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Program and abstracts

Compiled by:
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Session Program

Greetings: Prof. Paul Hudson, Secretary COMLAND

Chair: Prof. Haim Kutiel

09:00 – 09:20	Geoinformation Studies of soil and vegetation patterns along Climatic gradients: A review Maxim Shoshany
09:20 – 09:40	Assessments of human induced desertification processes, study case of Saratov region, Russia E. Argaman, A. Zeiliguer, S. D. Keesstra and O. S. Ermolaeva
09:40 – 10:00	The effect of Agriculture land use on soil erosion and Deposition on the Meghalaya Plateau, NE India Pawel Prokop and Grzegorz J. Poreba
10:00 – 10:20	Combating land degradation through participatory Approach: The case of Sudan Edinam K. Glover

10:20-10:40 coffee break

Chair: Prof. Jacob Maos

10:40 – 11:00	Land degradation as a consequence of industrial depression in North Hungary Gergely Horváth, Gábor Csüllög, Gábor Gercsák and Zoltán Karancsi
11:00 – 11:20	Environmental degradation caused by diverse mining activities in Sakha Republic (Yakutia) Russian Federation Bella Bychkova Jordan
11:20 – 11:40	Soil aggregation in semi arid rangeland I. Stavi, E. D. Ungar, H. Lavee and P. Sarah
11:40 – 12:00	Increasing climatic aridity (1970-2002) in Israel and impact on environmental degradation in the Arava Valley Hendrik J. Bruins, Ziv Sherzer and Hanan Ginat
12:00 – 12:20	Increasing Agricultural Wadi Terraces in the Negev Desert: Construction features to prevent erosion and land degradation Gabriel Ore and Hendrik J. Bruins

12:20-13:30 Lunch Break

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13:30 – 13:50	Floods and city planning in Budapest Gercsák Gábor
13:50 – 14:10	Changes in land use and environmental impacts on the Araguari River Hydrographic Basin, (MG) Brazil Carlos Rodrigues, S., and Silva, T.I.
14:10 – 14:30	Land degradation along large flood plains: A lowland perspective from Dutch Rhine and Mississippi Rivers Paul F. Hudson
14:30 – 14:50	Land degradation due to LULC changes in Israel's coastal watersheds: The Poleg watershed case study Roey Egozi and Naftaly Goldshleger

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Chair: Prof. Andrea Vacca

15:10 – 15:30	Geomorphic Degradation of volcanic cinder cones Moshe Inbar
15:30 – 15:50	Syn-eruptive degradation of volcanic hillslope and recoveries from it Suwa H. and Yamakoshi, T.
15:50 – 16:10	Some insights on soil heat induced chemical, physical and mineralogical changes cycles Gil Eshel, Rachel Lugassi, Gila Notesco, and Eyal Ben-dor
16:10 – 16:30	Trends in soil-vegetation dynamics in burned Mediterranean pine forests: the effects of soil properties Lea Wittenberg and Dan Malkinson
16:30 – 16:50	Origin and Nature of Notches on the carbonate slopes of the Carmel Mt. Nurit Shtober-Zisu

17.00 Departure to Carmel Forest, Evolution Canyon and Atlit Viewpoint

19.30 Dinner on the Carmel Dado Beach

Assessment of Human induced desertification processes, study case of Saratov region, Russia

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During recent decades, human-induced desertification processes spread over large areas in arid and semi-arid regions, globally. These processes are, mostly, the result of inefficient agricultural interface, which accelerate land degradation. Marks area, located in Saratov district, southeast Russia, is one of the largest and intensive agricultural areas that provide a large portion of field crops to Saratov district and its surrounding region. During the early 1960's the region experienced a vast growth in water availability, from the Volga River, via improved water harvesting and transport systems accompanied with constructions of modern irrigation systems that increased yields significantly. These new systems compensated the low annual rainfall & snow available for rain-fed agriculture. However, since the collapse of the Soviet Union, these infrastructures deteriorated and the region experience increased water stress and salinization that result from raising saline groundwater table. In order to detect human-induced desertification processes we utilized image-processing products of Landsat images from the past 30 years that provided the ability to detect the impact of salinization spread followed by land-use change and reduction of available water for irrigation. These products in conjunction with climate and ground truth data show that during these years the region experience deterioration of land quality resulting a decrease of yields and biomass production. Applying, statistical & physical, supervised classification algorithms based on surface quantitative and qualitative properties (e.g. albedo, surface temperature, NDVI & TVDI) and it dynamics enable the possibility to quantify the long-term impact of these land degradation processes. Our results show that physical classification methods provide the accurate and reliable outcome comparing commonly used statistical methods for classifying land-use change impacts over time. Furthermore, the analysis also show that over 50 percent of the region, that been transformed from irrigated to rain-fed, experience water stress due to salinization that became a major limiting factor. Therefore, we find that remotely sensed products enable fine detection and assessment of desertification processes by combination of surface fluxes and common vegetation indices.

This study was done by the support of the DESIRE project, as part of it global desertification monitoring program.

Increasing Climatic Aridity (1970-2002) in Israel and Impact on Environmental Degradation in the Arava Valley

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The study of climatic change is complex and not always unequivocal. Moreover, how does climatic change affect the landscape and the environment in hyper-arid desert regions, which are outside the official UNCCD definition regarding desertification? A three-fold analysis of climatic trends in Israel for the period 1970–2002 was conducted (Kafle and Bruins, 2009), based on three different parameters: average annual temperature, annual precipitation and the annual aridity index P/PET (P = Precipitation; PET = Potential Evapotranspiration). A total of 39 meteorological stations were included in the investigation, situated in most parts of the country. It appeared that a warming trend is evident in all parts of Israel. However, precipitation and P/PET aridity index values are usually not declining in the coastal plain, but in the more inland regions of Israel, both eastward and southward. In fact the ariditization of the climate for the period 1970-2002 is most pronounced in the deserts of Israel. A detailed climatic analysis will be presented of meteorological stations in the Negev and Arava Valley. Subsequently the impact of climatic acidification will be evaluated on the Arava Valley. The springs in the hyper-arid Arava Valley have been of great significance throughout the ages in terms of the environment and human ecology. Since the 1960s groundwater pumping caused a lowering of the groundwater table and the drying of springs in various parts of the Arava. Data will be presented of three selected springs to show environmental degradation: ‘Ein Amatsyahu in the northern Arava, ‘Ein Mashak in the central Arava and ‘Ein Netafim in the southern Arava. The apparent impact of ariditization on the vegetation, including the decline in Acacia trees, will also be discussed.

Reference: Kafle, H. and Bruins, H.J. (2009) Climatic trends in Israel 1970-2002: Warmer and increasing aridity inland. *Climatic Change* 96:63-77.

Environmental Deagradtion Caused By Diverse Mining Activities In Sakha

Republic (Yakutia), Russian Federation

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Since the early 1950s many Siberian regions have undergone rapid development due to the intensive extraction of valuable mineral resources, including gold, diamonds, oil, natural gas, coal, uranium and other. The Sakha Republic (Yakutia) has been called the 'diamond colony' of Russia, but in fact it has been a source of much more than rough diamonds. 50% of all Russia's gold comes from the republic. In addition, Sakha (Yakutia) has large deposits of coal and natural gas, as well as recently developed oil fields. Strip mining, underground nuclear explosions for so-called "peaceful purposes" and significant disturbance of large areas of permafrost are just a few factors that brought about unprecedented environmental degradation in the republic. This paper focuses on the major consequences of Soviet environmental policies for the ecology of the region, as well as the economic and political ramifications of those policies for the local society.

Keywords: environmental degradation, Sakha Republic (Yakutia), 'diamond colony', strip mining, destruction of permafrost

Land degradation due to LULC Changes in Israel's coastal watersheds: The Poleg Watershed case study

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Israel's coastal watersheds are characterized by mixed land uses including: urban, agriculture, and industrial uses. One such example is Nahal Poleg watershed, which has an area of approximately 120 km^2. Using aerial photography and satellite imagery we are able to identify anthropogenic pressure on the land, such as urban sprawl, and cultivating of natural open areas. Over the last decade the urban area and the cultivated area (row crops) have increased by 5% each. The increases of impermeable areas result in shorter concentration times and larger volumes of runoff water. In addition the sandy loam soils in row crops such as potatoes and carrots are left crumbled and bare during the first rain events of the season (autumn), which are typically convective in nature and thus have high rainfall intensities. The coupling effect of these land use and land cover (LULC) changes result in large amount of sediment supplies into the channel network.

While the fine material (clay and silt size fractions) is transported in suspension large amounts of well sorted sand (D_{50} = 0.210 mm; $\sqrt{D_{84}/D_{16}}$ = 1.2) are transported as bedload. While the banks of the river remain cohesive and overall stable the river bed is aggrading with sand bed deposits ranging between 0.2 and >1 m. The incised channels have been mutant into sand bed conduits.

Quantifying the spatiotemporal dynamics of the changes in sediment and channel morphology provide understanding of the dominant land degradation processes in Israel's costal watersheds but require further study. The data is significant for regulating water resource development and river basin management, including the evaluation of land use management and soil conservation techniques.

Some insights on soil heat induced chemical, physical and mineralogical changes cycles

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Calcareous soils are characterized by alkaline pH (~ 8) based on calcite mineral domination that serves as buffer agent. Numerous studies have reported that soil pH is likely to increase up to 3 units after fires (to pH 12), and about a year later, the soil pH returns to its original values. Several studies have related this phenomenon to the burned plants residuals (ash), rich in major soluble ions (Ca^{2+}, Mg^{2+}, K^{+}, Na^{+}) and their oxides.

In our resent study, spectral changes in a combusted Rendzina soil were investigated. Several interesting changes in the soil's mineralogical chemical and physical characteristics were observed. One of the most dominated changes was a shift of the calcite ($CaCO_3$) absorption peak at temperatures above 600^{o}C. Another interesting observation was a swelling of the combusted soil samples, a couple of days after the combustion. After conducting several mineralogical and chemical tests, we concluded that the changes observed were due to calcite pyrolysis to calcium oxide (CaO) with the release of CO_2. The formation of calcium oxide, already in moderate temperatures (e.g. 600^{o}C), could explain the rapid increase in the soil pH, observed in other studies: When calcium oxide reacts with water, it forms calcium hydroxide ($Ca(OH)_2$) which results as an alkaline condition (pH 13). The rapid decrease in the pH value after a year or two, could be explained by the presence of a CO_2 rich environment. When CO_2 and water react, with the presence of calcium hydroxide, calcite will precipitate. In such a case, the soil pH will be buffered back to its original pH values (~ 8). The swelling of the combusted Rendzina soils could explain the reduction in the bulk density and moister holding capacity observed in Biria after forest burning.

Floods and city planning in Budapest

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The capital of Hungary is situated on the banks of the Danube, the second longest river in Europe. The area of the city was hit by severe floods several times in the past centuries. Most of the floods on the Hungarian section of the river are caused by heavy rains in May or June in the western and northern parts of the water basin of the river accompanied with the rapid melting of the snow in the Alps. Less frequent, though much more dangerous are the floods that are caused by the ice drifts forming dams and blocking the river flow in late winter. This paper discusses first of all the historical icy flood of the Danube in 1838, which destructed the town (mainly the Pest part) and forced the city to combat the recurring flood hazard. As a result, the modern cityscape and the street pattern of the inner area of Budapest were formed greatly as an answer to the inundations of the Danub.

Combating Land Degradation through Participatory Approach: The Case of Sudan

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Land degradation emerging as a result of access to and control of forest resources provides a window on the social complexity of resource competition in the Sudan. Within the last three decades, Gedaref state in eastern Sudan lost its status as one of the major sources of food production in the country, due to large-scale degradation of its rich soil as well as other natural resources, mainly through unsuccessful land use policies and practices. This paper provides a scientific analysis of approaches used in rehabilitation, establishment, management, protection and sustainable development of forest resources while contributing to poverty reduction among local people. The study involved a cross-sectional survey of 162 farmers through questionnaire-based interviews, group and focus group discussions. Results from descriptive statistics found that the attitude to illegal entry into the forest for farming, fuelwood collection and grazing explains a low stocking density in the natural forest reserve. Findings further show that deforestation has contributed to land degradation in the area. The study concluded that the development of participatory forest management and agroforestry offers a multi-faceted strategy to meet the growing demand for nutritious food and wood products in the area. The study proposes options for policies and land-use arrangements that enable the rural population to manage their farm and forest resources in an integrated and socially, economically and ecologically sustainable way, and to add value to their products; thus improving their livelihoods.

Keywords: Participatory forest management, deforestation, land degradation, law enforcement, rehabilitation, Sudan, sustainable management, tenure.

Land degradation as a consequence of industrial depression in North Hungary

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The fall of the former “socialist” states in Central Europe resulted in a long lasting economic crisis of those cities that were industrialized first in the 19th century and intensively developed again during the “socialist” era. The breakdown of the industry and mining, the lack of their adequate reclamation as well as the ceasing of the migration of workers, transmigration of the population and the lack of investments limit the rational use of resources in the heavy industrial regions. This paper discusses these effects on the land in the region of depressed towns such as Ózd and Salgótarján in North Hungary.

The industrial decline resulted in secondary landscape degradation, which is perhaps irreversible and more dangerous than the first one caused by industrialization 100–150 years ago. The abandoned industrial landscape and the consequences of the social changes caused by the pauperization of the people add to the very negative landscape utilization. It is most difficult to find a solution. The revival of the industry is nearly impossible, because these "rust belts" do not attract capital. The agricultural land use can not be reformed without capital investment and manpower; therefore, the agrarian environment gradually degrades. The burgling of woods at Ózd is another recent effect on the environment. The deforestation assisted by the state for gaining biomass energy also results in the loss of forests and the degradation of both the natural and the cultural landscapes. Formerly, they were in a state of equilibrium – this is going to be lost in front of our eyes.

Geomorphic degradation of volcanic cinder cones

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The evolution of landscape over time is a central aspect of geological, paleogeographical and geomorphological studies.

Cinder cones are the simplest and most common volcanic landforms in existence. It is probably the only one on the globe with a distinct and defined initial date of formation, and lasting no more than a few million years, before erosional processes flatten it, a short time in the earth's geological history. The evolution of cinder cones erosion might be associated to the period of time of exposure to degradation processes. The progressive decrease of morphometric parameters with increasing of age is the basis for relative dating of cones by comparative measurements .

Recent volcanic features like cinder cones offer the opportunity to monitor the processes and development of the landscape. Morphometric and morphological studies, together with remote sensing, tephrochronology and methods of absolute dating, are efficient tools for determining ages of cinder cones, their morphological evolution and spatial-time development of volcanic landforms.

The aim of this study is to analyze erosional processes affecting the degradation of the cinder cones under different climatic conditions.

Degradation values for the Kamchatka peninsula are higher than the published for semiarid areas in the southern Andes or the Golan Heights.

Peaks of erosion occurred probably in the first stage of one or two years after the eruption, with the stripping of the fine ash material, as recorded in several volcanic areas of the world.

Morphological and morphometric values of the monogenetic cinder cones, measured in the field and by digital elevation models, can be used to validate their age and erosional processes affecting them.

Keywords: Landscape evolution, Cinder cones, morphometry, degradation processes, volcanic geomorphology.

Land Degradation along Large Floodplains: A Lowlands Perspective from the Dutch Rhine and Mississippi Rivers

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Floodplain land degradation occurs as accelerated aggradation or erosion and is manifest in a myriad of styles. Most attention to floodplain land degradation has focused on small floodplains that are strongly coupled to hillslopes, and therefore represent archives for studying changes in runoff and soil erosion. Floodplains along large coastal plain rivers are less strongly coupled to upland processes, but their substantial size is often associated with intensive engineering and land use practices that trigger "local" land degradation. In this study we categorize and examine different types of floodplain land degradation along the lower reaches of the Dutch Rhine and Lower Mississippi, which represent large floodplains that have been heavily modified for flood control and agriculture. The data sets include historical cartography and topographic data from recently available LiDAR, which is utilized to consider the spatial pattern of subsidence, aggradation, and floodplain removal in relation to floodplain development. The study results represent important lessons regarding the transformation of large floodplains that support dense populations, which in an era of recognized global environmental change has resulted in an increase in flood vulnerability and thereby triggering new approaches to manage large floodplains.

Keywords: Dutch Rhine, Lower Mississippi, LiDAR, floodplains, land degradation, fluvial geomorphology

Ancient Agricultural Wadi Terraces in the Negev Desert: Construction Features to Prevent Erosion and Land Degradation

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A large number of cross-channel terraces were constructed in the central Negev highlands in ancient times, including the Byzantine Period, to harvest runoff water for agricultural production in the desert. Wheat, barley, pulses, grapevines and olive trees were grown, according to documentary and archaeological evidence. The cross-channel terraces appear in many ephemeral stream channels (wadis) of the 1st to 5th order. Larger wadis are usually not suitable, as flash floods become too powerful, while gravel rather than loess soil covers the streambed. The terracing of wadis enhanced soil aggradation and prevented desertification. The terraces were abandoned during the early Moslem period – more than 1000 years ago. Despite the lack of maintenance, many of the cross-channel stone walls and terraces are still intact in the Negev highlands. Investigations were conducted to study construction features of stone terrace walls. It appeared that the orientation of some walls is not rectangular with respect to the longitudinal direction of the stream course, but has a distinct angle, apparently to better accommodate stream flow and prevent erosion. The orientation of individual building stones in the terrace walls was also investigated, showing sophisticated construction features to make the walls stronger vis-à-vis the erosive forces of flash floods. The amazing strength of the dry stone walls to prevent soil erosion over many centuries – without maintenance – is shown in a case study in the vicinity of the ancient Byzantine City of Avdat. A 4th order terraced wadi near the Cistern Farm (Havat Habor, in Hebrew) joins the large 6th order Wadi Zin, the main ephemeral stream in the central Negev. The confluence between the two wadis shows at present a difference of 2 meter in elevation between the respective streambeds, as a result of terrace building in the Cistern-Farm wadi. The lowest stone course in the last terrace wall before the confluence has preserved the geomorphic surface of the Cistern-Farm wadi at the time of construction during the Byzantine Period, being *ca* 30-40 cm above the present level of Wadi Zin. Subsequently, *ca* 170 cm of soil accumulated above this former surface level. Evidently, the terracing of the Cistern-Farm wadi resulted in soil aggradation and soil preservation until today, combating desertification long before the coining of the term in the 20th century.

The Effects Of Agricultural Land-Use On Soil Erosion And Deposition On The Meghalaya Plateau, Ne India

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Soil erosion related to agriculture is a major factor for land degradation on the hilly Meghalaya Plateau in North-East India. The agricultural system practised at higher elevations (1600-1900 m a.s.l.) is a modified form of shifting cultivation adopted for better utilisation of limited land and biomass which are under growing pressure of population. In this fallow system farmers cultivate potato, cabbage, raddish and legume on slopes inclined up to 30^{o} in the monsoonal rainfall conditions of 2400 mm annually. Intensive cropping in two seasons per year caused accelerated soil erosion. Consequently, the soils are often devoid of upper horizons, and they in many places, have a character of waste cover only. Therefore, it is necessary to quantify soil loss and to identify adequate land management to prevent progressive erosion. The mid-term soil erosion rate was estimated using the radionuclide tracer ^{137}Cs in the small (2.6 ha) agricultural catchment. The spatial distribution of ^{137}Cs activities reflects the erosion-deposition pattern. The depth of presence of ^{137}Cs varies between 5-10 cm for the most eroded convex part of the slope and 35-40 cm at the catchment bottom. However, for bottom part of the valley still caesium inventory is smaller than reference value. It indicates that valley floor is not only the deposition area but also a transit place with net soil loss. Soil erosion values were calculated by proportional and mass balance models. The results clearly show that soil erosion is considerable for study area and can exceed 50 t ha^{-1} $year^{-1}$.

Changes in Land use and environmental impacts on the Araguari River Hydrographic Basin, (MG) Brazil

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The Araguari River Basin is now suffering the effects of unsuitable land uses in recent decadesand the responses to these impacts are changing the environment. The Araguari River is located in the central uplands of Brazilian and in the last forty years these region suffered a huge change in the regional economy due to the agricultural green revolution. The Araguari River is one of the main tributaries of the Paraná River, the second biggest river in South America. This region has been occupied since the middle of the 19th century, but only in the last four decades of the 20th century has the natural vegetation been cleared for agriculture and livestock grazing, accelerating landscape transformation. The hydrographic basin is divided into three geomorphological systems (sedimentary plateau, dissecated landforms and a canyon). The natural vegetation of the region in which the Araguari River Basin is located is the *Cerrado*, a kind of Brazilian savanna where small trees and herbaceous strata merge to create a dense vegetation cover. A huge change in the natural vegetation occurs after the 1960 decade, with the clearing of vast Cerrado areas and introduction of agriculture and pasture. Now, the land uses varies from automated agriculture in the flat areas, to irrigated horticulture in the valley slopes, to pasture and natural vegetation on the high gradient slopes. The main changes in the landscape were the construction of four hydroelectric plants on the valley bottom, and now in the first 200km of the valley, only 9km has the original features. Even the river discharge in this small area is not the same, because the river flow was derived by a adduction tunnel and only a small discharge remain in the original channel path. The changes in the land use are derived from the insertion of technology on the agricultural production and uses of the river. New data obtained from the land use maps from 1979 to 2009 show that enviromental laws promotes the regeneration and development of areas with natural vegetation, which contributed also to the new scenario of the area. The main environmental impact which occurs in the rural area are soil erosion as gullies, rills, and sheet erosion, and changes in the amount and use of water, which was also changed by agricultural activities in special by irrigation systems, with a non-control of the water explotation. In urban areas the major impacts are soil sealing and changes in urban streams, causing flash floods and degradation of the lowlands.

GeoInformation studies of soil and vegetation patterns along Climatic Gradients: A Review

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Global evidence regarding magnitudes of desertification processes and recognition in their societal, ecological and climatological consequences had lead the international community to establish the United Nations Convention to Combat Desertification (UNCCD). Within the framework of this convention it is perceived that Desertification is a complex poorly understood phenomena which is " first and foremost, the result of resource management failures". Scientific research within this context have three primary roles: monitoring the situation, developing the understanding of relationships between factors promoting desertification and finally providing the international community with efficient recommendations regarding actions which may slow down these processes.

Study of desertification processes in regions of sharp climatic gradients is of special importance within this framework since they represent areas where the processes are most intensive and where most deserts actually expand.

The detection of threshold zones coupling sever land degradation with loss of resilience in their eco-geomophic systems is fundamental for the efficient combating of global desertification. Application of geoinformation tools and techniques is instrumental for this purpose: mapping biological, chemical and physical surface properties using remote sensing techniques, mapping historical patch-pattern changes using air-photographs, analysis of spatio-temporal variations in pattern properties and analysis of informational relationships between these surface properties and patterns with climatoloical, topographic, lithological and human factors. Numerous Remote Sensing studies had been undertaken during the last four decades in monitoring desertification through the provision of maps describing spatial distributions of biophysical surface parameters at resolutions between few meters to few kilometers and temporal resolutions between hours and weeks. These studies utilized radar backscattering, spectral reflectance at the visible, NIR and SWIR ranges and emissions in the thermal spectrum. However, despite the magnitude of these projects very few of the methods were proved to be operational yet. The main shortcomings of exiting methods are:

- They are highly dependent on accurate calibration which for large region is impractical.
- Most of the methods are semi-empirical: case dependent rather than representing robust physical indicators.
- There is no one imagery source which is good for all mapping purposes, most of the methods use single imagery source and there is relatively little synergy (fusion) between imagery sources.
- Data continuity for long time periods exits mainly for low resolution sources which are limited in supporting modeling of processes.
- Difficulties in scaling-up results and methods from the local to the broad-regional scales

Within the scope of interest here the most important shortcoming concern the fact that relatively little work treated explicitly regions of high climatic gradient partly due to their high spatio-temporal heterogeneity. Three areas of recent advancements in studying explicitly transition zones between humid and arid regions :

- Mapping bio-physical properties of vegetation forms (herbaceous, dwarf-shrubs and shrubs): cover proportions, biomass, primary productivity using synergy between optical (phonologies) and SAR imagery.
- Mapping chemical and physical soil properties and estimating their erodibility using hyper and multi spectral methods, and SAR backscattering.
- Mapping soil and vegetation patch patterns and their changes within the last decades using historical airphotographs.

These advancements lead to the detection of threshold zones between regions along these gradients according to following indicators:

- Life-forms compositions, biomass and primary productivity. Analysis of relationships between biomass and rainfall allow differentiation between cases were vegetation compositions and properties which follow 'expected' successional sequences and those which represent harsh land degradation with productivity significantly less than would be expected according to their average annual precipitation.
- Soil chemical compositions referring mainly to organic carbon, inorganic carbon and ferrum. These mapping allowed the detection of 'tipping points' in the high transition zones.

Analysis of historical patch-patterns, evolution modes using air-photographs and GIS techniques allowed insight into soil and vegetation pattern dynamics. Recent results had revealed that in some areas of low biomass there is maintained similar pattern fragmentation as in areas of higher rainfall. This signifies the functioning of self-organization and consequently the potential resilience of some areas of relatively low primary productivitylocated at desert margins.

In conclusion, current geoinformation tools and techniques on one hand had shown their potential contribution to the modeling and understanding of desertification processes in general and the formation of thresholds through the functioning of 'tipping' mechanisms and 'catastrophic shifts'. However, these tools and techniques are not yet operational at the wide regional scale. Better synergy of remote sensing sources and availability of longer time series of surface properties will facilitate the combat of desertification with both better understanding of the processes and predictions of expected spatial change in different warming and human disturbance scenarios.

Origin and nature of notches on the carbonate slopes of the Carmel Mountain

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Some of the best-known landforms associated with the Carmel Mountain are "Notches" (in Hebrew: Tsnirim). These morphological features, apparent on carbonate rocks, take the shape of half tubes that extend over tens or hundreds of meters, along stream valley slopes. Although this morphological phenomenon is widely observed, little is known about its origin and the processes that shaped these enigmatic forms. The term "notch" is used in the relevant literature to describe horizontal "C"-shaped indentations, developed on slopes or cliffs, regardless of their location or shaping mechanism. In previous studies conducted worldwide, few models were proposed for the evolution of notches, mostly implying on coastal or marine abrasion, stream banks erosion, karst erosion, or corrosion made by nearly static water along the slopes. The only previous research of these unique landforms of the Carmel Mountain, has been conducted 37 years ago (Butrimovitch, 1972). The research concluded that their appearance at three main levels should be attributed to past sea levels, and accordingly, the notches must be of coastal origin.

The present study suggests that the notches are dissolutional cavities cut into particular limestone or dolomite beds in accordance with specific chemical and mineralogical properties of the lithic material. It is suggested that the notches developed under subaerial conditions, formed by runoff accumulated along the slopes. The notches are not necessarily linked to past water table levels. It is possible however, that they represent past climate conditions, when abundant soils held close to the bedrock covered the slopes. As the sediments and the soils were stripped off, the notches were exposed. At present, bioerosional processes, carried out by cyanobacteria or additional organisms, continue to act upon the carbonate substrate, contributing to the further development of the notches.

Soil aggregation in a semi-arid rangeland

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Aggregation is an important process related to the soil structure and stability. This study examined a range of soil aggregation indices in a semi-arid rangeland in the northern Negev region of Israel. We examined how soil aggregation is affected by hillside aspect (north- *vs.* south facing hillside), type of surface cover, and livestock grazing. The soil of three types of surface cover – shrub patchs, intershrub areas, and flock trampling routes was sampled in an area subject to grazing and in grazing exclusion plots. We determined the aggregation indices of <250 μm, 1000-5000 μm, >2000 μm, >8000 μm, and the mean weight diameter. Considerable differences were found between the hillside aspects, as well as among the three types of cover. Grazing affected the fractions 1000-5000 μm and >8000 μm. The aggregation indices of the trampling routes were distinct from those of the intershrub area. It is proposed that in semi-arid rangelands, uneven grazing pressure in the intershrub area creates spatial heterogeneity in soil aggregation properties, which affect the spatial redistribution of soil resources and primary production.

Syn-eruptive degradation of volcanic hillslopes and recoveries from it

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Volcanic eruptions would induce abrupt increase in the frequency of lahars: volcanic debris flows and hyperconcentrated stream flows. This syn-eruptive degradation comes from two conditions. Firstly tephra-fallout increase storm runoff. Secondly substantial amounts of new fill of pyroclastics are prone to be scored by sheet and gully erosions. However the rate of sediment discharge would decrease exponentially in the post-eruption. The time constant for the function depends on the eruptive style, climate and so on. Potential hazards depend on the activities and magnitudes of the sedimentation. Observation of sediment discharge at volcanic torrents of Mount Unzen, Mount Yakedake in Japan, and Mount Merapi in Indonesia, provides insight into the degradation at volcanoes with histories of the eruptive activity. Comparison of sediment discharge at the torrents indicates that, although the erosion rate would abruptly increase by eruption, it is expected to decrease exponentially, from a syn-eruption rate of10^1-10^2 mm/yr, to a post-eruption rate of 10^1 mm/yr within several years, and finally may approach the level of 10^0 mm/yr or less within a few decades. The frequency of debris flow also markedly increases with eruptions, then it decreases with time after the termination of eruption. Both changes are caused mainly by a drastic increase and a progressive decrease in runoff coefficient of hillslopes. The observation from 1994 through 1999 at Mount Unzen indicates that a fast recovery of vegetation onto the once devastated slopes assures larger infiltration capacity, higher initial loss of rainfall and greater roughness of slope surface again to give smaller storm runoff than the values in syn-eruption, while the observation from 1975 through 1999 at Mount Yakedake indicates a similar change in revegetation augmented a threshold of rainfall intensity sufficient for triggering debris flows. The latter shows an example for the longer-term post-eruptive sedimentations.

Keywords: Lahar, Debris flow, Erosion rate, Sediment discharge, Storm runoff, Revegetation

Trends in soil-vegetation dynamics in burned Mediterranean pine forests: the effects of soil properties

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Fire has long been recognized as a primary disturbance affecting soil-vegetation dynamics in Mediterranean ecosystems. The temperature of the burnt soil coupled with addition of the ash produce changes in soil chemical and physical properties, decreased infiltration and increased runoff and erosion rates. Following wildfire events in two forests growing on different soil types, we investigated runoff, erosion, nutrient export and vegetation recovery dynamics.

The Biriya forest site, burned during summer 2006, is composed of two dominant lithological types: soft chalk and marl which are relatively impermeable. The rocks are usually overlain by relatively thick, up of to 80 cm, grayish-white Rendzina soil, which contains large amounts of dissolved carbonate. These carbonates serve as a limiting factor for vegetation growth. The planted forest in Biriya is comprised of monospecific stands of *Pinus* spp. and *Cupressus* spp. The Mt. Carmel area, which was last burned in April 2005, represents a system of varied Mediterranean landscapes, differentiated by lithology, soils and vegetation. Lithology is mainly composed of limestone, dolomite, and chalk. The dominant soil is Brown Rendzina whilst in some locations Grey Rendzina and Terra Rossa can be found. The local vegetation is composed mainly of a complex of pine (*Pinus halepensis*), oak (*Quercus calliprinos*), *Pistacia lentiscus* and associations.

At each site several 3X3 m monitoring plots were established to collect runoff and sediment. In-plot vegetation changes were monitored by a sequence of aerial photographs captured using a 6 m pole-mounted camera.

At the Terra-Rossa sites (Mt. Carmel) mean runoff coefficients were 2.18% during the first year after burning and 1.6% in the second. Mean erosion rates also decreased, from 42 gr/m^2 to 4 gr/m^2. The recovering vegetation was dominated by shrub and resprouting trees, and vegetation cover values of 31.5% and 24% were found in the north and the south facing slopes, respectively. In the second study year vegetation cover reached 65% and 54%.

In spite of similar precipitation distributions, different patterns were observed at the light rendzina sites of Biriya where both runoff and erosion rates remained high along the two-years study period. Mean runoff coefficients exceeded 10% on both aspects, during the first year and only a slight decrease was noted during the second one; erosion rates increased from 120 gr/m^2 to 180 gr/m^2. After the first rainy season only 5.7% of the plots were covered by herbaceous vegetation. At the beginning of the second season vegetation cover remained low, and towards the end of it mean cover increased to 38.7% / 52% on the north and the facing slopes.

Total P and total N were measured in the runoff water collected in the Biriya sampling plots. Results indicated that nutrient losses are well correlated with TSS concentrations. During the first season TP values (in runoff water) ranged from 2.2 – 142 mg/l, while TN concentration ranged from 2.5 – 2595 mg/l. During a high intensity rainstorm, TSS in the Biriya site exceeded a value of 1000 g/m^2.

Lower rates of revegetation as observed in the Biriya sites, and the consequent high runoff and sediment coefficients, can be associated with several factors. Among them is the maturity of the planted pine forest and the fire-induced destruction seed bank, but also to local soil characteristics. Amplified runoff rates associated with high TSS, and N and P losses, might further contribute to the relatively slow revegetation rates and to the consequent delayed decrease in runoff and erosion.