum*, does not have a toxic effect. The toxicity of *H. moellendorffii* was LD50 = 1.83 ml / 20 g for a mouse. When determining the percentage in the extract it was stated that the prevailing furocoumarins of *H. moellendorffii* were detected in such proportions: bergapten - 32.5%, xantotoxin - 25.3% and angelicin - 19.3%. Bergapten and xanthotoxin in the official medicine are used as a drug that increases the sensitivity of the skin to light irradiation and stimulates the formation of the pigment of melanin in it, which contributes to the restoration of skin pigmentation in a number of skin diseases (vitiligo, alimentary and total alopecia, mushroom mycosis, psoriasis). Thus, Heracleum moellendorffii deserves the official status of medicinal plant.

Radiocarbon measurements as a realiable tool to determine soil heterotrophic respiration

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The amount of soil organic carbon (SOC) released into the atmosphere as carbon dioxide (CO_2), which is referred to as heterotrophic respiration (Rh), is technically difficult to measure despite its necessity to the understanding of how to protect and increase SOC stocks. In recent decades, new techniques have been developed to better investigate the nature and turnover time (TT) of SOC. In particular, tracing radiocarbon (^{14}C) throughout terrestrial ecosystems has emerged as a viable tool for discriminating the Rh component of soil respiration (SR). In this work, two approaches were used to estimate the contribution of different C pools to SR. In the first approach, the variations in ^{14}C content of SR were monitored during one year and compared to the atmospheric and SOC ^{14}C signatures to determine the contribution of "fast" (root respiration and fast decomposing SOC) and "slow" cycling C pools to total SR. In the second approach an estimate of the total Rh, comprising the slow cycling C and the heterotrophic part of the fast-cycling C pools, was derived applying a box model based on the amount of the SOC pool and its ^{14}C-derived TT. Following the ^{14}C variation in SR from the former approach, allowed to determine that on an annual basis the fast-cycling C was the main contributor to SR, about 85 %, while the contribution of the slow-cycling C (with TT >1 yr) to total SR was 15 %. The second approach indicated that there were non significant differences between the Rh we determined and the Rh derived using independent measurements, suggesting the suitability of our methodology to infer Rh. In conclusion, radiocarbon analysis of SOC and its fractions provided a reliable estimate of the average annual amount of SOC released into the atmosphere; hence, its application is convenient for calculating Rh because it utilizes only a minimum amount of samples and no time-consuming monitoring activities.

Vegetation recovery at Arctic disturbed permafrost

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A ten-year study for vegetation recovery at disturbed Pleistocene loess-rich permafrost of Ice Complex in three stream goldfields of the Kolyma Lowland, Eastern Arctic has been carried out. The observations of mining removed deposits gave a possibility to study in more detail the succession recovery for disturbed and thawing permafrost. In the year of the disturbance and the first season after – thawing ground is covered with pioneer species of mosses (dominated by *Funaria hydrometrica*) and single shoots of *Tephroseris palustris*. Second year – *T. palustris* is dominated by seedling emergence of *Arctagrostis latifolia* at dry grounds and single shoots of *Tripleurospermum hookeri* and *Salix* sp. (not all sites). 3 years – expansion of *T. hookeri* and *A. latifolia* and emergence of shoots of *Chamaenerion angustifolium* and of *Calamagrostis purpurascens*. Pioneer moss species have almost disappeared. 4 years – continued expansion and co-domination of *T. hookeri* and *C. angustifolium* with *C. purpurascens* and less *A. latifolia*. *Salix* species shoots expanded. Almost pure meadows of these herbs dominate especially on the valley sides with additional moisture. The more years that have passed since the disturbance, the more so, the vegetation restoration is developing along different trajectories. After 4–5 years on the disturbed sediments meadows of *Calamagrostis purpurascens* with *A. latifolia* and *Salix pulchra*, *S. alaxensis* and other *Salix* species developed at the southern valley sides of streams. Abundance of willow grows and suppresses herbs after 6–7 years. Appearance of dwarf shrubs and single *Larix cajanderi* shoots occurs at 8–9 year. Vegetation recovery significantly reduces the carbon flux input from disturbed permafrost beginning with 2–3 years after the disturbance.

The organic matter and movable biophilic mineral elements of high-latitude steppes soils

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High-latitude steppes (HLS) were widespread and had zonal ecosystem status in the Pleistocene. Similar steppes were represented the vast part of the Beringia tundra-steppes. Now the steppe patches survive on steep slopes under southern aspects. Nevertheless they serve as unique information sources about the Beringia "mammoth" steppes. A three-year study for total (TOC) and dissolved organic carbon (DOC), dissolved total nitrogen (TN), soluble reactive phosphate (SRP) in two types of HLS soils of the Kolyma Lowland, Eastern Arctic has been carry out. They are presented petrophytic steppes (PS, more 65 vascular species) which were formed on rock weathering crust and thermophytic steppes (TS, more 35 species) formed on Pleistocene loss-rich sediment of Ice Complex. Hydrothermal and physicochemical soils properties strongly differ from soil properties of a zonal taiga and tundra. HLS soils have about neutral pH and Ca dominates for the exchange adsorption complex, high contents of soil organic matter (SOM) and DOC (to 590 mg), TN (to 80 mg, including NH_4-N to 250 mg/100 g soil) and highest value of labile P (PO_4-P to 1200 mg/100 g soil). SOM varied from 2.0 to 10.2 % in humus-accumulative horizons and 0.6-1.9 % of mineral part. SOM distribution has accumulative type and humus-fulvate composition of humus of the upper part. The soil biophilic elements in comparison with Beringia sediments has both similarity (TOC and DOC were comparable) and differences (SRP is higher in several times, but this trend is the reverse for NH_4-N).The research was supported by the RFBR (projects 07-05-00313-a and 15-44-05109 r_vostok_a).

Impact of the climate change on forest ecosystems: an overview of the results obtained in manipulative experiments at field scale

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In the last decades several field long-term experiments has been realised to study the complex interaction about climate change drivers (elevated CO_2, changing temperature and water availability, increasing the nutrient supply) and the main processes regulating the terrestrial ecosystems functioning (C-balance, water balance e nutrients cycle). FACE experiments contributes significantly to produce a robust framework of knowledge about the impact of elevated CO_2 at stand and ecosystem level, differently long term field experiments manipulating temperature are still lacking for forest ecosystems. Furthermore, scaling the responses observed at a certain level needs an important effort on modelling the interactions among pools and the connecting processes. New approaches on model validation has been recently suggested to better integrate the observations. Results obtained in different field experiments conducted by EcophysLab of the University of Tuscia, as part of international networks, will be presented and compared to a wide context. We investigated the impact of elevated CO_2 in a natural Mediterranean forest and in a poplar plantations, using Open Top Chambers and FACE technology. The functional changes induced by an increase of daily minimum temperature and by the duration of the drought period, were studied in a natural shrub community growing in semiarid environment. Suggestions for new research activities will be formulated as well as for a re-active management of forests and degraded lands.

Biodiversity and climate in national park “Alchanay”

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Problems of identification of climatic changes and questions of probable trends of forest vegetation of East Transbaikalia are extremely important for preservation of a biodiversity. At the same time, research of a biodiversity in Transbaikalia was studied sporadically until present time. Only with the organization of new National parks it becames possible to estimate temporal changes of the forests to reveal the climatic factors influencing a biodiversity. Researches were conducted in national park “Alkhanay” in 2003-2017. Results: 1. Various dynamic processes caused by the current climate changes are reflected in structure of forest phytocoenoses. Trends of climatic changes in forest biomes of “Alkhanay” reflect patterns of regional warming. In the southern forest-steppe areas the processes of both warming and aridization are well expressed. 2. The structure and a biodiversity of forest vegetation of “Alkhanay” are determined by wide variations of habitats. There are three belts of vegetation: subalpine, forest and forest-steppe. A variety of forest phytocoenoses is greater in the mountain and taiga boreal forests and in light-coniferous forests. 3. Warming of climate and aridization can be caused by deforestation along the rivers. Aridization of river valleys influences a biodiversity of ecosystems in the forest belt. 4. Multidirectional changes in different types of plant communities in areas with an island permafrost are also caused by climatic fluctuations. Thermophilic species become more common in boreal dark-coniferous forests and mesophytic species intensively invade the hemiboreal light-conifer forests. With warming climate a great increase of xerophytes is expected in the expositional forest-steppe plant communities. In the forests and forest-steppe communities a replacement of Larix sibirica with Pinus silvestris is expected that will result in evening the forest-steppe landscapes.

The carbon and methane balance of the Siberian Arctic Tundra on permafrost

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TBC

The effect of climate change on yield in agriculture

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We analyze the effects of climate change on cereal grain production in Russia. As a result, we represent the models which can evaluate the impact of climate change on yields of various crops (cereals, potatoes, vegetables, sunflower) and the dynamics of the development of agriculture.

Modelling energy economy interactions under environmental constraints

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The paper presents the evolution of models and model complexes used to study the relationship between economy, energy sector and environment; the authors characterize models that describe these relationships in exogenous form (optimization and simulation models) and endogenous form (models of economic interactions (general equilibrium models), integrated assessment models of climate change). The researchers also develop a model of economic interactions of the Far East with a detailed energy sector and propose a series of experimental calculations based on this model. It is shown that the substitution of coal with natural gas leads to not only cleaner ecology in region but also to growth of regional macroindicators. The study includes the directions for further improvement of the model.

Influence of internal waves on the color of the marine surface in the coastal zone of the Peter the Great Bay

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Internal waves play an important role in the exchange of energy, heat and impurities processes, between the inner layers of water. They affect the heat exchange, the dynamics of the upper layers of the ocean, the propagation of acoustic signals, bio-productivity, etc. Internal waves manifest in fluctuations of temperature and salinity of water,and have significant impact on vertical water stratification, turbulent mixing, distribution of planktonic suspensions, oxygen enrichment, vertical migrations of plankton and fish, and conditions for spread of sound in the ocean. Study of internal waves is important for the purposes of hydrobiology, hydrochemistry and the general ecology of water bodies. The appearance of sea-color scanners, installed on satellites in geostationary orbits, makes it possible to study the high-frequency and low-frequency of internal waves by analyzing temporal diurnal variations in the brightness of the sea at different wavelengths. The detection of internal waves is of interest for studying a whole series of phenomena in the near-surface layer of the ocean and in the possibility of determining their parameters from satellites, as well as in turn:

- in the evaluation of bio-productivity and the perspectives for fishing;
- modeling the propagation of acoustic signals in sea water;
- in the development of complex oceanological models.

The paper presents the results of studies of the internal gravitational waves influence on the stratification of optically active components of sea water (phytoplankton, colored dissolved organic matter, suspended particles) in the southern part of the Gulf of Peter the Great. The paper used ship data obtained during the period of 2008-2016 at daily and semi-daily stations with hourly profiling of the vertical distribution of hydrological and hydro-optical parameters.

Ownership unbuilding and monopoly privileges in electricity transmission

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The paper discusses how ownership unbundling and government-granted monopoly privileges in electricity transmission affect consumer electricity prices. Four cases are considered: government-granted regulated and unregulated transmission monopolies and a sole incumbent transmission company (without monopolistic rights) under and without ownership unbundling conditions. Aprioristic mathematical modeling taking into account potential competition shows that absence of monopoly privileges in electricity transmission can decrease end consumer prices even at high market entry barriers (high costs of new transmission lines). It is shown that ownership unbundling can nearly eliminate the effect of potential competition in transmission. The research is supported by the RFBR grant №16-06-00071, and the European Union's Seventh Framework Program FP7/07-13/ under REA grant agreement number 609642.

Air quality and climate: two sides of the same coin

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Climate change and air pollution are both critical environmental issues that humanity is facing. On the one hand, air pollution is globally the second leading risk factor for the global burden of diseases, and the premature deaths due to air pollution are estimated globally as 3.5 million. On the other hand, the 5th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) has clearly stated that "warming of the climate system is unequivocal and, since the 1950s, many of the observed changes are unprecedented over decades to millennia". Anthropogenic activities are responsible for the emission of gaseous and particulate pollutants that modify atmospheric composition. Such changes are, in turn, responsible for the degradation of air quality at the regional/local scale as well as for climate change. Air pollution and climate change are therefore two intimately connected environmental issues. However, in many areas of both science and policy these two environmental challenges are still viewed as separate issues, which are dealt with by different science communities and within different policy frameworks. Indeed, many mitigation options offer the possibility to both improve air quality and mitigate climate change. There are, however, also mitigation options that may provide benefits to one aspect, while worsening the situation in the other (win-lose policy options). Therefore, many coordinated actions that take the air quality-climate change linkages into account provide the most cost-effective strategies. These coordinated actions need to be based on strong scientific grounds. Furthermore, social acceptability is a key for any environmental policy action and an adequate communication plan to inform citizens needs to be implemented.

The seasonal forecasting activities at CMCC

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Skilful climate forecasts on seasonal timescales can have large socio-economic benefits and seasonal predictions have therefore been performed operationally at centres around the world for more than 40 years. The skill of these predictions derives primarily from tropical phenomena such as the El Niño Southern Oscillation (ENSO), whereas predictability and forecast quality is currently still relatively limited over continental areas of the Northern Hemisphere. This talk presents the main features of the CMCC seasonal prediction system, illustrating the operational chain and discussing the skill of the forecasts both in terms of deterministic and probabilistic metrics. The impacts of the improvements in the initialization techniques will be shown and discussed along with an outlook of the planned future developments.

Carbon dioxide soil emissions in forest stands of the Primorskaya State Academy of Agriculture

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Global land surface emissions amount to 80×1015 g C annually, which is about 10 times higher than the sum of anthropogenic emissions from fossil fuel combustion. Because of climate change organic soil losses are expected to increase, which would lead to a positive feedback between emissions and an increase in atmospheric CO_2 concentration. Forest ecosystems often act as carbon sinks and can build-up considerable carbon stocks. Thus, they play an important role as a buffer abating the increase of greenhouse gases in the atmosphere. With 20 % of global forested areas being in Russia, the country plays a key role in preventing or slowing down the increase in average global temperature. Currently used greenhouse gas inventories are derived from global model estimates, which in turn are based upon empirical data. When considering regional data, the information about the carbon budget for Russian forests is not evenly represented by current databases. Especially the carbon cycle of forest ecosystems in the Russian Far East remains amongst the least studied regions. Since 2012, field investigations of carbon emissions were conducted by employees of the Institute of Forestry and Forest Park Management of Primorskaya State Academy of Agriculture (Ussuriysk). A forest stand belonging to the Academy (28,000 ha) adjoining the Ussuri reserve was used for conducting measurements to determine the temporal (seasonal and diurnal) as well as the spatial variability of carbon fluxes. After five years of measurements the data acquired encompasses three types of forest formations – oak dominant forests, pine dominant forests and ash-elm dominated floodplain forests. Results show that soils in pine forests have temperatures above 0 degrees for about 250 days per year. Soil temperatures were determined to be the main factor for seasonal variability in soil respiration. The following mean values for total soil respiration were obtained (in g C per m^2 and day): 4.39–6.74 for pine forests, 7.30 for oak forests in summer, 5.22 for ash-elm floodplain forests in summer.

Molecular role of biodiversity on our planet and links of the to human survival with the examples and implications in epigenetics and cancer

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We observe a sharp decline in biodiversity since modern extinction rates are high, at 100 to 1000 times greater than background extinction rates calculated over the eras. Though new species appear, however, existing species go extinct at a rate 1000 times that of species formation. The biodiversity loss will alter the ecosystem functions and their ability to provide goods and services for the human health and wellbeing. More importantly, the irreversible loss of traditional medicine and metabolites diversity concomitant with the extinction of microbes, plants, fungi and animals will threaten the scientific discoveries for medicinal purposes. Despite all efforts to include biodiversity protection within the international agendas, developing countries, the home of most of the world's biodiversity, are rapidly losing their biodiversity heritage. Here we argue that biodiversity is also the key for maintaining public health as well as the success of global drug discovery efforts. Despite scientific or technical "improvements" and managerial "process optimisation", drug discovery was more productive in the 1950s, 1960s, and 1970s, when many of the methodologies that are now widely applied had not been invented and when other R&D approaches were dominant. In particular, most early successful blockbuster drugs were derived from phenotypic screening rather than target-based drug discovery. Our phenotype based screening of various natural extracts using patient derived cell lines are pointing to the multitude of the anti-cancer molecules, which promise to solve cancer problems, provided conservation and research of the host species. We aim to create an interdisciplinary knowledge hub to connect conservation, medical chemistry, public health data, traditional medicine, etc. to facilitate global efforts in preserving natural bio- and chemodiversity.

Biological productivity and annual carbon deposition in some forest formations of the Southern Sikhote-Alin

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Biological productivity (phytomass, NPP and SNPP) is one of the most important features of forest ecosystems, which is used to assess the carbon deposition capacity of forests, ecological monitoring, sustainable forest management, modeling of forest productivity in relation to global changes, studying the structure and biodiversity of forest cover. Today estimates of the biological productivity of forests do not correspond to carbon deposition rates that makes predictions of regional and global environmental situation impossible. The reasons for this situation are the absence of sufficiently reliable basis of empirical data about the biological productivity of forests and inaccurate baseline information on forest inventory and biological productivity estimates. One of the main objectives of our research is to obtain empirical data on the biological productivity of forests. In the period from 2013 to 2016, 10 PSP were established in the Ussuriisk forests in the 9 most common forest types. 140 model trees of 20 species (including 4 conifers species) were sampled. The phytomass, NPP, SNPP and annual carbon deposition data were obtained and analyzed. Extrapolating the obtained information using forest inventory materials and the state forest register to larger areas by using multiple regression equations, it is possible to obtain reliable information on carbon deposition in the phytomass of tree species and the basic formations of coniferous-broadleaf forests of the Southern Sikhote-Alin.

Phylogenetic relationships among congeneric *Oxytropis* species from Asian Pacific region based on trnS-trnG sequences

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Reliable discrimination of congeneric species based on molecular markers is required for preserving genetic diversity. There are conflicting opinions on the relationships of four far-eastern endemic *Oxytropis* species (*O. kunashiriensis* Kitam. from the Kuril Islands, *O. ruthenica* Vass. from the South Primorye, *O. erecta* Kom. and *O. litoralis* Kom. from the Kamchatka Peninsula). Some authors consider these species in the rank of separate species. In other treatments, *O. ruthenica* is considered as a subspecies of *O. litoralis*, the last species – as a synonym of *O. erecta*, and *O. kunashiriensis* – as a closely related to *O. litoralis* and *O. erecta*. The trnS–trnG intergenic spacer of the chloroplast DNA has high resolving power to reveal the relationships of closely related *Oxytropis* species, and it is informative and reliable marker for species identification and discrimination. The results of phylogenetic analyses of *O. kunashiriensis*, *O. ruthenica*, *O. erecta* and *O. litoralis* inferred from trnS-trnG sequences show that *O. kunashiriensis* and *O. ruthenica* are the separate species. There were not found significant differences between *O. erecta* and *O. litoralis*.

Climate smart investment with visioneering by monitoring energy, matter and information flows

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Sustainability science is an emerging trans-disciplinary research, which necessitates not only the communication and collaboration of scientists and practitioners from different disciplines, but also the paradigm shift from deterministic and reductionist approaches to the old basic (i.e., the fundamental laws of nature). Rural-urban systems are co-evolving complex systems that are defined as systems having many interacting parts (or agents), whose interactions give rise to dynamic, non-linear and indeterministic outcomes through self-organizing processes. We introduce a conceptual framework for such continually morphing dynamical systems, i.e. self-organizing hierarchical open systems (SOHO). To understand the structure and working of SOHO, we revisit the two fundamental laws of physics (i.e., the entropy law and the action law). The re-interpretation of these laws elucidates that energy dispersal between a system and its environment will occur along the paths of least action (or in the least possible time) and throughput (i.e., the movement of a material through a system such as the flow of energy, matter and information) plays a key role. We introduce an additional essential framework, the so-called visioneering (V) (i.e. engineering of vision) - skilful direction and creative application of experience and scientific principles to fulfil the vision. The V process is then integrated with the SOHO framework as feedforward loops so that 'a minimally guided (or nudged) self-organization process' may enable decision makers to choose better path (or scenario) toward sustainable rural-urban systems. (Acknowledgment: This work was funded by the Weather Information Service Engine Program of the Korea Meteorological Administration under Grant KMIPA-2012-0001.)

Soils of the Lake Khanka lowlands

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The composition and structure of the soils of the Lake Khanka lowlands have been analyzed according to their position in the scheme of administrative regions and in the system of soil-geographical regionalization. The grouping of soils at the geomorphological level was proposed using criteria of their optimal use for agricultural production in accordance with the agrochemical characteristics of the arable horizons, such as the thickness of the humus layer, the acidity and the availability of nutrients (phosphorus and potassium). The use of soils as a mean for agricultural production causes the problem of sustainable nature management that targets the increase the nature resource potential of agro-landscapes and, above all, a progressive increase of soil fertility. The elements of sustainable nature management include: 1) the elaboration of eco-friendly agricultural technology, including livestock maintenance and processing of agricultural products and their waste; 2) development of adaptive and soil protective systems of agriculture and livestock production on the basis of recycled and non-waste (balanced) agricultural production; 3) introduction of complex land reclamation for expanded reproduction of soil fertility of multi-purpose reclamation systems; 4) comprehensive testing of intensive and promising resource-saving technologies; 5) recultivation of disturbed and rehabilitation of degraded soils. To develop measures for the ecologically optimal use of the soil cover, it is recommended to use special mapping based on the contemporary and traditional methods. Detailed studies of soils as territorial units of different levels of organization and indicators of soil diversity should be aimed at characterizing soils as a component of natural and derivative biogeocoenoses. Ecological optimization requires the development of monitoring systems, information support, the compilation of ecological passports and scientifically sound standards for agricultural activities, as well as the widespread development of complex, operational cartographic surveys. Without a comprehensive study of environmental problems of soil cover, without the ecologization of technologies for cultivating agricultural crops, it is impossible to solve environmental issues. In order to prevent the negative consequences of human activities, we need: 1) the legislation of ecologically clean systems of agriculture in a monsoon climate and 2) objective criteria to reliably monitor the state of soil cover. Consequently, the problems of environmental monitoring are of particular relevance.

Total economic value of forest ecosystem services in Primorsky krai

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Economic policy of the Russian government aimed at the priority development of regions with active use of natural resources, as well as application of mechanism for greenhouse gas emissions reduction as part of climate policy of the Russian Federation, provide the need to make an instrument for sustainable forestry development under conditions of global warming. In this regard, economic assessment of forest ecosystems can be considered as a way out. It can be used to determine efficiency of investment in sustainable forest development as well as to select strategic approaches and to make optimal managerial decisions in the Department of Forestry of the Primorsky Krai Administration. To achieve full economic evaluation of forestry, it is proposed to apply an integrated methodological approach that covers all functions of forest (provisioning, regulating and social). Forest evaluation without considering external factors will result in losses with negative economic and social consequences, which essentially leads to a further degradation of the ecological situation. The concept of total economic value, including the evaluation forest ecosystem services from different aspects, is the basis for the implementation of systematic management of forest resources, taking into account the interdependent criteria of sustainable development: environmental protection, economic efficiency and social significance.

Climate envelope models for temperate trees in insular sector of the Russian Far East: current and future distribution of *Kalopanax septemlobus* (Araliaceae) and *Phellodendron amurense* var. *sachalinense* (Rutaceae)

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I modelled distribution of temperate trees species *Kalopanax septemlobus* (KS) and *Phellodendron amurense* var. *sachalinense* (PAS) in Sakhalin Island and the Kuril Islands (south boreal zone generally) according to climate change scenario for the time period until 2050 year. Climate envelope models was constructed based on actual species locations (n=38 for KS, n=29 for PAS) and WorldClime v.1.4 bioclimatic data (30 arcsin resolution) using the maximum entropy technique (MaxEnt v.3.3). I used six bioclimatic variables: mean annual temperature, Kira's warm index, mean minimal temperature of coldest month, index of continentality, total precipitation in months with mean temperature below 0°C, total precipitation in coldest quarter. I used RCP2.6 and RCP8.5 scenarios of global warming based on CCSM4 (Community Climate System Model). According to permutation importance and jackknife test Kira's warm index is the most influential predictor for species distribution models, followed by total precipitation of the coldest quarter. Current climate models predict 1.27 % (~1 100 km^2) of islands territory for KS habitats and 2.55 % of territory for PAS habitats with 50% minimum threshold probability of suitable habitats. Range of both species would begin to expand north in future. Models based on RCP2.6 projection (increase of annual mean temperature in region on 3.9°C) predict 9.55 % of territory for KS habitats and 14.65 % of territory for PAS habitats. Models based on RCP8.5 projection (increase of annual mean temperature on 5.2°C) predict 45.86 % and 66.24 % of territory for species habitats respectively. The trees regeneration niches are necessary to expansion of both species in suitable climate condition. The large-scale windfalls may promote ecological niches for temperate trees expansion in region.

Problems and perspectives of sustainable development of tourist destination Russkii island

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The report examines the current state of natural, historical, cultural and infrastructural resources of the Russian Island, which allows optimizing its tourist-recreational development. Data on the recreational potential of some parts of the Russian Island are presented with a predominantly beach, recreational, recreational, consumer, and educational tourism specialization. Problems are discussed that hinder the sustainable development of tourism and recreation on the island territory, recommendations are given on the creation of a tourist and recreational cluster on the basis of the FEFU campus, with the inclusion of connected territories and water areas in it.

Climatic control of zonal vegetation in northern Asia

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This study focuses at the problem of indication of climatic gradients by vegetation complexes and aims to quantify the local and regional scale relations of vegetation units, their complexes and climatic parameters within boreal vegetation zone in Northeast Asia. We used phytosociological (over 5000 relevés), climatic (2200 climatic stations) and floristic (distribution records for 22 000 species) databases. Identification of bioclimates was made in accordance with Rivas-Martínez et al. (1999) approach using additional climatic parameters such as Kira's warmth (WK) and coldness (CK) indices, continentality index (CI), ombro-evapotranspirational (OEI) index and winter precipitation (WP). Analysis of indices calculated with an aid of developed models showed the significant differences of vegetation units of the order rank in bioclimatic ranges. WK decreases from values over 75 in the middle temperate zone (*Saso-Fagetalia*, *Aceri-Quercetalia*) to 20 in subarctic zone. Among boreal vegetation units the orders of *Betulo-Ranunculetea* have the lowest warmth index in the circumboreal zone that can be explained by cool summer in conditions of oceanic climate. CK varies between values of -25 and -150 within boreal and temperate zones with prevalence of deciduous broadleaved, mixed and evergreen broadleaved forests. The boreal orders *Lathyro-Laricetalia* and *Ledo-Laricetalia* representing boreal deciduous coniferous forests are characterized by very low values of coldness index that, in this case, is comparable to that of subarctic orders. The ranges of orders along the continentality gradient are reflected by changes of vegetation types within a zone with proximity to the ocean. In boreal zone the lowest values of CI are characteristic to the forestless and not yet described class of Aleutian meadows, followed by *Alnus fruticosa* scrub and *Betula ermanii* forests of the class *Betuletea ermanii*. Highest values belong to deciduous coniferous orders *Lathyro-Laricetalia* and *Ledo-Laricetalia*. The snow affects vegetation strongly in oceanic regions of boreal zone, where the strong accumulation of snow causes 2-3 week delay of its melting and a considerable shortening of growing season. The communities of *Betula ermanii*, *Alnus fruticosa* and tall-forb meadows are characteristic to the regions with slower-melting heavy snow deposits.

Advanced remote sensing technology for forest inventory

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Recent advancements in remote sensing technology opened new roads for forest inventory and parameters prediction, allowing to extrapolate local field measures to large areas with increased accuracy. The relevance of forest parameters, such as biomass and biodiversity, to the global carbon cycle is well known. Here the functioning and role of lidar sensor (light detection and ranging) is reviewed to illustrate how this tool, in conjunction with ground records and satellite imagery, can be employed to map above ground biomass over large regions. Specifically, lidar point cloud provides different height metrics that are used to establish robust regressions with stem biomass. Lidar airborne acquisitions can be realized as transects over prestratified forested regions; these lidar data strips, and the derived biomass predictions, calibrated with limited field plots, can then be used as surrogate ground truth for predictions over entire regions using as upscaling support additional optical and SAR satellite data. Optical data at current spectral and radiometric resolution offer the opportunity to discriminate among various forest types also detecting disturbance at fine scale; SAR advanced polarimetric information can be directly related to forest volume. The SAR and optical merged information, together with the abundant surrogate ground truth provided by lidar, are the basis to build accurate biomass prediction at country and regional levels. Lidar has been used also to predict biodiversity, as the vertical structure of the forest scanned by lidar in 3D is in direct relationship with the number of species of certain taxa (birds, insects), whose presence is influenced by the vegetation structure. In addition, lidar can support optical data to understand forest disturbance and canopy species biodiversity.

Stock of forest litter

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Forest litter is one of the main carbon pools in the forest. In this study, the stocks of forest litter in cedar plantations in the forest area of Primorskaya SAA have been determined. The study was carried out during three seasons – 2014, 2015, 2016. Forest plots with different average age of the dominant species were selected. The average tree ages in sample plots were 50, 80, 130 and 200 years. The litter was collected using a 25×25 cm frame in three replicates once every 1–2 weeks from April to November. At sites of 130 and 200 years, 7 catchers 0.5 m^2 each were installed. The fall was collected monthly from September 2016 to August 2017. The accumulation of litter continues year-round with a maximum in October during the period of massive leaf fall in deciduous species. The share of autumnal litter averaged 60 %. In the period from November to July, the bulk of the litter is represented by needles of cedar and fir. The decomposition of the litter depends on the humidity and temperature in a certain period of time. To convert the litter stock into a mass of pure carbon, a coefficient of 0.37 was used. The average carbon content in the litter of the investigated forests was: 50 years – 4.25±0.13 t C / ha; 80 years – 4.21±0.11 t C / ha; 130 years – 4.59±0.16 t C / ha; 200 years – 5.25±0.19 t C / ha. The ratio of the litter on the ground to the litterfall on both sites is characterized by the litter-fallow coefficient. For the maturing Pinus koraiensis forests, this ratio was 3.5 that indicates a high turnover rate of the matter in the litter.

The seasonal dynamics of soil CO_2 fluxes in Central Siberia

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Studies on the role of soil processes are needed to quantify the large scale surface effluxes of greenhouse gases and to determine the effects of land use and land cover changes. The efflux of soil CO_2 is highly sensitive to changes in surface temperature and relatively small changes in surface temperature may have a major influence on the magnitude of soil efflux. The potential increase in CO_2 release from the soil caused by future elevated temperature may have a positive feedback effect on the atmospheric CO_2 and global change. In our study we compared the dynamic of soil CO_2 fluxes from different types of underline surfaces for four different growing seasons (droughty, normal and overmoistened years). The research region was located in the middle taiga zone in Central Siberia (60°N, 90°E). We found that the soil efflux is highly vary and depends on meteorological conditions of exact year. The soil temperature and soil moisture determined the magnitude of soil effluxes with relations depending on land cover of each site. The max fluctuations and variation of soil efflux were observed: in July – mid of August; in the mixed forest with the highest plant diversity. Analysis of Q10 is identified the efflux from the feathermoss pine forest controlled by moisture conditions higher than in lichen pine forest due to the distinction in the soil properties. The temperature is the main driving factor of the soil effluxes in the mixed forest and the max fluxes were similar in years with a comparatively high temperature and low precipitation level. The destroyed area was characterized by the lowest soil effluxes and we did not detect any changes in the dependence with soil temperature and soil moisture during the different years. The mean efflux for the whole measurement area is 197 mol CO_2 m-2 for one growing season.

Greenhouse production and postharvest: sustainable emerging technology

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Italy is a Country where the technological innovation in horticultural crop production and postharvest is a priority. In fact, the strong competition in Europe and the need of export has driven the research and the company to find the way to produce high quality products and to develop unique technology for handling, storage, shipping, and processing. In this talk, the innovative technique in greenhouse building but overall the great advance in postharvest technology will be dealt also touching the aspect of sustainability. Greenhouse sector has found a new development with the ICT, in fact the new greenhouses are mainly censored for irrigation mapping and illumination in order to make the production economically and environmentally sustainable. Postharvest also has improved its technology with a look to sustainability. Innovations in cooling to improve the cooling efficiency, innovation in insulation of storage room to have less heat leaking, improved efficiency of handling lines to have less waste, new sensors for quality control to guarantee the consumer. Today energy coefficient is mandatory to check the efficiency of cooling plant. Finally, oversea shipping has seen to give more attention to reduction of ship hull friction or to favour the ship speed of the huge container ships.

Voluntary carbon market modeling based on economic experiments

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Opposed to enforcement forms of governmental influence on the producers of goods and services with the aim of providing compensation for their carbon emissions above the established standards per unit of output, voluntary carbon markets require use only market-based methods of regulation. Enterprises should have natural market incentives to reduce carbon emissions by creating demand for carbon re-emission services and, more importantly, introducing innovative resource-saving production technologies. The key condition for creating such incentives seems to be the differentiation of consumers attitude to various producers based on compliance with the relevant standards. Thus, this project proposes a series of pilot studies aimed at clarifying the following issues: 1. How do demographic, socio-economic and other factors affect the willingness of the population to give preference to goods and services that have been complied with (including the purchase of offsets in the case of emission standards are exceeded) international carbon emissions standards per unit of output with other things being equal? 2. How do macroeconomic, industrial, institutional and other factors affect the readiness of producers to comply with international standards for carbon emissions per unit of output? 3. What methods of ensuring the supply of carbon offsets (methods of reemission) are the most effective in modern conditions (in theory and in practice, including commercial relevance)? Accordingly, the requested funding which is necessary for conducting and analyzing the results of the pilot studies will allow the development of financial model for the voluntary carbon market in the Far East of the Russian Federation to be presented at the Eastern Economic Forum 2018.

Climate change studies at the EuroMediterranean Center on Climate Change

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The EuroMediterranean Center on Climate Change (CMCC) is the main italian institution working on studying climate variations, both natural and anthropogenic, including their impacts on the ecosystems, society and the economic sectors. The Center is channeling fundamental research and innovation results into applications for the development of climate services and predictions from the seasonal scale to the long term scenarios scale. CMCC is also active in global and regional ocean predictions at shorter scale (up to 10 days), developing basic data and applications for offshore operations, search and rescue, emergency handling and security. The talk will give an overview of the science activity and application being done at CMCC.

Assessment of beetle species diversity of the genus *Carabina* in the forest area of Primorskaya State Academy of Agriculture

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Forest ecosystems experience powerful anthropogenic influence. It leads to a sharp reduction of forest area. Since 2000s the area of intact forests is reduced by 40,2 million hectares. This process affects the decline of biological diversity, which entails many side effects including the consequences of a global scale. Permanent destruction of forests is one of the reasons for the increase of greenhouse gases concentration in the atmosphere. At a global scale 463 million hectares of the world's forests are allocated for conservation of biological diversity. The forests occupy almost three quarters of the Primorskiy region and they are characterized by a high biodiversity of flora and fauna. Experimental forest of Primorskaya Agricultural Academy has an area of 28830 hectares, and it borders with Ussuryiskiy state natural reserve named after of V.L. Komarov. Over 35 % of the area is occupied by forest plantations of Korean pine. Research was conducted in the uneven-aged pine forests. Nine plots have been established to account beetles of the genus *Carabus*, 15 Barber's traps were installed in each plot. The beetles are defined by Lerr's index. 1109 beetles of nine species were caught during spring and summer period: *C. billbergi*, *C. vientinghoffi*, *C. venustus*, *C. careniger*, *C. granulatus*, *C. smaragdinus*, *C. schrenkii*, *C. makleii*, *C. maakii*. We traced the dynamics of the beetles number and the influence of abiotic factors on them. It has been revealed, that activity of bugs has strong relation with humidity of litter and ground wood debris and is limited by duration of the periods without precipitation.

Biogeophysical feedbacks of land use/cover change on climate

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Since agricultural civilization developed ~20,000 years ago, land use/cover change (LUC) such as agricultural expansion spread throughout the world. More than 40 % of global land are croplands and pasture now. LUC can impact climate at local, regional and global scales through biogeochemical and biogeophysical feedbacks. First, I present one case study for the biogeophysical impacts of afforestation in China on surface temperature because China has the largest afforested area in the world (~62 million hectares in 2008). Afforestation is found to decrease daytime LST by about 1.1±0.5°C (mean ±1 SD) and to increase nighttime LST by about 0.2±0.5°C, on average. The observed daytime cooling is a result of increased evapotranspiration. The nighttime warming is found to increase with latitude and decrease with average rainfall. Afforestation in dry regions therefore leads to net warming, as daytime cooling is offset by nighttime warming. Then, I will summarize the progresses about the feedbacks of LUC and vegetation greening on climate. Until now, most of studies reported the effects of LUC on temperature at local, regional and global scales, while few on precipitation. Land use including management is a key mitigation for climate change, but we still lack comprehensive recommendations for policymakers to realize potential climatic benefits.

Benefits of comprehensive, continuous multiplatform observations and their synthesis

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There is a direct societal need to answer the global, interconnected grand challenges, such as climate change and air quality. A special attention is required in the polar and boreal context. Trans-disciplinary research utilizing the full capacity of comprehensive in-situ observations together with state-of-the-art satellite observations is required to make advances e.g. in the understanding of atmospheric and cryospheric processes in the Arctic environment. In this presentation I will introduce several initiatives and activities that produce, utilize and integrate the comprehensive observational data, such as Pan Eurasian Experiment (PEEX) Program, global network of Stations Measuring Earth surface - Atmosphere Relations (global SMEAR), and Integrative and Comprehensive Understanding on Polar Environments (iCUPE).

What happens with *Picea jezoensis* population?

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I analyzed a current state of Yezo spruce population in the Korean-pine-broadleaved forest of the Southern Sikhote-Alin Mountains. Decrease of a recruitment and low vitality of the immature and virgin plants suggest the instability of population. Despite a high stress-tolerance of the species, only 8 % of virgin trees reach the matter stage. Part of those trees dye off in the middle generative age. All these facts prove that the degradation of the Yezo spruce population is going on. We suppose that the Yezo spruce population degradation has complex reasons which are related to the biology of species and triggered by climatic factors. Trees of Yezo spruce in the Korean-pine-broadleaved forests are characterized by complex, ecological conditions dependent CSR strategy that maintains the stable demography of population. Other limitations for spruce population include such long term climatic changes as decreasing precipitation and increasing frequency of droughts, and also human-induced acidification of precipitation.

Marine derived fungi of the northeast Pacific

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Marine fungi involve ecologically defined group of primarily filamentous ascomycetes, basidiomycetes and their anamorphs. The ecological importance of filamentous fungi in marine systems is often underestimated or ignored completely, and yet these organisms represent a diverse range of saprobes, pathogens and symbionts that form an integral part of coastal systems. The interactions between microbial diversity and ecosystem function are not well understood. In particular, it is unclear how population stability and metabolic function are related to diversity. Assessing fungal diversity accurately, encompassing phylogenetic diversity, species richness and evenness, is the first step towards modeling fungal assemblages dynamics in terms of species redundancy, species spatial and temporal distributions, and nutrient cycling. Similar limitations also apply to the identification, isolation and quantification of fungi from marine environments, with the additional complication of distinguishing between transitory and native forms. At present 32 species of 11 genera ascomycetes, 249 species of 57 genera anamorphic fungi were defined. It has been established that marine-derived fungi are more diverse in temperate waters than in tropical zone. More than 300 producers of new antibiotics, anticancer substances, and inhibitors of enzyme were obtained and structures of these substances were elucidated. About 50 producers of new enzymes were obtained.

Opportunities and prospects of assessment, identification of factors and ways to increase the elasticity of agricultural production to fit the weather and climatic conditions of Primorsky Kray

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Global climate changes have negative effect on the volume, structure of production and quality of agricultural production. There is an increase in frequency of origin of extreme weather events to which agricultural vendors do not manage to adapt. The conducted researches show that the considerable deviations of the actual weather conditions from normal are available and accrue. The volumes of agricultural production which are defined by productivity of different crops are not elastic in relation to changes of climatic variables. In world practice a row of the models designed to increase productivity in adverse weather conditions, including APSIM v7.5, SARRA-H v3.2, CMIP5 is used, each of which has the advantages and shortcomings. Adaptation and elasticity of agricultural production to weather and climatic changes is one of components of effective management in agriculture. Therefore it is important: 1) to carry out the review and the analysis of efficiency of use of different methods and indices of assessment of elasticity of production of crops to weather and climatic changes; 2) to research possibilities of development of model and indices of assessment of the elasticity of production of crops to changes of weather climatic conditions adjusted for specifics of climate of Primorsky Kray; 3) to carry out assessment of elasticity and a level of adaptation of production of the main crops (wheat, rice, soy, etc.) to changes of weather climatic conditions of Primorsky Kray; 4) to justify and offer the recommendations about increase in elasticity and adaptation of production of crops, both to short-term (weather), and to long-term (climatic) changes. Enhancement of theoretical model of assessment of elasticity of agricultural production to climatic changes, including taking into account regional specifics, will allow to justify and develop actions for the development of agrometeorological support of agricultural branch of Primorsky Kray. Thereby, increase in a level of adaptation of agricultural production to changes of weather climatic conditions in the edge is provided.

Diversity of vegetation and soils of the North-eastern part of the Island Simushir

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The main distribution patterns of soil and vegetation northeastern part of Simushir Island were studied. Simushir is an uninhabited volcanic island near the center of the Kuril Islands chain in the Sea of Okhotsk in the northwest Pacific Ocean. Simushir is highly elongated, consisting of a series of stratovolcanoes. At the north end of the island is a half-submerged caldera, Brouton Bay. Four courts measuring $10\times10m^2$ for the description of vegetation and soil cover were selected. The soil profile and morphology characters are described. Vegetation description was given. Different types of vegetation properties upper soil horizons define. Pedogenesis has synlithogenic (volcanic) character. The first accounting platform for sampling of soils and vegetation was planted on the South-Western coastal slope of the Peninsula the Eastern Klishnia. This site was dominated by mixed grass-meadow vegetation and individual plants *Duschekia fruticosa* (Rupr.) Pouzar, *Rosa rugosa* Thunb and *Sorbus sambucifolia* Cham. et Schlecht. Under this vegetation dry-peaty volcanic soil was formed. The second site was located in the Central part of the Caldera, in the North-Eastern slope of the side of the cone, dominated by *Betula ermanii* Cham. and individual plants: *Duschekia fruticosa*, *Sorbus sambucifolia*, *Salix udensis* Trautv. et C.A. Mey, *Sasa kurilensis* (Rupr.) Makino et Shibata. Under the birch raw-organic volcanic ocherous soil was formed, with more acidic (pH 5.4 to 5.9) reaction medium, higher (15,3–13,4 %) content of humus in the upper horizons and the presence of a bright buff illuvial-metamorphic horizon BAN, as well as a high content of iron oxides (9-11 %) and aluminium (15-18 %), typical of volcanic soils.

The concept of development of public non-financial reporting and the GRI (Global Reporting Initiative) standard: prospects for application in Russia

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The UN adopted the Fundamental Principles for the Development of the World Community for the period from 2015 to 2030 in December 2014. The Program for International Development - the Goals of Sustainable Development was adopted. The basis of this program is the principle of sustainable development, a version of the global development both for world community, both for countries, which can meet the basic needs of today's generation, without risking life and future development. In accordance with Article 9 of programs named Financing for sustainable development of the world until 2030, the National Program for Sustainable Development (social responsibility) will be the basis of this program for the countries that signed the agreement. The Concept for the Development of Public Non-Financial Reporting was approved in Russia in 2017. It is aimed for improving the incentive system for Russian organizations to increase the information openness and transparency of the results of their activities on society and the environment, including the economic, environmental and social components. In Russia, non-financial reporting retains the status of a voluntary initiative. An urgent national task is to raise awareness in Russian society on issues of social responsibility, sustainable development and public non-financial reporting, as well as the international standard GRI (The Global Reporting Initiative). The Sustainability Reporting Guidelines (GRI) is an international reporting standard for voluntary application by organizations reporting on sustainable development. The guide is an international reference for all who are interested in disclosing information on management approaches, as well as on the environmental, social and economic performance of the organization. In connection with the foregoing, the Concept of the development of public non-financial reporting and the GRI standard has prospects for application in Russia.

Role of climate in polygenic burozem formation in coast-island zone of southern Primorye

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Biodiversity present-day state and dynamics depend greatly on the condition of a complex natural ecosystem – the soil. Soil cover changes are tightly connected with climate change as illustrated by polygenic burozem formation. The polygenic burozems under study form on red residual soil in the coast-island zone of southern Primorye (coasts of Spaseniya Bay, Popov Island, Rikord Island, Muravyov-Amursky Peninsula). The upper part of the burozem profile represents recent soil that formed on buried relic residual soil. This research shows that the polygenic burozem specific morphologic structure, physical-chemical properties, spore-pollen spectra of each genetic horizon, formation and age of the horizons are in many respects the result of the past and present-day climate change. Palynological data prove that both horizon C and the lower part of horizon BMC formed in the Atlantic period of Mesoholocene (Rikord Island – 4530±180 cal yr. (LU-7127), Popov Island – 5230±250 cal yr. (LU-7462), the warmer-than-present climatic conditions triggering clay and kaolin deposition in the burozem soil mass. The burozem spore-pollen spectra of the period represent thermophilic species such as Carpinus Cordata. Horizons AYBM, AYEL, and AY formed in colder climatic conditions of the Sub-Boreal period of the early Neoholocene (1550±110 cal yr. ((LU-5763)). The soil mass of the horizons is highly skeletal due to active soilfluction at the period. The spore-pollen spectra represent Betula fruticosa. Leaf litter horizon O formed in the period of the present-day climate warming, and the horizon spore-pollen spectrum represents plant species, characteristic of the period.

Assessing the humus status and CO_2 production in soils of natural and agrogenic landscapes under global change

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The humus status and CO_2 production have been assessed in soils of natural and anthropogenic landscapes in southern regions of the Far East. A higher production of CO_2 is typical of burozems and soddy-eluvial-metamorphic soils. These are soils with medium or high humus content, high potential humification capacity, and medium enrichment with catalase. A decrease in the content of humus in the plow horizons of soils in agrogenic landscapes is revealed compared to their natural analogues. The studied soils have humus of the fulvate–humate type. The fractions strongly bound to the mineral soil component prevail in humic acids. In waterlogged mucky-humus gley soils, the anaerobic conditions hamper the biological activity and transformation of organic matter, which favors its accumulation. A low production of CO_2 is observed in soils with reducing conditions. In soils of agrogenic landscapes (agro-dark-humus podbels and agro-dark-humus gley soils), the content of humus and the production of CO_2 decreased because of the removal of organic matter of plant origin at the agricultural use of soils and the lack of fresh organic matter. A low potential humification capacity (0.07) was revealed in agro-dark-humus podbels. This was largely favored by the increase in the number of bacteria and actinomycetes, which enhance the mineralization of humus, and the predominance of FA fractions in humus. The catalase activity in soils increased because of their high biogeneity, and the production of CO_2 remained low. This is related to the periodical overmoistening of soil surface and the low content of organic matter.To determine the differences between the CO_2 emission parameters in soils of agrogenic and natural landscapes under global change, monitoring studies should be extended.

Climate change and anthropogenic pressure consequences for environmental diversity: a case study of islands of Prymorsky krai

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Information concerning diversity of the natural environment and its transformations is crucial to sustainable nature management. The aim of the present research is to study the diversity of environment components (species, vegetation, soil and landscape diversity) of insular geosystems of Primorsky Krai and transformation of nature environment during the Late Holocene. Our paleopalinological researches have shown the climate fluctuations which resulted in vegetation transformations. Global warming occurring throughout XX century and anthropogenic influence have resulted in the destruction of coniferous communities, expansion of broad-leaved forests, shrub-grass communities and pyrogenic succession. At present, on the largest islands which have some economic activity, material-energy flows in landscape elements are broken. These impacts have resulted in decrease of environmental diversity. The small islands with less anthropogenic influence have more species diversity of vascular plants and lichens, including rare species per area unit. The largest islands subjected to human activity have lower species diversity. Most part of the islands is an erosion vulnerable area. Sheet erosion is a serious problem along roads in human affected areas. Small islands are of minor interest in terms of economic activity and have natural protection against anthropogenic influence (inaccessibility), therefore they are “hot spots” of environmental diversity. Both current geosystem state and paleogeographical data of the beginning of XX century have shown that largest island geosystems become less resilient. We are indebted for the financial support to RFBR (grant 15-05-01419).

Comparative study of modern bio-char production methods

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Biochar is a kind of charcoal that can be produced by carbonizing agricultural and forestry waste, or any other organic matter in the absence of oxygen. In this process three sub-products are created: first biochar, second liquid fuel, and third gas. The application of biochar to the soil has two major advantages: First, it improves agricultural soil by increasing the availability of nutrients, avoiding leaching from fertilizers, retaining water, absorbing pollution (specially heavy metals), and others. Second, it keeps the carbon from going back to the atmosphere for hundreds or more years which is a great mitigating measure against climate change (the less carbon in the atmosphere the less the temperature increases). Modern methods strive to maximize the amount of biochar produced and minimize the possible negatives effects of its production so that the benefits are much higher. The aim is to reduce or eliminate the need of external sources of energy by utilizing the subproducts to power the process. There are a few modern ways in which the anaerobic carbonization of biomass can be done in alignment with those parameters, namely: pyrolysis, microwave carbonization, and hydrothermal carbonization. This study compares the three methods in terms of the amounts of biochar - subproducts obtained; the extent to which additional sources of power are required; their possible negative effect; and the costs of the machines employed.

Promoting sustainable durum wheat production in Italy: the Barilla Sustainable Farming project

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Since the year 2010, the Barilla Company, a leading player in pasta market worldwide and one of the top Italian food companies, has implemented a project that is aimed to increase both the environmental and economic sustainability of durum wheat production. Wheat is used in over 95% of the company's products. The project introduced an integrated approach to wheat production, which mainly included an accurate planning of crop rotations and the use of a decision support sys-tem. The Barilla Sustainable Farming model was applied on 13 farms in 2011/2012 and 22 farms in 2012/2013, in the areas where durum wheat cultivation is more signifi-cant in Italy. Results show that low input agronomic practices are environmentally friendly (- 36% GHG) and increase net income of farmers (up to 31%). A decision support system contributes in reducing carbon footprint (-10%), and costs for pesticides and fertilizers (- 10%).

Nature-based solutions for Climate Resilient Cities

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Cities around the world are facing significant risks from climate change. Different concepts and approaches have been developed and adopted in urban planning policies to mitigate climate change risks. In order to develop climate resilience in cities, urban planners and researchers are now encouraged to promote nature-based solutions (NBS) which can also improve human health and well-being. NBS applied at the urban scale can be used as climate mitigation and adaptation tools that emphasise multifunctionality in terms of services and functions and provide cost-effective approaches to the urban sustainability. However, the concept of NBS has not been widely adopted in Russian cities. This paper examines the benefits of NBS in cities and contributes to a better understanding of how cities can adapt to climate change. These results can be used for climate change policy implementation in Russian cities.

Forest ecosystems and their impact on soil organic matter content on former agricultural locations in Vojvodina Region

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Vojvodina is the main agricultural region of Serbia, and it is under heavy anthropogenic pressure. Land use change from natural steppe to agriculture is acute problem in chernozemic region of Vojvodina, which represents 60 % of the area. Changes in soil organic matter (SOM) amount, resulting from switching from natural to agroecosystems on Vojvodina's chernozem were thoroughly researched, shoving disturbing trend of decreased amount of SOM in agroecosystems (up to 46,1 %). In purpose to mitigate windage, forests ecosystems, consisted primarily from Robinia pseudoacacia, were formed on the former agricultural locations. Goal of our research was to determine usability of forest ecosystems as carbon sinks and remediator of SOM content in Vojvodina's chernozem. In that purpose we've sampled soil from natural reserve Čarnok, agricultural locations immediately near natural reserve (Carnex T-49, Čerevićke livade) and on locations under forest ecosystems as near to the agricultural locations (Provalije, Čerevićke livade). Work on the project took place in two phases: field survey with sampling and laboratory analyses. Field survey and collection of soil samples was performed in July 2016. Samples were taken by mean the agrochemical probe from the surface layer of the soil to a depth of 30 cm. The content of humus in the soil was determined by oxidation of soil organic matter with $K_2Cr_2O_7$. Mean distance between locations and natural reserve was 6 km. Results showed that humus content on agricultural areas (3,47 % and 2.46 % respectfully) was significantly lower than in natural reserve (5.33 %), Forest ecosystems, on the contrary, tend to increase the content of organic matter in the soil (4,01 % and 3,62 % respectfully). Researched forest ecosystems are formed on former agricultural land, and it is evident that they are currently engaged in sequestration of carbon and are remediating SOM content. Results of the research showed that the humus content in forest ecosystems on Vojvodina's chernozem has increased significantly, which should be taken into account when planning a strategy towards carbon sequestration and soil organic matter content remediation on the chernozem soils in Vojvodina region.

Carbon in the aquasoils of the Sea of Japan

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We found no clear relationships between the amount of organic matter in bottom sediments and the characteristics of the distribution and nature of living matter in the oceans and seas. Humus of studied bottom sediments can be attributed mainly to the humic type by its composition. Non hydrolyzing part of humus reaches 70-90 %. This is characteristic feature of bottom aquasoils formed in the small bays, internal coastal shelfs and the underwater slope. The carbon of humic acids in organic matter ranges from 4 to 80 % of total concentration of humic and fulvic asids. This is due to conservation conditions favourable for humic acids in precipitation with high content of organic matter. Whereas fulvic acids in the aquatic environments are more labile and almost not dumped. The greatest concentration of organic matter was found on the submarine and coastal slopes at depths more than 120 m. Slight variation in parameters that characterize the composition of humus is notable for all bottom sediments, as well as the marine environment, largely cancels the general conditions of humus formation around the basin of the Sea of Japan.

Biogeochemical tracing techniques to study the flood runoff generation processes at small representative catchments (south Pacific Russia)

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Extremely high variation in rainfall rates (up to 200–300 mm per day as typical in Pacific Russia monsoon climate) provides as usual 10–20 times increase in discharge values in river flow. How and how fast does atmospheric water reach the streams? The authors share their 2011–2017 experience in the present-day biogeochemical tracing techniques application to the summer runoff generation research. The Mobile Research Catchment (MRC) we used in study is offered to be discussed. This approach is illustrated by the case short-term studies from small research catchments in Sikhote-Alin Mountains, mostly the Ussuri/Wusuli River headwaters. The advantages and limitations of use of natural dissolved solids are shown, and the available methods of high temporal and spatial resolution, hydrological monitoring for precipitation and flow, and chemical features of atmospheric, soil (subsurface), low stream and flood stream water and, also, laboratory analysis of water samples to reveal tracers to track the stream flow sources, are presented. Combined hydrological and biogeochemical monitoring results in discrete concentration-time series and continuous discharge series, which allow to obtain detailed information about the stream flow generation mechanism and catchment- and slope-scale flow paths as mostly based on the End Members Mixing Analysis modelling. The biogeochemical tracers provide the estimating the volume of the slope conduits, shallow groundwater and water contributions to stream flow. The proposed MRC–approach seems to have significant implications for short-term hydrological and environmental research in vast scarcely studied areas of the North East Asia.

Ammonia-oxidizing bacteria respond to multifactorial global change

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Human activity is profoundly altering ecological systems. Recent studies have demonstrated that multiple co-occurring global changes can alter the abundance, diversity, and productivity of plant communities. These alterations include increases in atmospheric CO_2 due to fossil-fuel use and land-use change, with subsequent changes in air temperature, precipitation, and the deposition of nitrogen containing compounds. Belowground processes, often mediated by soil microorganisms, are central to the response of these communities to global change. Very little is known, however, about the effects of multiple global changes on microbial communities. We examined the response of ammonia-oxidizing bacteria (AOB), microorganisms that mediate the transformation of ammonium into nitrite, to simultaneous increases in atmospheric CO_2, precipitation, temperature, and nitrogen deposition, manipulated on the ecosystem level in an agricultural soil. Both the community structure and abundance of AOB responded to these simulated global changes. Increased nitrogen deposition significantly altered the structure of the ammonia-oxidizing community, consistently shifting the community toward dominance by bacteria most closely was most pronounced when temperature and precipitation were not increased. Total abundance of AOB significantly decreased in response increased atmospheric CO_2. This decrease was most pronounced when precipitation was also increased. Shifts in community composition were associated with increases in nitrification, but changes in abundance were not. These results demonstrate that microbial communities can be consistently altered by global changes and that these changes can have implications for ecosystem function.

What are the prospects for the organization of the carbon market in the Russian Far East?

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The implementation of the climate policy strategic directions of reducing emissions in Russian Federation in accordance with adopted Decree № 752 on reducing greenhouse gas emissions sets a target of reducing emissions 25 % below 1990 levels by 2020. In this regard, the development, adaptation and introduction of well-known instruments for controlling greenhouse gas emissions remains relevant for the regions of Russia. The cap-and-trade system for reducing emissions is recognized in the world economy. According to the World Bank, in 2017, the coverage of carbon pricing initiatives on global emissions has increased threefold over the past decade, translating to the equivalent of around 7 gigatons of carbon dioxide ($GtCO_2e$), or about 13 % of global GHG emissions. The carbon market is sensitive to the political will of the governments, the uncertainty of the world economy, the willingness of society to pay for reducing the level of CO_2. Looking ahead, next year could see the largest ever increase in the share of global emissions covered by carbon pricing initiatives in a single year. If the Chinese national Emissions Trading System (ETS) is implemented in 2017 as planned, it would become the largest carbon pricing initiative in the world, surpassing the EU ETS. The huge ecological potential of the Russian Far East with its forest and other ecosystems that play a planetary role in the carbon cycle and climate mitigation remains uninvolved in the market turnover. It serves the absorption of carbon dioxide on its territory and other countries, not covering the costs allocated from the budget for its protection. What are the institutional conditions and prerequisites formed in Russia for the organization of a regional carbon trading system in the Far East? What obstacles prevent the involvement of environmental potential in market relations for its protection and territory development? What is the advantage of voluntary carbon markets? All these issues related to the regulation of carbon emissions in the Russian Far East are going to be discussed.

Theoretical and practical issues of landscape studies

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Based on the analysis and synthesis of inter-component and inter-landscape correlation, considering deep roots of pericontinental dichotomy, orographic, climatic, and phyto-vegetative factors, the nature is reflected in a medium-scale landscape model of Primorsky Krai, including individual landscapes, types, kinds, subclasses, classes, districts, provinces and territories. The regional landscape differentiation and organization of natural environment was mapped at the scale of 1: 500,000. The obtained data can be used for a multistage analysis of correlations among landscape geosystems different in scale (global, regional, local) and structure. In general, the organized system is a basic morphological model aimed at various natural interrelations in Primorsky Krai in Pacific pericontinental landscape belt. It is specially noted that absence of basic regional structural model results in inaccurate reflection of current natural situation by numerous models of nature management. That is why it is necessary to have a basic model of landscape geosystem before making objective multi-profile assessments of dynamics and functioning of geographical space. Such a model, considered within the limits of landscape geography, is represented for instance by the landscape geosystem model of Primorsky Krai. In this case, the basic geosystem model is the structural landscape geosystem developed through landscape synthesis within landscape morphology approach. Application of this kind of geosystem model through landscape method and on condition of continuing geosystem studies is of a great potential for solving of numerous tasks of various profile, including nature use, environmental, managerial, forecasting etc.

Functional-ecological assessment of organic C dynamics in soils designed for sustainable lawn ecosystems in Moscow conditions

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Sustainably functioning urban lawns are vitally important component of the modern urban ecosystem. In the biggest European megalopolis Moscow its urban lawn soils' environmental functions are especially important in conditions of high anthropogenic impacts. According to Moscow governmental regulation of urban lawn soil quality the specialized private companies need renew the lawn topsoil after their organic C content decreases lower acceptable values. It means not only extra costs but also the huge resource of annual CO_2 emission comparable with the transport one. The 3-year (2012–2015) functional-ecological monitoring of soil CO_2 emission and topsoil organic C dynamics in the field container experiment with different composition and construction of the man-made lawn topsoil showed the best level of the integrated environmental functioning in case of versions with 10-cm and 5-cm horizons with peat and sand mixtures. Soil atmosphere-regulation, biota-support and water-regulation environmental functions are considering as the principal ones effected by organic-mineral interactions in the lawn topsoil and subsoil. Obtained results became the basics for new field experiment designed in the Environmental Station of the Russian Timiryazev State Agrarian University with 8 monitoring plots 2 by 5 meters and 10-cm topsoil created from mineral sandy or loam materials compounded with peat moss or lowland peat. Transfer of the already verified monitoring protocol from the container experiment to the field one with plot areas comparative to the real lawns and with additional loam versions of the lawn soil mineral component will give us possibilities to develop experimentally based recommendations for sustainable lawn soil design taking into attention soil environmental functions including CO_2 emission regulation one.

Mountain-Taiga Station as an object for geo-environmental integrated monitoring of the mountain-valley area

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The Far Eastern Federal District includes a phase of intensive settlement and exploitation of natural resources. Statements and actions on the high Presidential, Parliamentary and Governmental levels confirm this. Such activities show the entire historical experience of humankind, accompanied by a variety of disfunctional natural environmental components. This will lead to a variety of environmental consequences if we don`t track the real situation, fix and assess the adverse consequences of such activities. The Mountain-Taiga Station is the target of a research for monitoring the environmental conditions in the mountain-valley landscapes of South of the Far-East. In this territory, there are landscape units of varying degrees of disturbance and are in the process of recovery. When the of Mountain-Taiga Station was set up, soil and vegetation cover were represented by the areas either in their natural state and anthropogenically modified, including in the process of degradation. Numerous and valuable research in the field of stationary studying of plant resources, conducted by the staff of the Mountain-Taiga Station, will require comprehensive monitoring of soil and vegetation cover. Therefore, obtaining new data on the soil condition and soil mapping is important for obtaining reliable data on long-term changes of ecosystems under the influence of natural and anthropogenic factors. In 2017 a soil-geobotanical survey has been repeated to obtain new data on the state of soil and vegetation cover. The author's original soil map of the Mountain-Taiga Station in the scale of 1:25,000, reflecting the current state of the soil, was created. The map of the vegetation cover was created. Soil and plant cover of the territories of the Station, including anthropogenic, has undergone changes in the direction of recovery. Results show cessation of the soil erosion, restoration and increase in the number of natural vegetation species. These researches are important to study and evaluate the degree of degradation or restoration of natural and anthropogenically transformed lands of Southern Primorye.

Perennial monitoring of soil respiration in Moscow urban forest

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Perennial environmental monitoring of soil respiration has been run at the RTSAU Forest Experimental Station which is a background object for environmental monitoring in the northern part of the Moscow metropolis. Its area is almost 250 hectares with absolute height variation 160–175 m and predominance of Sod-Podzoluvisols which different forms of organic, humus-accumulative, podzolic and transitional horizons have various degrees of hydromorphic and gley features. In general, soil cover patterns are represented by combinations according to the mesorelief forms that are characteristic of the background south-taiga ecosystems in the center of the European Russia. The maximum soil CO_2 emission was 36.29 g/m^2 per day recorded in early June 2013 on the top of the soft moraine hill. In the most dry season 2014, the maximum CO_2 flluxes were observed in the down part of the short North-Eastern slope during summer period (between 26 and.27 g g/m^2 per day). In 2015 and 2016, the dominant limiting factor for the seasonal dynamics of soil respiration (carbon dioxide fluxes) in the 5 representative plot with different versions of Sod-Podzoluvisols was soil temperature as in summer (RST = 0.64 - 0.91) as in fall (RST = 0.62 - 0.92). Soil moisture is more significant environmental factor in fall various conditions (RSW up to -0.62) than in summer (RSW = 0.11 - 0.50). In 2015 with usual precipitation level there was stronger soil moisture effect than in 2016 with unusual high summer precipitations. Taking into attention that over the past decades, the average annual temperature in the RTSAU campus has increased significantly: by 1.7°C in 2010 – 2015 in comparison with 1949 – 1981, these monitoring results give us possibility to predict future CO_2 emission in the Moscow forest Sod-Podzoluvisols with various hydromorphic/gley features and recreation impacts on soil cover.

Impact of redox cycles on accumulation of selected trace lithophile elements in iron-manganese nodules

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Iron- manganese nodules occur in soils of different origins and act as specific filters for soil self-purification. The nodules consist of different combinations of Fe and Mn oxides. The nodules are also characterized by a well-defined sorption activity for different elements. Elements differ in their selectivity for sorption by the Fe-Mn compounds in the nodules. Climate change and, respectively, soils redox cycles changes can affect the properties of the major Fe-Mn compounds in the nodules and of their associated elements. Despite extensive studies, little is known about how the accumulation of Sr, V, and Y in nodules varies according to variations in redox potential. Strontium and V are potentially dangerous for the natural environment. Yttrium is considered as “immobile elements” of soils. In this work, we collected nodules from Udepts on the west coast of the Pacific Ocean (south Russian Far-East) and investigated the dynamics of Sr, V, and Y accumulation in the nodules under controlled redox conditions in a column experiment, and studied Fe-Mn nodules using energy dispersive X-ray fluorescence spectroscopy, atomic absorption spectrometry, electron probe microanalysis, and field-emission scanning electron microscopy. The nodules consisted of a complex Mn-Fe-oxide matrix, soil mineral grains, and C-rich areas. In the nodules, Mn was the most important determinant for the accumulation of Sr and Y whereas V was predominantly associated with Fe under natural conditions of redox cycles that occur in surface soil horizons. The results show that the redox conditions above the value of 120 mV was sufficient to release Sr and Y from the nodules into the soil solution, while V was fixed into the nodules. These observations led us to suggest that V would not be released from the soil during nodule dissolution, whereas Sr and Y would be released.

Dendroclimatic reconstruction of autumn–winter minimum temperature in the Southern Sikhote-Alin, Russian Far East, since 1509 AD

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The aim of our research was to reconstruct climatic parameters (for the first time for the Sikhote-Alin mountain range) and to compare them with global climate fluctuations. As a result, we have found that one of the most important limiting factors for the study area are the minimum temperatures of the previous autumn-winter season (August-December), and this finding perfectly conforms with that of other territories. We reconstructed the previous August-December minimum temperature for 505 years, from 1509 to 2014. We found three cold periods (1650-1681, 1791-1853, 1865-1918) and four warm periods (1509-1529, 1562-1583, 1747-1781, and 1944-2014). These periods correlate well with reconstructed data for the Northern Hemisphere and the neighboring territories of China and Japan. Our reconstruction has 2-4, 9-,11-, 48- and 189-year periods, which are in line with high-frequency fluctuations in ENSO, the short-term solar cycle, PDO fluctuations and the de-Vier quazi-200 solar activity cycle, respectively. We have confirmed the climatic response to solar activity, which corresponds to cold periods during the solar minimum. These comparisons show that our climatic reconstruction based on tree-ring chronology for this area may potentially provide a proxy record for long-term, large-scale past temperature patterns for northeast Asia. The reconstruction reflects the global traits and local variations in the climatic processes of the southern territory of the Russian Far East for more than the past 500 years.

XXI century challenges in climate change opportunities and constraints for the Russian Federation agriculture

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While globally projected climate changes will result in most crop yields general decline (up to 20 %, IPCC 2014), Russia will benefit from temperature warming due to an increasing of growing season length and generally more mild climate conditions, including predicted enhancement of precipitation (Valentini, Vasenev, 2015). Characteristic for the RF southern taiga zone in XXI first decades accelerated annual temperature growth is almost in 3 times higher than mean planetary one (Vilfand, 2017). Together with essentially increased precipitation values this resulted in 2 record years for grain crops total harvest in 2016 and 2017. Grain export growth and more favorable agroclimate conditions gradually improve RF farming profitability and sustainability. Growing RF agricultural potential will be strengthened due to arable land area increasing in case of previously abandoned farms and profitable farming development in new intensive agricultural regions with favorable agroecological conditions – especially in the east and north parts of Russia. However, despite these favorable circumstances further sustainable development of RF agriculture requires land current and predicted state agroecological assessment, climate-smart agricultural land-use design using new crop varieties and agrotechnologies – best adapted to local agrolandscape and agroclimate conditions. Increased temperature and precipitation are favorable not only for crops but their pests, weeds and pathogens too that already resulted in the fusariose fast expanding in 2016. To be able to solve the new agroecological problems and to use the new land agroecological potentials we need the adapted to concreate regions of Russia smart agroecological monitoring and decision support systems (Vasenev e.a., 2017) as combination of climate, soil, crop and land-use models to help land-users in implementation of agriculture best practices.

Identifying national biodiversity hotspots using abiotic and climatic factors with modelling approach (example of China)

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We suggest quantitative measures which allow transfer of two criteria of the 25 global biodiversity hotspots to a national level for 74 large countries and show, how these measures can be applied for mapping of national biodiversity hotspots. To qualify as a global hotspot, an area must contain at least 0.5% of the world's 300 000 plant species as endemics, and should have lost 70% or more of its primary vegetation. The plant endemism criteria of global hotspots are captured by quantitative measures of endemism, which are approximately scale-independent and can be corrected for a country's environmental conditions and priorities in conservation. The definition of global biodiversity hotspot is based on a type of the Threshold Endemism (TE) measure: TE is equal to percentage of plant endemic species to the 300,000 world plant species, where endemics can be meet only in this hotspot and nowhere else. The plant endemism criteria for a national biodiversity hotspot can be defined using the TE lower limit approach as for the global hotspots: a region in a country is defined as the national biodiversity hotspot if TE of the region is larger than a certain predefined percentage of the total number of country's plant species. As the first approximation we adopted the global average values for the ratio of plant endemics, 0.43. The flexible land use criteria for national biodiversity hotspots are defined from percentage of natural vegetation remaining in the global hotspots. The percentage of land use conversion of natural vegetation in the hotspots is at least two times the global value. We can use a similar criteria for identification of national hotspots in a country: an area should have lost at least two times more primary vegetation in comparison with the country's average loss as a whole. Thus, we show that national biodiversity hotspots can be mapped from the species-energy relationship for vascular plants using climate, topographical and land use data, when spatial pattern of species richness is unknown. The elaborated methodology for mapping national biodiversity hotspots from abiotic factors was applied for case study in Asia-Pacific region (on example of China). The minimum-area-required approach was applied to border national biodiversity hotspots from the simulated vascular plants species richness data at 0.5°x0.5° spatial resolution. The resulting hotspots are in good spatial correlation agreement with the Chinese hotspots determined independently by experts.

Reconstruction of spring-summer precipitation and temperature from tree-ring data for the middle Sikhote-Alin Mountains, Russia

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The influence of climatic factors on the tree-ring of Pinus koraiensis was studied in the middle Sikhote-Alin Mountains, the Russian Far East. Ring-width residual chronologies were developed for two ecologically different sites. Both precipitation and air temperature affected the radial growth significantly. March–April mean temperature, May–August mean temperature (1678–2009) and March-July precipitation (1717–2009) have been reconstructed from Korean pine tree rings. These represent the first spring-summer mean temperature and total precipitation spring-summer reconstructions for this region (42.00–54.00°N and 132.00–138.00°E). As a result, the March-July precipitations from both chronologies were combined together into one regional chronology from (1717-2009). We found the high significant relationships between March-April air temperature and the Arctic Oscillation Index in the negative phase (the period from 1940 to 1980, $R^2 = 0.75$) and between precipitation amount in March-July with the same Index ($R^2 = 0.67$).

The influence of anthropogenic load on urban forest carbon dioxide fluxes assessed by eddy covariance measurements

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Modern urban forests are represented by complex mosaic of areas with wide range of anthropogenic load. RTSAU Forest Experimental Station is urban forest typical for the northern part of Moscow megalopolis. In its southern part there is a complex path network, several service buildings, small green houses, garden and forest areas, where eddy covariance tower was installed. Tower is 5 meters higher than maximum canopy level, which is about 25 meters. Forest areas significantly differ in species composition wile most of the species are deciduous ones: Quercus robur, Acer plantanoides, Tilia cordata, Betula pendula. Coniferous species are represented mainly by Pinus sylvestris and Larix decidua. In soil cover there are dominated by Sod-Podzoluvisols with thin litter (in forest area) and developed humus-accumulative horizon with mean humus content 3,24 %. Analyzed here six-month carbon dioxide fluxes data (from April till October 2014) shown mean footprint diameter around 400 m with all directions evenly due to wind rose fluxes obtained from. Utilizing UAV obtained investigated territory orthophoto, area around tower was separated into sectors, according to its anthropogenic load, which was assessed as ratio of sector area under forest to the residential or manmade area. Dynamics pattern of diurnal carbon dioxide fluxes for all sectors was the same during all investigation period, except August, due to long period without precipitation. Estimated daily fluxes values were higher in sectors with lower anthropogenic load for the whole period of investigation, except August, and ranged from -2 to 8 g C CO_2 d^{-1} m^{-2} with mean value at 2,5 g C CO_2 d^{-1} m^{-2}.

Eastern sector of the Northern Sea route: problems and prospects for the development of sea transportations

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The article explores the specifics of cargo transportation by sea in the Eastern sector of the Northern Sea Route. Dynamics of cargo handling in northern ports and transportation of cargo by sea transport. The main factors influencing the transportation of goods. The problems of ensuring the delivery of goods to the regions of the Far North and the areas equated to them are investigated are reviewing. The prospects for the development of the Free Port of Vladivostok regarding the development in the Northern Sea Route.

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