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REMOTE SENSING METHODS FOR PHYTOMASS ESTIMATION AND MAPPING OF TUNDRA VEGETATION

ABSTRACT
Mapping of above-ground phytomass provides a baseline for monitoring climate-induced changes, especially in the northern regions. This is important for practical applications, such as assessing quality of pastures and defining reindeer migration routes. Use of very high resolution (1 m and better) aerial and satellite images is of particular interest, because changes at the level of individual trees can be monitored over comparatively large areas. The goals of this study were to: i) establish relations between phytomass values and structure and spectral reflectance derived from ground research and ii) upscale from ground data to QuickBird satellite imagery to compile maps of above-ground phytomass for key sites. As a result, the study has produced a preliminary map of the above-ground phytomass of lichens for a test site in the Tuliok Valley, Khibiny Mountains, central Kola Peninsula, Russia, with phytomass values well in line with fieldwork data.

KEY WORDS: above-ground phytomass, lichens, Tuliok, Kola Peninsula, ground spectroradiometry, QuickBird, mapping

INTRODUCTION

Vegetation is the most informative component in studies of geosystems at different scales. Vegetation defines geosystem features and their structural and functional organization including processes of creation, transformation, and migrations of matter, energy, and information. Large-scale mapping of vegetation may be a useful tool in analysis of biodiversity and in monitoring of vegetation productivity. Cartographic methods facilitate identification of spatial patterns and structure; they also help to define the nature of vegetation changes and their trends, to determine vegetation productivity, and to develop cartographic models that describe situations arising from impacts of natural and anthropogenic factors. At the present stage, large-scale mapping and remote sensing data (RSD) enable the most accurate (depending on image resolution) representation of vegetation structure. Assessment of stocks and structure of above-ground phytomass is one of the primary challenges in addressing some of the problems of the rational use of natural resources, especially in less accessible northern areas. RSD can facilitate studies of

spatial structure of vegetation and of natural and anthropogenic factors that influence phytomass while minimizing labor-intensive fieldwork.

Biological productivity is a fundamental property of the biosphere. The term refers to the ability of living matter to reproduce biomass thus forming biotic cover. The issue of biological productivity in providing energy resources for ecosystem functioning is the object of studies of many researchers [Bazilevich, 1993; Ilyina, Yurkovska, 1999; Zlotin, R.I. 1995].

The main purpose of this study was to develop a methodology for mapping lichen phytomass of mountain and lowland tundra ecosystems using multi-spectral high-resolution satellite imagery in a case study on the Kola Peninsula.

OBJECTS AND METHODS OF THE RESEARCH

The study was conducted in two key plots that differed in topography and climate. The first site is located in the Tuliok River valley, the Khibiny mountains, in the center of the Kola Peninsula. The second site with more severe climatic conditions is located on a low-hill plain near Lake Kanentiavr, east of Murmansk (Fig. 1).

The vegetation of Khibiny mountains is primarily of northern and sub-Arctic types and includes about 400 species of higher plants and lichens. Clearly marked altitudinal zonation is visibly expressed: the bottom of the valleys are occupied by spruce and pine forests and birch scrub woodlands; higher up in elevation, the landscapes change from forest-tundra to mountain tundra on the slopes of the mountains and to arctic deserts on the plateau-like tops. From 500–600 m in the Khibiny mountains, the upper and, occasionally, middle parts of the slopes, mountain tops, and glacial cirque bottoms are covered with mountain tundra phytocoenoses. The lower boundary of the tundra zone begins from a narrow strip of dwarf shrub tundra dominated by dwarf birch. The sites with a stable high moisture

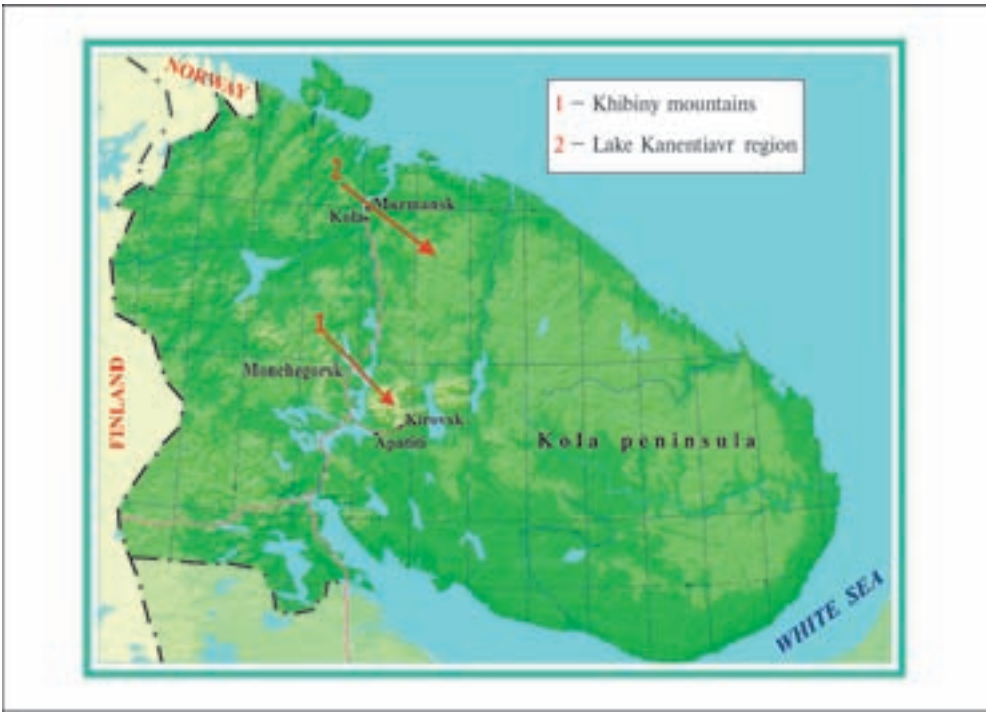

Fig. 1. Location of the sites.

regime and the steep slopes are associated with grass-dwarf shrub-green moss-dwarf birch tundra.

A significant part of the territory is occupied by dwarf shrub-lichen tundra. On the plateau-like tops of mountains, rocky dwarf shrub-lichen tundra is formed; here, the vegitation is the most sparse. Near Lake Kanentiavr, from north-east to south-west, fragments of tundra and forest tundra alternate successively. Forest-tundra is formed by birch primarily, whose patches grow together with tundra ecosystems. Along rivers, birch forests are developing. Tundra zone is heterogeneous and is represented in the north by dwarf shrub tundra dominated by crowberry (*Empetrum nigrum*), alpine bearberry (*Arctostaphylos alpina*), cowberry (*Vaccinium vitis idaea*), and dwarf birch (*Betula nana*); mosses and lichens cover up to 25% of the soil surface. Down south, dwarf shrub tundra is replaced by grass-shrub lichen tundra with crowberry, dwarf birch, blueberry *(Vaccinium myrtilis)*, alpine bearberry, alpine asalea *(Loiseleuria procumbens)*, and various species of lichens [Milkov, 1964; Ramenskaya,1983].

METHODS FOR MAPPING OF PRODUCTIVITY PROCESSES

There is a large variety of mapping techniques for representing productivity processes, among which are the two fundamental: the first method is based on field data and on previously created maps and the second method is associated with the use of RSD. Although today the second kind of mapping is considered to be the most widespread, especially for large and hard-accessible territories, field studies are needed for building "training samples" and for verification of models obtained.

Data on spatial and species structure of the plant cover were collected at the key plots. Samples were collected from the plots, 25 × 25 cm in size, to measure above-ground phytomass. Reflectance factors were identified using ground spectroradiometry. These surface values were compared with the summer satellite imagery QuickBird 2005–2006 (spatial resolution of spectral bands is 2.4 m) for further compilation of maps of above-ground phytomass based on multispectral images. These activities continued the long-term studies that have been conducted in the central part of the Kola Peninsula beginning in 1993 [Ecology of the North, 2003; Kapitsa, Golubeva, 1997].

Indices are often used in work with satellite images. These indices represent parameters that combine reflectance factors of image pixels in several spectral bands. Such derived features are most widely used in analyses of vegetation cover [Labutina, 2004]. These features include characteristic differences in spectral reflectance of plant objects in the red and near infrared bands of the electromagnetic spectrum. Differences in the optical characteristics of plants in these bands are associated with the composition and state of plant pigments and tissues, morphology of plants in general, age, and different environmental conditions. Vegetation pigments absorb light energy selectively, most intensely in the red spectrum, while the near infrared region is associated with the maximal reflectance of vegetation. There are several versions of vegetation indices, including the VI (Vegetation Index), the SAVI (Soil Adjusted Vegetation Index), the NDVI (Normalized Difference Vegetation Index), as well as dozens of other indices, some of which represent modified indices mentioned above while others are more complex indices based on biophysical modeling and calibration with ground-based data, such, for example, as the LAI (Leaf Area Index) [Labutina, 2004]. The NDVI, which is a simple quantitative index of green biomass, is most often used when interpreting the vegetation cover. The NDVI is calculated as follows:

$$\mathbf{NDVI} = (\mathbf{V}ir - \mathbf{V}r)/(\mathbf{V}ir + \mathbf{V}r),$$

where **V**r and **V**ir – reflectance in the red and infrared bands of the spectrum, respectively. The calculation of the NDVI is based on the

two most stable (not dependent on other factors) parts of the spectral reflectivity curve of vascular plants [Knizhnikov, Kravtsova, Tutubalina, 2004].

Ground-based spectroradiometry mainly allows separation of vegetation by type, species composition, and its condition on the basis of spectral parameters, their correlation with phytomass, and through assessment of correspondence of ground and remote sensing data. Ground-based spectroradiometry allows separation of lichen, lichen-dwarf shrub, and dwarf shrub vegetation and separation of lichens by type. The shape of spectral reflectance clearly identifies dead plants and rocks with or without crustaceous lichens. It has been shown that specific levels of technogenic impact on tundra vegetation (i.e., completely dead tundra vegetation and vegetation with strong, medium, and slight damage) are expressed in four-channel ground spectroradiometry [Ecology of the North, 2003; Rees, Tutubalina, Golubeva, 2003].

Thus, ground spectroradiometry can be used to assist in understanding spectral representation of vegetation obtained using multispectral satellite images and for addressing various tasks: detailed measurements of spectral radiance/reflectance values, identification of dependences of spectral reflectance of objects upon various natural factors, and investigation of reflectance dependence upon the direction of observation under different lighting conditions.

During fieldwork, we gathered over fifty 25 × 25 cm vegetation samples, which were measured with a spectroradiometer and geobotanically described. The main goal of the field spectrometric studies was to determine the values of the reflectance coefficients for individual plant species and for specific areas that can be detected in high-resolution satellite images (Fig. 2). For this purpose, we used a portable field SkyeInstruments SpectroSense 2 + spectroradiometer (http://www.skyeinstruments.com), consisting of two sensors, one of them pointing down and capturing reflected radiation within a solid angle of 25°, while the second sensor pointed up and covered by a diffusing glass capturing the incident and scattered solar radiation within the hemisphere. The measurements were made in four spectral bands, centered at the wavelengths of 475, 546, 677, and 837 nm. The results of the measurements were calculated to the coefficients of reflectance using calibration certificate of the device.

Measurement results were visualized as reflectance coefficient plots (Fig. 3), demonstrating the ability of green vegetation to selectively reflect incident solar radiation depending on species composition and conditions of plants.

After the measurement, all the above-ground vegetation was harvested from the key plots and separated by species and by green and non-green parts of plants. Later in the lab, the samples were dried at 105 °C and weighed to derive absolutely dry above-ground phytomass values.

The next stage was to define the relationship between the values of phytomass and two spectral metrics of samples derived from the ground radiometry: the NDVI and the average spectral reflectance in the visible spectrum (blue, green, and red spectral bands). For this analysis, absolutely dry phytomass values were summed up for three groups: green parts of plants, non-green parts of plants, and lichens. Then, linear regression analysis of these grouped phytomass values against the NDVI and against average visible reflectance was performed.

At the final stage, we have attempted to compile a preliminary map of the above-ground lichen tundra phytomass for the Tuliok site using the QuickBird image of 28.06.2006. We have identified lichen tundra areas on the preliminary classification map (courtesy of our colleague Anna Mikheeva) which was compiled by maximum likelihood classification of the QuickBird image.

We have calculated the NDVI image from the QuickBird image radiometrically corrected to radiance values. We have then used three GPS-located lichen tundra field plots within the Tuliok site to obtain the relationship between the ground NDVI and the satellite image-derived NDVI, by linear regression. Finally, we combined this relationship with

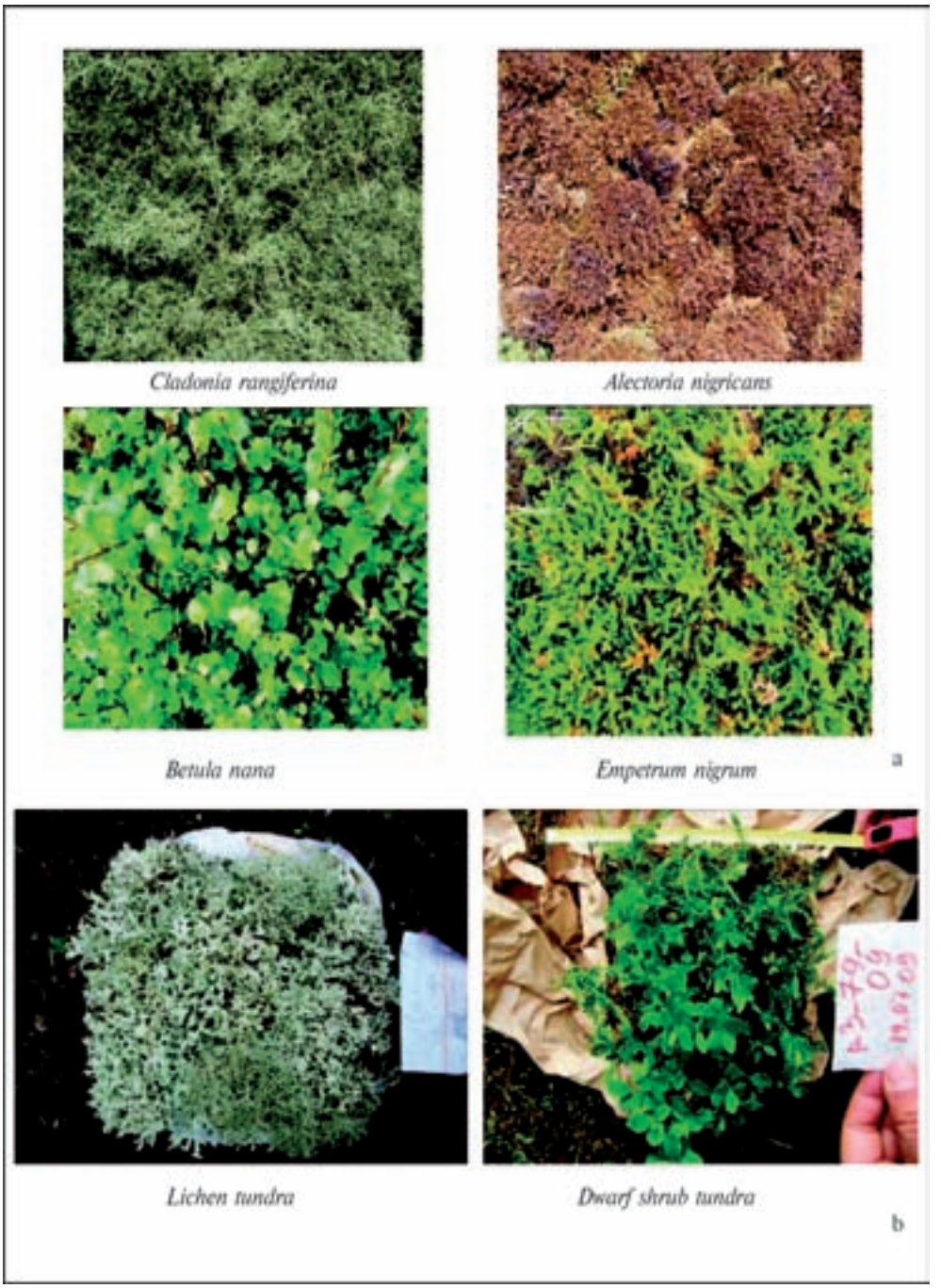

Fig. 2. Example of ground spectroradiometry samples: a) "pure" species, b) samples from test areas for comparison with satellite images

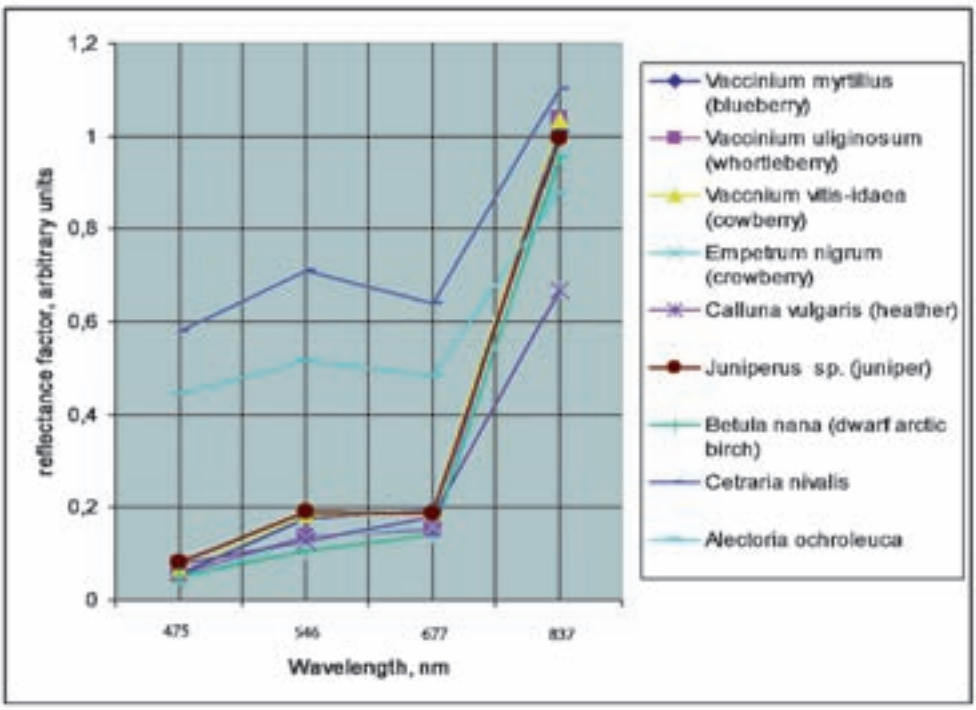

Fig. 3. Reflectance coefficients for typical tundra plant species.

the relationship between the above-ground phytomass of lichens and the ground NDVI established earlier to upscale from the ground-level to satellite data in order to create the map of the above-ground phytomass of lichen tundra within the limits of the "lichens" class in the QuickBird image classification.

RESULTS

Optical properties of forest-tundra and tundra landscapes of the Kola Peninsula were primarily determined by reflective properties characteristic of their moss, lichen, dwarf shrub, shrub, and tree components. Tundra landscapes have diverse optical properties. Most of light-colored, fruticose lichens (*Cetraria nivalis, Cladina mitis, Alectoria ochroleuca,* etc.) are characterized by high values of spectral reflectance in the measured bands (Rees et al., 2003). Experience gained in field interpretation of the Terra ASTER and the Landsat ETM+ images indicated that even small projective coverage of terrain by lichens significantly increases the values of reflectance coefficients on the satellite images. In lichens, the maximum reflectance in the green band of the spectrum is weak; however, the transition to the infrared band is expressed relatively strongly. For almost all lichen species, the main region of the chlorophyll absorption in the red band is weakly expressed and it is in this spectral band that their reflectance coefficients are greater compared to higher plants.

The only high correlation values and significant relationships were found between the above-ground phytomass of lichen tundra with average reflectance (normal relationship, Fig 4b) and the NDVI (inverse relationship, Fig 4a). For all other vegetation groups, the correlations were very low and usually insignificant (Fig. 4 c, d e, f).

The derived relationship between the satellite-image (QuickBird) and the field (SkyeInstruments radiometer) NDVI values was as follows:

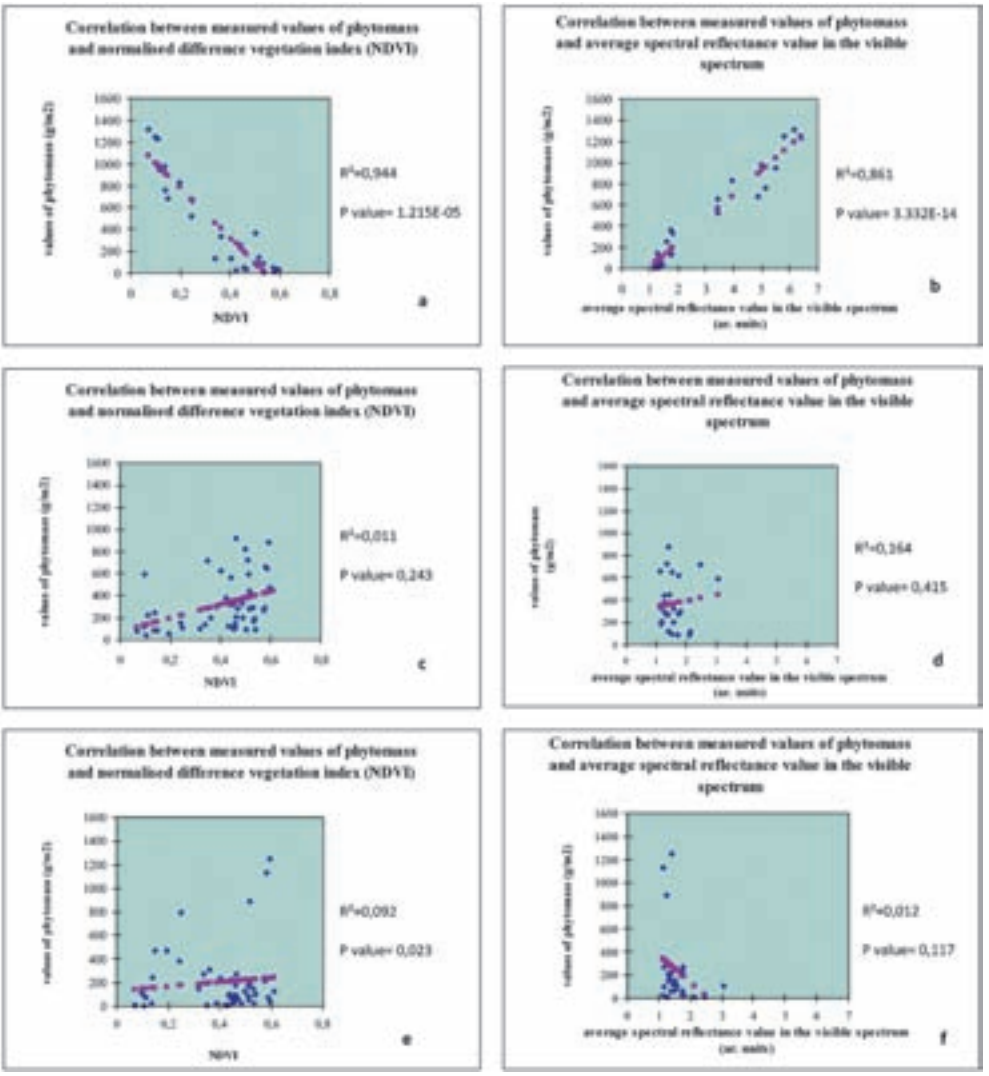

Fig. 4 Relationships between phytomass and spectral metrics of ground samples, where ◆ original values of photomass; ■ predicted values of photomass (a, b – lichens; c, d – green part of phytomass; e, f – non-green part of phytomass)

NDVIfield **= NDVI**sat.im **· 0.542 + 0.031.**

This relationship was obtained by linear regression using three field samples of lichen tundra only (more samples were not available for the Tuliok area). The relationship is characterized by a low R^2 (0.247), and a high P-value (0.876). However, the compiled preliminary map of the above-ground phytomass of lichen tundra (Fig. 5) displays a plausible range of phytomass values (from over 860 to just below 1,100 g/m^2) which is in good correspondence with the field data on above-ground phytomass (for the Tuliok field sites with the most pure and thick lichen cover, it varied within 940–1,230 g/m^2).

CONCLUSION

We have successfully demonstrated the potential for deriving the above-ground tundra phytomass maps from very-high resolution satellite imagery. Definite relationships between spectral and phytomass characteristics were derived only for lichen tundra. This is probably because

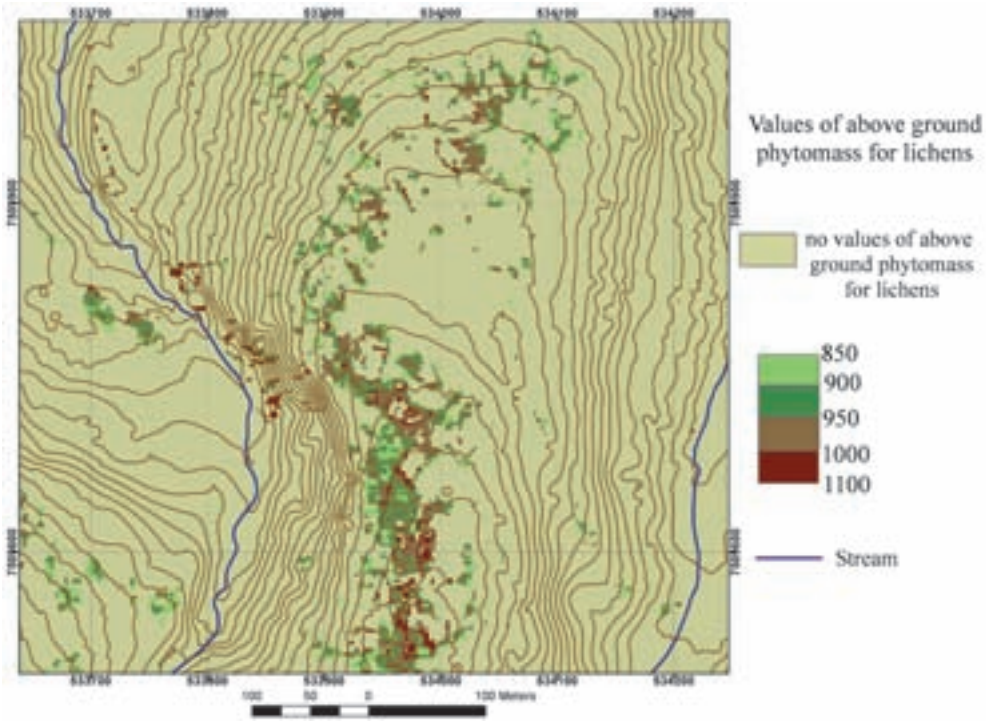

Fig. 5. Map of above-ground phytomass of lichen tundra at the Tuliok site.

the lichen tundra samples are much more homogenous vertically and do not have many vertical levels in comparison with the samples dominated by green vascular plants; this is of a great importance because ground and satellite radiometers predominantly measure radiance from the top surfaces of samples. Also, lichen tundra has a lesser variety of species and a lesser spectral diversity. It is important to note that the spectral properties were measured when samples were in their natural moist condition; however, we were not able to weigh moist phytomass in situ.

There were many uncertainties in subsequent upscaling from the ground data to the satellite image-derived map of the lichen tundra phytomass. First, the boundaries of lichen areas need field validation (in some areas at Tuliok, lichens and light stones are spectrally similar). The upscaling from the field to the satellite NDVI was not very accurate due to a small statistical sample size, spatial resolution effects (the NDVI of the field 25 × 25 cm samples was upscaled to the satellite image NDVI of 2.4 × 2.4 m pixels), and GPS location uncertainties (accurate only to several meters). However, the resulting map shows a plausible range of the phytomass values and conservative estimates suggest that the error in the phytomass estimation is well below 50%.

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SIGNIFICANCE OF MAIN MONUMENTS IN HISTORICAL DISTRICTS OF ODESSA AND ST. PETERSBURG FOR PERCEPTION OF THESE CITIES

ABSTRACT

This paper analyses the significant role of the monuments of historical districts of two major cities in Russia and Ukraine in perception of their images by people. Certain historical monuments and artifacts of Odessa and St. Petersburg have been used by official ideology and propaganda in creating of clear associations-clichés. It has been achieved through the conscious use of color combinations, lush décor, careful placement of the monuments, etc. Future research activities in this field should involve further investigation of the role of locations of socially important historical buildings and analysis of the role of various images of the city and its individual components in fiction and popular tourist literature. These efforts will facilitate holistic understanding of the value of entire cities, as well as of their individual components to collective mentality and to the public policy and ideology.

KEY WORDS: historical monuments, historical districts, mental images, Odessa, St. Petersburg, architecture, opera theaters, cruiser *Aurora*, battleship *Prince Potemkin Tavrichesky*, Eisenstein's films.

INTRODUCTION

Investigation of the role of cities in creation of space is a new area of the national school of geo-urban research that may help to understand the role of the cities in formation of their mental images and in the national geopolitics.

In this study, we relied on the works of our colleagues in the field of perceptual geography and geopolitics [Atkinson & Cosgrove, 1998; Bailly, 1986; Carmona, 2009; Cohen & Kliot, 1992; Harvey, 1979; Gravari-Barbalas, 2004; French, 1983; Miroshnychenko, 2009; Sénécal, 1992; Tuan, 1980]. The role and importance of Odessa (Ukraine) and St. Petersburg (Russia) as the focus of the national foreign policies in construction of mental images of the population and of stable narratives in official ideology became possible through understanding the concept of *geopolitical representation* by Yves Lacoste [Lacoste, 2003, p. 330-331], the methodology of "low" geopolitics in relation to realities of the post-soviet space [Kolosov, 2010], and the concept of *loci memoriae* by Petri J. Raivo [Raivo, 2004, p. 63–64].

"The city and its concrete form can be perceived by none other than through the images that they radiate" [Sénécal, 1992, p. 35]. Many of these images are now iconic objects in the perception of the city by the tourists and the townspeople[1]. Dmitry N. Zamyatin

[1] "Speaking of the Eiffel Tower in specifically used the term "image" <icône – *in the original text – I.S.*>; the word... I believe best reflecting perception of historical-tourist scenery of Paris" wrote Michel Carmona [Carmona, 2009, p. 56].

believes that the "geographic image of a city is a system of ordered interrelated concepts of space and spatial structures of the city, as well as a system of signs and symbols that most vividly and informatively represent and describe a certain city" [Zamyatin, 2004, p. 206]. It should be noted that modern Russian geographers examined St. Petersburg specifically from the standpoint of perceptual geography [Zamyatin, 2004, pp. 209–221, 257–258]. Issues of urban perceptual geography are also discussed in the paper by R. Anthony French [French, 1983].

"Political symbols, such as the national flag, the emblem, or the national heroes reproduced in statues, are uniformly distributed throughout the country in public places in such a way that the population comes in contact with ideology and they become one", indicates André-Lois Sanguin [Sanguin, 1984, p. 25]. Petri J. Raivo believes that "historical monuments and the rituals associated with them form an important part of the nation's collective memory and traditions, and serve as places that bind the members of the community to the past of their nation" [Raivo, 2004, p. 64]. "Historical sites and monuments are of obvious importance in recognition of landscapes by individuals", indicates André-Lois Sanguin [Sanguin, 1984, p. 26].

As Yi-Fu Tuan rightly observes: "...an artifact designed for control is not necessarily something crude and ugly. Beauty, after all, includes the idea of order and order implies constraint. The broad thoroughfares of Paris are splendid monumental artifacts. Yet, at least one reason for their creation by Baron Haussmann under Napoleon III's direction was to minimize the risks of rebellion and fighting of the kind that occurred in 1848" [Tuan, 1980, p. 465]. Detailed features of transformation of the iconic images of the monuments in the mental image of the city and the state ideology and propaganda are described by David Harvey on the example of Basilique du Sacré Coeur (Paris, France) [Harvey, 1979] and by David Atkinson and Denis Cosgrove on the example of the Vittorio Emmanuele II Monument (Rome, Italy) [Atkinson & Cosgrove, 1998].

METHODOLOGY

In this work, we focused our attention on commonalities associated with shaping stable images of Odessa and St. Petersburg during the period of their existence under one nation. Their images associated with the Russian Empire period are uncovered by isolating iconic, to their mental perception, buildings and monuments that have become hallmarks of the cities at that time and have maintained this value in our days. Changes in the cities' images in the Soviet Union era have been studied through popular art (images of the cities that appeared in promotional postcards and film-posters of the Soviet period) and symbolic artifacts whose images are linked to the state's official ideology.

To support our research, we used certain characteristic objects that reflect the stereotypes of Odessa and St. Petersburg in the tourist guides and textbooks for secondary schools. These objects represent the established mental clichés of these cities [Bakhnev, 2004; Belous & Kolyada, 1989; Economic Geography of the USSR, 1988; Fernandez, 1994; Kulibanov & Chistobaev, 1990; Lappo, 1993; Odessa. Yalta et Crimée, 1997; Selinov, 1930; There is a City by the Sea, 1990]. The focus on different perceptions of the city and its parts is important in creation of their mental images in this context[2].

To determine the effect of the city's cosmopolitan culture on its mental image, one should specifically look at architectural appearance of its historical core. Development of this part of the city determines the

[2] Known works of Russian and Ukrainian colleagues on this issue [Aksenov, Brade, Bondarchuk, 2006; Armand, 1992; Dergachev, 998; Lappo, 1993; Zamyatin, 2004] basically contain just a description of associations connected with images of specific cities; however, they are lacking a theoretical and a methodological background necessary for such research. References of publications by the leading world's experts in this field of geography are presented in [Sénécal, 1992, p. 38].

perception not only among visitors but also among the local population. The look of the facade of the city's downtown buildings is very important. Using the architectural style of classicism as a monumental propaganda was important from the standpoint of authorities because they were interested in creating an aesthetically valuable image of the port-city specifically from the side of the sea. Also, public performance of theatrical works "was not just an entertainment, but a significant part of social and everyday life" [Odessa: City – Agglomeration – the Port-Industrial complex, 1994, pp. 180–181] prior to the mass spread of television and radio. Therefore, it is very important to pay attention to the emergence of the cities' first permanent opera houses. Their functioning indicates inclusion of the city in the all-European, and later, in the world's cosmopolitan elite musical and theatrical cultural development.

Formation of stable geopolitical images associated with Odessa and St. Petersburg by the official ideology and propaganda of the Russian Empire

In the "low" geopolitics and in perceptual geography, stable population's stereotypes, such as motherland, fatherland, countries'/nations' enemies – friends, etc.) articulated by the official propaganda and ideology are very important. The cities, as large objects of reality, have a special role of "reference points" with a high concentration of socially significant symbols of collective mentality. In this context, the role of individual monuments and the appearance of historical districts are essential to the perception of their residents. They are the elements of the spatial identity of the citizens.

From the viewpoint of geopolitics and perceptual geography, Dmitry N. Zamyatin is quite correct asserting that "as a 'northern capital', the image of St. Petersburg contrasts more 'southern', but also metaphysically dense saturated images and it itself, in fact, is becoming more southern, more 'warm.' The metaphysics of Petersburg is rooted in the 'physics' of the Black Sea and the Mediterranean (no wonder, since Peter I first moved to the Black Sea and not having achieved a serious success, turned to the Baltic Sea). This is a warm and cozy Mediterranean world (according to Fernand Braudel) at a specific location in the Baltic's" [Zamyatin, 2004, p. 221]. "Sweet rhetoric of the eighteenth century is clouding the untruth of the 'Mediterranean' Winter Palace. The middle-class burgher Baltic's hasn't fulfilled the imperial hopes for the images of the 'South'" [Zamyatin, 2004, p. 258].

In the perception of the residents of Odessa and St. Petersburg, the "golden age" of their cities coincides with the period of their existence within the Russian Empire – being a free port, for the first of them, and the end of the reign of Catherine II – the beginning of the rule of Nicholas I, for the second [Fernandez, 1994, p. 126, Shlipchenko, 2009, p. 176]. This was reflected in the formation of a special display of a nostalgia spirit for the lost greatness of the past and resistance to innovations that entail changing external appearances of the historical districts of the cities[3]. In this context, a recovery, at the beginning of the 1990s, of most names of the cities' facilities that had existed before the Bolsheviks came to power (including the return of the name "St. Petersburg" in 1991), and special efforts by the cities' authorities, aimed at maintenance in a perfect condition of the most important monuments of the cities, especially important in the mental picture of their townspeople (for example, reconstruction of the building of the National Academic Theater of Opera and Ballet in Odessa and the Peter and Paul Fortress in St. Petersburg) should be noted. This policy supports a well-established myth of the romantic-imperial "Northern Palmira" and "Southern Palmira", where cosmopolitan European style[4] "reigned;" this style was created by invited foreign architects and sculptors and was embodied in a particular

[3] "In Odessa, where obsession of the past and hysterical and convulsive attempts to 'revive' this past along with rather tangible uncertainty regarding the present resulted in a rather poor condition of historical facilities and most dwellings of the old city" [Shlipchenko, 2009, p. 178].

[4] "It is the debt of Petersburg to fill the Empire with the desire of true Europe" wrote Dmitry N. Zamyatin [Zamyatin, 2004, p. 257].

"dialect" of the Russian language and in the formation of special Odessa's and St. Petersburg's (Leningrad's) literary schools at the end of the XIX and beginning of the XX centuries [Aksenov, Brade, Bondarchuk, 2006, p. 57; Fernandez, 1994, pp. 26, 46, 61, 73, 85, 126, 156; Kulibanov & Chistobaev, 1990, p. 32; Lappo, 1993, pp. 23, 26; Popova, 1993, p. 48; Shlipchenko, 2009, p. 180].

It is important to note that in the historical districts of Odessa and St. Petersburg since their founding, much attention was paid to the use of different colors in order to emphasize not only an aesthetic appeal of the architectural ensembles, but to also express ideological functions they perform in the mental image of the cities. This is largely due to the widespread, in the Age of Enlightenment, of ideas about the symbolic meaning of different colors. This furthermore suggests that color was used as a kind of non-verbal language specifying a particular interpretation of the appearance of buildings or sculptures and of their relations in the surrounding space by creating allegories and experimental constructs.

The front facades of the buildings in the historic centers of Odessa[5] and St. Petersburg[6] are dominated by two colors – white and yellow. White color is a symbol of holiness and purity in Christianity and is traditionally used for exterior decoration of the Orthodox churches. Yellow color in classicism[7], is the symbol of Apollo the Sun, with whom Louis XIV, who established the regime of absolutism in France, identified himself [Dyakov, 1988, p. 207]. Since the construction of the Pavlovsk Palace (1782–1786) in the Russian Empire by British architect Charles Cameron, "the theme of Apollo appears, however without its association with the Sun King, as it was at Versailles. And this is one of the main differences between the ensembles of the XVIII and of the XVII centuries" [Dyakov, 1988, p. 220].

A single carrier of both types of power in the Russian Empire was personally the Emperor and Autocrat of all the Russias himself [8]. The conscious use of a combination of white and yellow colors served as a form of emphasizing the important administrative buildings, the symbols of the supreme power in the spatial structure of the city[9].

Yellow color dominated the facades of the buildings, which can be interpreted as the rule of secular authority over spiritual authority. For example, "the contrast of golden color and whitewashed architectural details stands out in... the elegant Winter House of Peter" I in St. Petersburg [Ovsyannikov, 1988, p. 148]. It was "undoubtedly the center of the left bank of the Neva. <...> It was the focus of the state power: there, the emperor lived and met the Senate" [Ovsyannikov, 1988, p. 148]. We can assume that in its decoration, the basic ideas of a perfect color of the front facades of model urban city-centers of the power in the Russian Empire have been laid. This very combination of colors was used for public institutions and residences of the monarch and his supreme field representatives (governors-general and governors) since the end of the XVIII century.

Given that in the construction of St. Petersburg as the state capital, the state town-planning principles of Paris/Versailles were utilized and that typical architectural plans of its residential quarters were developed based on experience of the French architects, we can assert that the image of the Winter House of Peter I (1724) has, in some way, embodied the idea of a model palace of the absolute monarch of that era – the Great

[5] Based on [Bakhnev, 2004, p. 63, 83, 89; Odessa, 2000].

[6] "White columns on a yellow background – this is the true face of St. Petersburg" [Fernandez, 1994, p. 74]. "It owes it to the ancient decrees...<...> it should be kept in mind that color in Leningrad plays the role as in no city in the world" [Lappo, 1993, p. 28].

[7] In western historiography of arts, it is called neoclassicism. For a detailed explanation of the role of color in architectural ensembles of classicism see [Dyakov, 1988].

[8] These colors together with black were the heraldic colors of the Russian Empire. A combination of white and yellow colors is also present in the Vatican banner – the only modern absolute monarchy in Europe.

[9] In 1839 after the repairs, the Winter Palace "was repainted with white and yellow" [Custin, 1996, p. 471]. The symbols of the supreme power in Odessa – the Imperial Palace – the palace-residency of the governor general of New Russia (1829) has a yellow-white colonnade too [Bahnev, 2004, p. 63].

Palace of Versailles. We can assert this from the fact that in 1717, Peter I visited Versailles that had completely preserved, due to the young years of King Louis XV, settings of the state rooms and the park complex of his famous predecessor. Peter I had a chance to appreciate the effectiveness of the influence of luxury decoration of the palace and the park complex on visitors and could realize that the "unique, unprecedented, and vertiginously high position of the monarch requires exceptional circumstances"[10] [Dyakov, 1988, p. 206].

As pointed out by Andrei V. Ikonnikov, for baroque, the "object-spatial environment was primarily the entourage of a ritual, a spectacle, and a celebration demanding the uplifting nature of image expression" which "could be expressed by compositional techniques meaningful in terms of linear perspective and subordinate in the dominance of a certain axis directed to infinity" [Ikonnikov, 1988, p. 192]. "Architectural composition of settlements was established in accordance with the schemes of ideal cities developed in the European town planning... They were subject to strict geometrical principles... As for the functional content of the city... it was specifically expressed in the building of the ceremonial center dominating the residential buildings. The ideas of centralism in emphatic order became leading in that era and subsequently transitioned into reality" [Timofeyenko, 1984, pp. 198–199]. As pointed out by R. Anthony French, "Le Blond's grandiose plan for St. Petersburg was never put into practice, but it introduced the concept of a regularly planned city and St. Petersburg grew through the eighteenth century in conformity with the constraints of centralized, planned control" [French, 1983, p. 239].

Dmitry N. Zamyatin states that "the geographical image of Petersburg is quite obviously a core to understanding the image-geographical space of Russia" [Zamyatin, 2004, p. 221]. In this case, "the image of Petersburg can always be built upon using the features and attractions of its architecture and layout and finding connections and metaphors at the level of conceptually important events of the world's history that can be localized and conceptualized through a variety of cultural landscapes... or through other cities" [Zamyatin, 2004, p. 209].

Basically, in the historical districts of Odessa and St. Petersburg, continuous dense development of streets with a virtually complete absence of significant green areas[11] available only near socially significant buildings, dominates (Fig. 1). This was largely due to the fact that "the canonized approach of harmonization of composition at any level – symmetric-axial composition, regular rhythmic composition, geometric correctness of simple forms, or fronts and facades determined by the axial composition corresponds" to the architecture of the New time [Kirichenko, 1988, p. 253].

An important feature of the central parts of Odessa and St. Petersburg is a dissonance – a richly decorated facade that contrasts sharply with a virtually complete absence of decoration in the courtyard of the building[12]. The authorities of the Russian Empire were more interested in forming an aesthetically appealing image of an imperial port city seen from the sea. Therefore, the main objects of government, cultural sphere, and city attractions of the cities are as if

[10] The organizational principles of the palace-park complex at Versailles had been already reflected in the first official country seat of the tsar near St. Petersburg, i.e., in Peterhof (the modern Petrodvorets) [Leningrad, 1969, p. 221–230]. Here also, the "Big Palace – a former official seat of Peter I" has bright yellow walls decorated with white molding [Leningrad, 1969, p. 228] similar to the Grand Palace of Versailles [Dyakov, 1988, p. 208]. Later, this combination of colors was used by Charles Cameron in decoration of the facades of the Pavlovsk Palace [Dyakov, 1988, p. 209, 220]. "Multiple copies of Versailles – from England to Russia and from Sweden to the Kingdom of Napoli – show the level of cultural leadership in entire Europe of the Age of Enlightenment." [Braudel, 1998, c. 54] because «Ensemble of Versailles it is metaphor of State order» [Dyakov, 1988, p. 206].

[11] "A classical... type of a tenement building is designed based on a given configuration of the site which becomes the initial point of the house plan" [Kirichenko, 1988, p. 281].

[12] "Classicism corresponds to a multi-character nature of a ceremonial social space of streets and squares and isolated from it private utility internal space of a block or a site..., of the image of the facades of the same buildings – of the frontal side and of the back side." [Kirichenko, 1988, p. 255].

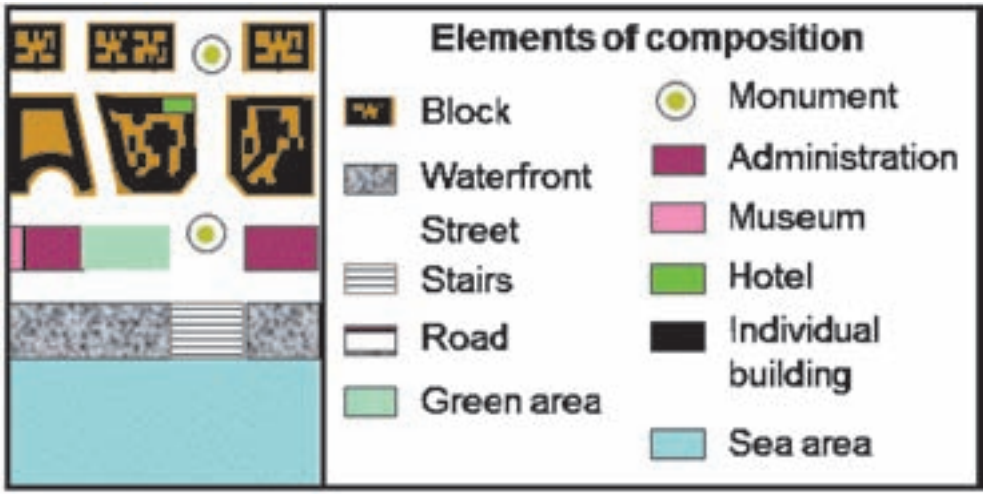

Fig. 1. The model of the historical centers of Odessa and St. Petersburg. Compiled based on [Odessa, 2003; Saint Petersburg and detailed suburbs, 2003]

Table 1. First permanent Theaters of Opera in Russia and Ukraine

City of location	The modern names of the opera house	Dates of foundation	Year of construction of the contemporary buildings	Architect of the contemporary buildings
Kyiv	Taras G. Shevchenko National Academic Theater of Opera and Ballet	1860	1901	Viktor J.G. Schröter
Moscow	Bolshoi State Academic Theater of Russia	1776	1856[13]	Alberto Cavos
Odessa	Odessa National Academic Theater of Opera and Ballet	1809	1887	Ferdinand Fellner and Hermann G. Helmer
St. Petersburg	Mariinskiy State Academic Theater of Opera and Ballet	1783	1860[14]	Alberto Cavos

Compiled from [Artists of Ukraine, 1992, pp. 602, 658, 721; Popovych, 1998, p. 468; The Soviet encyclopedic dictionary, 1988, pp. 156, 701; Ukrainian Soviet Socialist Republic, 1984, p. 477].

aligned along the waterfronts of Odessa and St. Petersburg (see Fig. 1). The most famous objects of the first city are basically concentrated within Primorsky boulevard that goes straight to the Black Sea[15]; and in the case of the second city – within the limits of Big Neva embankments transitioning into one another. The exception are the locations, in the middle of the urban sprawl, of the widely known throughout the world Mariinsky State Academic Theater of Opera and Ballet and the Odessa National Academic Theater of Opera and Ballet (Table 1).

If the construction of the permanent opera house in Odessa was the first in Ukraine, it was the second in St. Petersburg in Russia after Moscow. Till now, the two cities are, respectively, the southernmost and the

[13] Was initially constructed in 1825 in empire style (architect Joseph Bové); was completely reconstructed in 1856 [The Soviet encyclopedic dictionary, 1988, c. 156].

[14] Reconstructed in 1883 by architect Viktor J.G. Schröter [Artists of Ukraine, 1992, c. 658].

[15] "Odessa is unimaginable without it in the same way as Leningrad is unimaginable without Nevsky Avenue" [Belous & Kolyada, 1989, p. 52]. The buildings on Primorsky Boulevard were designed to be perceived from close and far distances from the seaside considering a sharp bluff", at the same time, "the development rhythm...was highlighted by a powerful vertical of the grand steps with a narrowing perspective that was designed to enhance its grand effect even more" [Timofeyenko, 1983, p. 35].

northernmost centers of art the opera in Eastern Europe. As can be seen from Table 1, construction/reconstruction of existing opera and ballet theater buildings in Odessa and St. Petersburg was done in one historical era by the architects of a similar trend[16]. ***This led to their modern form in the same architectural style (eclectic) and direction – the Viennese neo-renaissance with baroque elements***[17]. It was during that very period when such famous European Theaters of Opera[18] were built in this style: *Hungarian State Opera*[19] (Budapest, 1884), National Opera (Brussels, 1856), *National Opéra of Paris*[20] (Paris, 1875), State Opera of Vienna (Vienna, 1869) [Quid 2005, 2006, pp. 442–443].

Thus, in the mental image of Odessa and St. Petersburg, opera cannot be separated from the architectural style of eclecticism. Such close attention to this kind of specialized structures is largely due to the fact that it is precisely at that time when Russian and Ukrainian own art of opera and the cycle of outstanding works of Western classical opera national schools within the European elite culture was established [The Soviet encyclopedic dictionary, 1988, p. 930; 70, p. 381]. There is every reason to believe that parallel blooming of eclecticism in the architecture styles and of opera is not accidental, but is a natural consequence of the development of European elite culture[21].

On the squares in front of the buildings where public authorities of the Russian Empire (the Senate and the Synod in St. Petersburg and the Imperial Palace and State Public Offices in Odessa) were previously seated, are the monuments to the cities' founders (Peter I and Armand E. Richelieu[22]). The monuments can be seen from the sea. There is a certain similarity in their locations (see Fig. 1). The monuments are separated from the sea by the embankments with steps to the water, and the monuments themselves are not obstructed from the seaside by other buildings and are best seen from these positions.

In order to enhance the visual effect, the monument to the founder of Odessa stands on a pedestal and the monument to Peter I stands on a large granite slab[23]. It is important to note that these sites do not have any meaningful decor and, thus, all the attention is drawn to the figures on the pedestals. Such rigor austerity in presentation of the images of the founders of the cities, in our opinion, is related to the common ideas about presentation of the hero image in the art of the era of ancient Rome during the dominance of the style of classicism in the Russian Empire[24]. In sculpture of these monuments, an idealized image of the founder of the city, dressed in ceremonial clothing of the ruler of the Late Roman Republic/Early Roman Empire, is represented. In this style of art, it was the example of an ideal enlightened monarch[25]. A founder of the city was conceived as a demiurge that created splendor and

[16] For example, Ferdinand Fellner and Hermann G. Helmer drew their inspiration for the Odessa Theater of Opera in the Garnier palace built earlier [Odessa. Yalta et Crimée, 1997, p. 76].
[17] Based on [Artists of Ukraine, 1992, pp. 602, 658; Bakhnev, 2004, p. 80; Encyclopedia of Ukraine. General Part, 1995, pp. 811-812; Odessa, 2003; Timofeyenko, 1983, p. 58].
[18] This list contains current contemporary names of the opera theaters.
[19] It, as well as the buildings of the opera theaters in Vienna, Dresden, Zagreb, and other cities, was designed by Ferdinand Fellner and Hermann G. Helmer [Odessa, 2000].
[20] The Garnier Palace.
[21] Jean-Christophe Victor points out the pan-european character of the territorial opera art as a unique cultural phenomenon [Victor, 2007, p.46–47].
[22] Full name – Armand Emmanuel Richelieu duke of Plessis [Richelieu, 1994, p. 49].
[23] Josef Brodsky, in his story "Far from the Byzantine" was one of the first to conduct an original literary-geographic comparative investigation of the locations of the monument to Peter I and the monument to V.I. Lenin in St. Petersburg (cited based on [Fernandez, 1994, p. 156]).
[24] As Lev A. Dyakov wrote, "The main idea of classicism...is heroism. Heroism was understood as submission of passion to a harsh will directed by a mind" [Dyakov, 1988, p. 205].
25 "Classicism, being the official style, reflected simultaneously a high social pathos and patriotic inspirations. This is vividly reflected in the monumental sculpture in antic style (... the monument to A.E. Richelieu, in Odessa, 1823–28, sculptor I. Martos)" [Ukrainian Soviet Socialist Republic, 1984, p. 367]. "The statue, in a sharp and concrete form, revealed the inner content of the boulevard and its expressive silhouette and modest size emphasized the scale and rhythm of the development" [Timofeyenko, 1983, p. 26].

harmony of the city from scratch taming the forces of Nature[26].

Both of these monuments ***are the oldest surviving civil monuments erected in honor of a particular person in Russia and Ukraine***[27] [Leningrad, 1969, p. 118; Ukrainian Soviet Socialist Republic, 1984, pp. 364–368]. The fact that they were not demolished during the Soviet era highlights their paramount importance in the stable images of Odessa and St. Petersburg.

No less symbolic is the fact that the monuments to the founders of the cities are connected by direct roads to the other important, to the official mental images of the cities, monuments, i.e., the monuments to the rulers-benefactors (see Fig. 1) who, from the standpoint of the official historiography of the Russian empire, made the greatest contribution to the development of the cities – to Catherine II (in Odessa) and to Nicholas I[28] (in St. Petersburg). The decor of these monuments is very lush. The presence of numerous minor figures allows one to suggest that there is a kind of allegorical expression of a particular mental attitude. The main figures of the monuments are made in full dress. It seems possible to decipher the splendor of the decor and the presence of figures at the foot of the pedestal of the monument as indication of the unprecedented prosperity of the cities. This is highlighted by the outfits of the main and secondary figures of the monument: they are dressed in contemporary (to their time) clothes and they have a more realistic look compared with the image of the founder of the first (relatively to the time of construction) urban monument.

The two monuments – of the city's founder and of its principal benefactor, the king (in the official historiography of the Russian Empire) are on one axis and the second monument is as if looking back at the first, thus underlining the continuity of his policy towards the city (see Fig. 1). It is important to note that in the second monument, the main sculpture points directly to this by stretching out its hand towards the monument to the founder of the city. The creation of such iconic landmarks in the cities is associated with the need to consolidate certain associations and narratives in the official mythologized mental picture of their historical past[29]. It is not a coincidence that in fiction literature and urban folklore, these monuments to the cities' founders have a clear emotional appeal and act like real characters (e.g., St. Petersburg's allegoric name of the monument to Peter I is Bronze Horseman [Leningrad, 1969, p. 119] and in Odessa, the name of the monument to Armand E. Richelieu is Duke [History of Ukrainian culture, 2005, p. 1095]).

In our opinion, placing the major hotels in the cities just opposite to the monuments to the rulers-benefactors (*Astoria* in St. Petersburg and *Petersburgskaya* in Odessa)

[26] Our statement is based on the following lines from the letter of Etienne Falconet to Denis Diderot about the leitmotiv of the monument to Peter I: "The monument will be simple... I will limit my work only to the statue for this hero that I am interpreting not as a great military leader, not as a great victor though he was undoubtedly both. The personality of a creator, of lawgiver, of benefactor of his country is much higher and that is how it should be shown to the people. <....> the monument speaks about Russia and its Reformer" (cited based on [Leningrad, 1969, c. 119]). As Marquis de Custine correctly points out, "Peter here is the Romans of the Louis XV time" [Custine, 1996, p.124]. The *figure of Armand E. Richelieu* "expresses the ideal image of the ruler that is concerned with the достаток and order. This image is supplemented by the bas-relief from the three sides of the pedestal, which reflects allegorically successful accomplishments of the Duke Richelieu in such areas, as agriculture, trade, and law" [History of Ukrainian culture, 2005, p. 1095]. Ivan P. Martos, in his letter to Mikhail S. Vorontsov (12.02.1824) explained the idea of the monument to Armand E. Richelieu in this way, "The Figure of the Duke Richelieu is reflected in the moment of motion, not just standing still, which explains his activity; the right hand of the figure points to the Black Sea filled with ships whose trade is to take to all countries the products of land brought from Odessa; the left hand holds the Charter which is the attribute of all great victories and virtues, It was composed in the antic style" (cited based on [Selinov, 1930, p. 16]).

[27] They differed from the monuments – grave-stones with sculptured images of the dead that were wide-spread in Ukraine as early as in the Age of Enlightenment [Encyclopedia of Ukraine. General Part, 1995, pp. 821–822]. The monument to Peter I by Carlo B. Rastrelli was molded in 1753 and erected in 1799 [Romm, 1944, p. 17].

[28] Actually, during his reign most of the known architectural ensembles and individual buildings in the style of classicism in the historical district of both cities were erected; they were build from the plans of West European architects [Leningrad, 1953, p. 528; Odessa, 1954, p. 520; Popovych, 1998, p. 312]. Therefore, both cities "are included into pan-imperial preferences that reflect primarily the taste and artistic ideas of western and cosmopolitan government" [Popovych, 1998, p. 312].

[29] We consider that in Odessa, as well as "in Petersburg, folklore is especially topographic and geography; any of its three-dimensional images has folklore connotation" [Zamyatin, 2004, pp. 209–210].

only emphasizes the need for paying tribute to them by the guests for their generosity in improvement of these cities (see Fig. 1). In this context, the decision reached in the official historiography and literature of the Russian Empire of comparing both cities with the legendary Palmyra – the ideal of a flourishing city in the classical Russian literature ("Northern Palmira" – St. Petersburg and "South Palmira" – Odessa)[30] as a direct indication of the successful development of these cities under the rule of an enlightened monarch, should be noted.

THE STABLE SOVIET GEOPOLITICAL IMAGES ASSOCIATED WITH ODESSA AND ST. PETERSBURG

For the Soviet historiography, ideology and propaganda, St. Petersburg/Leningrad is "the cradle of the October Revolution" [Economic Geography of the USSR, 1988, p. 122] and Odessa is, first and foremost, the uprising on the battleship *Prince Potemkin Tavrichesky*[31]. Both cities have been closely linked in this mental construction through a special grand narrative – the official image of the First Russian Revolution (1905–1907) which, in Soviet historiography, "has become a 'dress rehearsal' of the Great October Socialist Revolution of 1917" [The Soviet encyclopedic dictionary, 1988, p. 1111]. The warship cruiser Aurora and the battleship *Prince Potemkin Tavrichesky* play an important role in the official Soviet historiography and propaganda. It should be noted that the pattern of a successful armed rebellion used by the Bolsheviks in Petrograd (1917) formed the basis of their plan to seize power in Odessa (1918) [Bakhnev, 2004, p. 39].

The presence of the legendary, in the mass consciousness and in the mental image of the citizens of Russia and Ukraine, and established by the official historiography and state propaganda of ships-symbols clearly associated with Odessa and St. Petersburg is a unique phenomenon in the world's history. It is important to note that both of these images were created by one director – Sergey M. Eisenstein in his pictures *The Battleship Potemkin*[32] and the *October* (1927) that represent standard examples of intellectual trends of the world's cinema [The Soviet encyclopedic dictionary, 1988, p. 1540]. The presence of numerous methods of propaganda posters in these films is a consequence of his experience working as director and artist-designer of the agitation trains of the Red Army [Eisenstein, 1970, p. 977].

Today, the cruiser *Aurora* is a branch of the Central Naval Museum of the Russian Federation. In the Soviet times, it was turned into not only the city's symbol, but into the symbol of the whole country and it became, in the official historiography, ideology, and propaganda, one of the sacred images of the Great October Socialist Revolution. In the Soviet mass propaganda, it was conventionally portrayed as a symbol of devastating power of the industrial revolution (Fig. 2) destroying with its exaggerated fire power and with its incredibly strong spotlight retarded old political regime that is hiding in the darkness of night in the shelter of the forces of evil – in the tsar's palace.

This image was created by Sergey M. Eisenstein in the film *October* (1927). "Without the challenge of reconstruction of event chronicles... E.[33] sought to reveal in the f. [34] the meaning of the events. With this f. ... the theory of intellectual cinema launched by the director is associated. E. believed that joining two frame-images together produces the third, a concept that contains an ideological assessment" [Eisenstein, 1970, p. 979]. Already in the film The *Battleship*

[30] "South Palmira is seen as the southern reflection of St. Petersburg that is simultaneously bright and seductive, as a window of the Slavic world into the Black and the Mediterranean Seas" [Fernandez, 1994, pp. 61–62]. In the print press of the Russian Empire, "Odessa was advertised as the 'Southern Capital', as the 'South Palmira', and as the 'Second Petersburg'" [Zagoruiko, 1960, pp. 53–54].

[31] Was officially named in the Soviet historiography as 1905 Odessa July Armed Revolt [Ukrainian Soviet Socialist Republic, 1984, p. 445]. This was the "first mass revolutionary appraisal of the armed forces" of the Russian Empire during the First Russian Revolution [The Soviet encyclopedic dictionary, 1988, p. 1046].

[32] The official name of the warship was Prince Potemkin Tavrichesky [The Soviet encyclopedic dictionary, 1988, p. 1046].

[33] In the original text, a citation in the form of "E." was the accepted abbreviation for "Sergey M. Eisenstein"

[34] In the original text, a citation in the form of "f." was the accepted abbreviation for "film."

Fig. 2. Official images-clichés of the cruiser *Aurora* in the Soviet propaganda postcards. Compiled based on [Happy Holidays! 1987; Glory to Great October! 1969; Glory to Great October! 1986; Glory to Great October! 1987; Glory to October! 1968; Glory to October! 1973; Glory to October! 1988]

Potemkin (1927), which "many film historians consider to be the final determination of cinema as an art form" [Eisenstein, 1970, p. 979], the implementation of these ideas by S.M. Eisenstein are clearly seen. "Based on the real facts and, at the same time, converting them boldly, E. created a five-part composition of the f. ... that resembles the structure of an ancient tragedy. <...> Entering into a conflict of power – the tsarist regime and seeking to be freed from oppression and injustice the people, receive vivid imaginative realization in the f." [Eisenstein, 1970, p. 979]. Thus, a clear antinomy is formed: the rebels used a modern ship – a symbol of technological progress, as a basis for overcoming a "backward" social regime (see Fig. 2 and 3). In these films, Sergey M. Eisenstein focused specifically on the technical advantage of firepower of the military ship captured by the rebelled sailor relative to the armed police forces of the existing political system aimed at suppressing the rebellion. Therefore, it is precisely why all known authors of the posters of the film The *Battleship Potemkin* present the artillery of the battleship *Prince Potemkin Tavrichesky* and not the actual ship itself (Fig. 3).

This interpretation of the role of technological development in this mental setup is associated with highly prevalent, in the period between the two Russian revolutions, religious and mystical sentiments among the general population (see, for example, sermons of Saint John of Kronstadt – the most famous Orthodox preacher of the era of the empire, and literary works of the Dmitry Merezhkovsky). In this context, as Arnold J. Toynbee correctly points out, "the Russian communist movement, though dressed in European costume, is a fanatical attempt to shake off Russia the hopples of Westernization that Peter the Great threw on it two centuries ago" [Toynbee, 1995, vol. 1, p. 242], for "the unwavering belief in firmness of the truth of the teaching was finding support in the underlying mechanisms of dark folk mythological consciousness" [Toynbee, 1995, vol. 2, p. 551].

We should not forget that Anatoly V. Lunacharsky – People's Commissar of Education in Soviet Russia (1917–1929), in 1908–1910, "preached god-building" [The Soviet encyclopedic dictionary, 1988, p. 730] and that Vladimir I. Lenin was perceived as a "follower of

Fig. 3. Official images-clichés of the cruiser Prince Potemkin of Tauris in the Soviet propaganda posters. Compiled based on [Lavinsky, 1926; Rodchenko, 1926a; Rodchenko, 1926b; Stenberg, 1925; Stenbeg & Stenberg, 1929]

the archpriest of Habakkuk, of the old-believers, and of the Slavophiles. In this role, he acts as one of the prophets of the 'Holy Russia' displaying a protest of the Russian soul against Western civilization" [Toynbee, 1995, vol. 1, p. 209].

It can be argued that an adaptation of the famous myth of the ancient world took place, where the struggle between the light and the darkness in the original interpretations of traditional Christian eschatological conventions takes place. In it, the establishment of the Kingdom of God is possible only after the final battle between good (the heavenly host led by the Archangel Michael and the host of Christian saints) and the forces of evil (a mob of fallen angels led by the Antichrist and human followers), which only temporarily seized power on Earth (*Revelation of St.* John, Ch. 12, art. 7). Before this, the city – "Babylon the great *whore*", will fall and this will be preceded by descent from heaven of an angel "having a great power; the earth was lightened with his glory" (Ch. 18, art. 1 and 2), before this event, "there were lightnings, thunders, and voices, and a great earthquake" (Ch. 16, art. 18).

For the first time such an effective method of the Soviet ersatz version of the Christian eschatology in the form of poster art that was so close and clear to the population was used in the films by Sergey M. Eisenstein' *October* and *The Battleship Potemkin* (1927). The correct "reading" of the parallel between the heavenly host and the Bolshevik Party on the one hand and the forces of evil and the tsarist regime/ Provisional Government, on the other hand, was clear to any Orthodox believer and to any educated person of the Russian Empire, in which the teaching of theology was a compulsory subject in primary and secondary education. In an exemplary Soviet propaganda text[35], there are all relevant parallel descriptions of the end of the world and establishment of the Kingdom of God. The image of the angel of *Revelation of St. John*, illuminating the path

[35] On 10.24.1917, "Aurora, was moving along the Neva River with a powerful light. <...> at 3:30 a.m., the cruiser was brought up near the Nikolaevsky Bridge. Junkers left the positions having seen the cruiser." On 10.25.1917 at 9:45 p.m., "a bright flash lightened the Neva. A thunder of blank shot brattled over the city. And immediately after it from the side of the Palace Square, the sounds of a thick gunfire... of grenade explosions, and, soon after, of vigorous "hurray!" came. Workers, soldiers, and sailors began the storm of the Winter Palace [Leningrad, 1969, p. 44].

and sending thunder and lightning over the city very early in the Soviet propaganda was transformed into the cruiser *Aurora* (see Fig. 2), whose shot found a special sacred significance in the official Soviet historiography[36]. Numerous Soviet propaganda postcards on the events of November 7, 1917, consistently portrayed this event (see Fig. 2). They present incredibly expressively the spotlight of the cruiser and the vessel itself on a black sky background. The *Order of the October Revolution*, approved on 31.10.1967, depicts exactly this well-established image of the cruiser emitting light (Fig. 2). The "personification" of the cruiser in the Soviet mentality is reflected in the fact that in 1968, it was awarded this Order "in connection with the 50th anniversary of the Soviet Armed Forces" [Leningrad, 1969, p. 45].

"Without the 'dress rehearsal' of 1905 the victory of the October Revolution of 1917 would have been impossible", wrote Vladimir I. Lenin (cited in [Atlas of the Leningrad Region, 1967, p. 28]). Based on this famous thesis, the role and image of the battleship *Prince Potemkin Tavrichesky* in the official Soviet history becomes clear. It is relatively well represented in the film by Sergey M. Eisenstein, where the vessel has a special meaning. The ship is presented as a kind of refuge of the faithful in their last days not succumbing to blandishments of the earthly unjust authorities (see Fig. 3). The actions of the crew also reproduce the well known from the Holy Scriptures righteous acts of the saints in the latter days. The most spectacular scene of the film is a scene of shooting of the demonstrators on the giant stairs[37], which is easily identified with the corresponding plot of Revelation of St. John – martyrdom of the faithful Christians from the forces of the Antichrist. The death of innocent people is presented as a death for a cause at the hands of a temporary triumph of evil, but at the end of the picture, it is clearly stated that soon after the final battle between good and evil, the latter will be definitively defeated and the kingdom of justice on earth will be established in full accordance with the plot of the *Revelation of St. John*. This very idea laid the foundation of the sculpture monument "To the Potemkins from the Descendants" [38] (sculptor V.A. Bogdanov, architects M. Wolf and S. Lapin, 1965) where the "multi-figure composition captures the beginning of the uprising" [Timofeyenko, 1983, p. 143] on the deck of the battleship when the sailors rise to the rebellion.

CONCLUSIONS

The analysis of the role of the main monuments in the perception of the image of Odessa and St. Petersburg in their historical sections made it possible to establish several general dependencies:

1. The conscious use in the color combinations of the grand facades of the buildings in the historic centers of Odessa and St. Petersburg of white (spiritual) and yellow (worldly power), one possessed by the Emperor and Autocrat of all the Russias only) the colors served as an element in the territorial structure of the emphasis of the important administrative buildings – the symbols of the supreme power.

2. There is some similarity in the placements of the monuments to the cities' founders (Peter I and Armand E. Richelieu). They are located on the squares opposite to the buildings of the former (at the time of construction) state authorities of the Russian Empire. They are separated from the sea by the promenades with stairs to the water offering the best angle for their examination. All the attention in the monuments is directed to just figures of the cities' founders in the image of statesmen of the late Roman Republic/early Roman Empire.

3. The monuments to Peter I and to Armand E. Richelieu are the oldest surviving civil

[36] Standard official propaganda construction "When the shot of the legendary Aurora announced to the world the victory of the Great October socialist revolution the fight for the Soviet power in the Balta's has reached its final stage" [Balta, 1978, p. 221].

[37] Modern name – The Potemkin Stairs.

[38] It is derived from the famous inscriptions on both monuments of Peter I in St. Petersburg, "To First from Second" and "To Great Grandfather from Great Grandson."

monuments in honor of particular persons in Russia and Ukraine. It speaks to their exceptional significance in the mental image of these cities.

4. From the monuments to the cities founders, there are straight roads to other important monuments in the official mental picture of the cities – to the monuments to the rulers-benefactors, who made the greatest contribution to the development of the city from the perspective of the official historiography of the Russian Empire. The decor of these monuments is very lush that should have symbolically indicated the unprecedented prosperity of the city.

5. The presence of the legendary, in the mass consciousness and the mental image of the citizens of Russia and Ukraine, and of established, by the official historiography and state propaganda, ship-symbols clearly associated with Odessa and St. Petersburg is a unique phenomenon in the world's history. The image of Petrograd / Leningrad as the "cradle of the October Revolution" and Odessa as the "center of the uprising on the battleship *Prince Potemkin Tavrichesky*" was created, in 1927, by S.M. Eisenstein in the benchmark films of the world's cinema *The Battleship Potemkin* and *October* in the Soviet ersatz version of Christian eschatology.

DIRECTIONS FOR FURTHER RESEARCH

The investigation of the role of the main monuments of the historical districts of Odessa and St. Petersburg in the perception of their images allowed outlining the following possible research directions in the field of urban perceptual geography and geopolitics:

1) Study of features of the city development in the formation of its mental image;

2) Consideration of characteristic locations in the city of significant buildings and artifacts of important social and cultural value;

3) Analysis of the role of various images of the city and its individual components in fiction literature and in popular tourist literature.

All of this will facilitate holistic understanding of the values of the entire city, as well as of its individual components, in collective mentality and in public policy and ideology. ■

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"L'ENTRE DEUX" BALKANIQUE

"La frontière entre les écritures cyrillique et latine te traverse le cœur;
tu aimes la première et tu utilise la seconde,
tu es mal à l'aise par rapport a l'une et à l'autre.
Tu n'es ni en toi, ni en ce qui est censé te remplacer"
(M. Danoïlitch, Lettres d'un village serbe)

THE "IN-BETWEEN" BALKAN

ABSTRACT
The paper is focused on the geographical processes which support the specific features of the Balkan Peninsula, giving them civilisation content. The concept of "in-between" is proposed and its three components exposed: I) a space where developments are governed by outside interferences and influences stronger than inside forces, and producing small fragmented territories; 2) a space where recurrent adversity causes feed-back to previous conditions, contributes to cyclic experience of time and prevents accumulation of development; 3) a space where all kind of discontinuities further creativity but without local implementation. These three interactive components of the "in-between Balkan" are analysed in its version of geopolitical front area during the Cold War, then in the intermediary area's version since 1990. The next future is involved through the topic of organic links between Balkans and Istanbul and Turkey.

MOTS-CLÉS: entre deux, espace intermédiaire, espace/temps, système spatial, analyse multi niveaux

KEY WORDS: in-between, intermediary area, space/time, spatial system, multilevel analysis.

Les Balkans posent la question de la force d'une situation géographique *d'entre deux* dans la construction d'une identité. Péninsule méditerranéenne orientale de forte individualité culturelle au contact de l'Anatolie et des mondes de l'Orient, elle fut l'assise de l'empire byzantin puis la partie européenne de l'empire ottoman. Son actuel maillage en 4, 6, 8 et peut être bientôt 10 Etats, inspiré du principe de reconnaissance nationale à l'œuvre depuis le XIXe siècle, révèle une fragmentation et un cloisonnement, contient une violence active qui sont au fondement de l'image négative qu'exprime le terme générique de balkanisation utilisé hors de la région.

Si les travaux qui se penchent sur la 'question balkanique' font certes la part belle à la position, il nous a semblé que la question pouvait encore être reprise, en cherchant à *dégager quels mécanismes spatiaux* ***auto entretiennent*** *l'ensemble des traits dits 'balkaniques' et lui donnent une durabilité telle qu'on entre dans le registre d'une construction de civilisation*.

Notre réflexion se déroule en quatre temps: après la construction du concept de l'entre deux, deux moments de mise en travail du concept – l'entre deux de front de la période communiste, l'entre deux d'intermédiaire faiblement disputé depuis 1990 – et

enfin l'appréciation des tristes richesses balkaniques et des ressources mobilisables pour un proche avenir.

A l'amont de cette analyse centrée sur la période contemporaine, rappelons l'enracinement millénaire de la propriété balkanique principale, celle de la *discontinuité*. Cette discontinuité plonge dans l'univers symbolique le plus profond: celui des signes et des adhésions religieuses. La ligne de séparation entre les alphabets grec et latin remonte à l'Antiquité et traverse la région; s'y ajouteront l'alphabet cyrillique et l'alphabet arabe. Les trois religions qui cohabitent se sont installées aux dépens les unes des autres dès la fin du premier millénaire (le grand schisme de la chrétienté en 1054, l'implantation islamique ottomane à partir du XIVe siècle); elles ont façonné des attitudes culturelles distinctes, renforcées par leur symbiose avec des appartenances politiques ennemies. Enfin ces clivages majeurs, qui pourtant ont fait preuve d'une réelle cohabitation pendant la période ottomane, se sont concrètement appuyés sur un espace géographique au relief étonnamment fragmenté, relief qui a donné une assise physique aux cloisonnements humains.

CONSTRUIRE LE CONCEPT DE L'ENTRE DEUX[1]

L'objectif est de passer de la notion commune (topos) d'intermédiaire, d'entre deux, reconnue par tous les analystes de la région, à une conceptualisation et modélisation des processus spatiaux qui en fondent l'individualisation. Pour soutenir cet objectif nous avons défini le champ d'interactions entre trois grands mécanismes, chacun ayant un rôle spécifique dans la production des caractéristiques de l'entre deux balkanique, au point de faire des Balkans l'archétype de l'espace d'entre deux.

En 1r lieu le jeu des forces organisatrices liées aux exercices de pouvoir donne l'avantage la majeure partie du temps à des *forces extérieures* et concurrentes sur les forces internes; cette dissymétrie favorise diverses fragmentations internes et *discontinuités*, sources potentielles de conflits locaux, tout comme elle est porteuse d'évènements radicaux dont l'origine est ailleurs et dont la portée dépasse très largement le lieu d'apparition; il en résulte un état d'*instabilité* et d'*impermanence*, une fréquence des aléas.

En 2e lieu la radicalité périodique d'*évènements* entraine des renversements complets de dynamiques sur des durées relativement brèves (évènements qui peuvent conduire à une bifurcation pour utiliser un vocabulaire systémique). D'une part ceci se traduit par la nécessité d'avoir "à *tout recommencer à zéro*" à chaque changement de domination d'influence et contrecarre tout effet d'accumulation. D'autre part cette radicalité des renversements renvoie à des mémoires de temporalités beaucoup plus anciennes, en général refoulées mais latentes, et qu'elle réactive. Il s'en dégage à la fois un *vécu cyclique du temps*, une valorisation du moment présent et une perception de l'évolution en termes de retard et de *décalage*.

En 3e lieu l'expérience de la discontinuité du temps des œuvres paraît favorable à l'invention, à la *création* comme nécessaire et absolue nouveauté; mais le manque de durée et de moyens empêche qu'il puisse sur place y avoir ensuite une mise en œuvre effective avec une construction d'innovation/diffusion, ce qui engendre une perception de frustration.

De telles relations spatiales et temporelles se traduisent par un foisonnement de différences et une exacerbation des altérités, une anxiété quant au destin toujours imprévisible; ce foisonnement donne la part belle à des *interférences macro-micro plutôt que méso*, et qui font apparaître les contradictions dont l'entre deux est tissé.

A une période donnée, ce modèle théorique de fonctionnement d'un espace particulier prend une modalité propre, selon le contexte englobant et les rapports de force en présence: on le dénomme un *entre deux*

[1] Ce texte est une version reprise et développée de mon article "Balkans, lecture d'un espace «d'entre deux»" paru dans la revue Anatoli, n°1, 2010- CNRS Paris.

d'espace inséré, quand les influences externes sont d'intensité modérée et que les fonctions de passage et mise en creuset peuvent prévaloir; il est un *entre deux de front* quand la domination des forces externes est très forte et que les cloisonnements l'emportent.

Cette approche, qui peut être considérée comme une variante des modèles géopolitiques centre/périphérie (shatterbelt, bufferzone etc...), n'inclut pas de métathéorie sur les finalités de domination. Par ailleurs c'est dans les cas où le modèle peut être exploré sur une longue durée qu'il permet de mieux comprendre la construction d'une aire culturelle, parce que l'exploration est alors véritablement centrée sur l'espace d'entre deux lui-même.

UN ENTRE DEUX DE FRONT GÉOPOLITIQUE SOUS LE COMMUNISME

Il s'agit alors d'un fonctionnement *à la limite, un entre deux de front géopolitique*, celui de la Guerre Froide avec le face à face militaire à forces égales du bloc soviétique et du bloc atlantique. L'espace balkanique n'en est qu'un tronçon, dont les propriétés apparentes ne se distinguent guère de celles observées plus au nord dans l'aire de l'Europe centrale. Les trois mécanismes définis ci-dessus fonctionnent de la manière suivante.

1 – C'est une période où *les forces extérieures* à la région surdéterminent les orientations intérieures. Du point de vue géopolitique et géoéconomique les Balkans sont en position de première périphérie de l'URSS; les flux sont soumis et dirigés à l'Est, mais les attentes des habitants sont tournées vers l'Ouest. Ces orientations opposées ont un caractère stérilisant et constituent la contradiction très profonde qui fonde l'entre deux de la période. Si le tracé des contours étatiques reste inchangé par rapport à l'avant guerre, l'imperméabilité des frontières est partout la règle avec une intensité maximale sur le Rideau de fer. Le cloisonnement spatial d'Etat à Etat multiplie les discontinuités d'échanges et les ruptures de voisinage; il commande aussi l'organisation à l'intérieur de chaque Etat. La Grèce et la Turquie sont en situation symétrique de périphérie du pôle occidental, avant postes des Etats-Unis et des forces de l'OTAN.

2 – L'implantation de l'idéologie communiste correspond à une radicale opération de *"tout recommencer à zéro"*, qui touche tous les secteurs et tous les lieux. Rappelons la violence des collectivisations dans les campagnes, la diffusion d'une industrialisation/urbanisation au profit de centres moyens et aux dépens le plus souvent des grands centres historiques, le modèle standard des réformes administratives avec leurs maillages départementalisés de telle sorte que soient laminés les découpages antérieurs. La construction d'un Homme nouveau, d'un temps nouveau dans un espace nouveau, vise l'émergence d'une identité plurielle dégagée des cloisonnements de l'ethnicité; mais elle va aussi avoir en contrepoint une résistance invisible: les micro-organisations que sont la famille et les territoires les plus locaux au sein des villages et des villes deviennent des points de repli. Il s'agit de manifestations qui incorporent les formes traditionnelles de vie sociale et les consolident même en partie. La question s'ouvre maintenant chez les chercheurs pour apprécier dans quelle mesure ces micro structures ont été aptes à absorber le système nouveau ou à le valoriser, dans quelle mesure l'épisode communiste est l'avatar provisoire d'une structure de beaucoup plus longue durée.

3 – *La créativité et la diversité* interne mises comme troisième propriété de l'entre deux trouvent dans les Balkans pendant le communisme une expression plus marquée qu'en Europe centrale, et cela précisément parce l'entre deux historique de la longue durée est plus complexe dans cette péninsule balkanique. Tandis que la Bulgarie va le plus loin dans l'imitation du modèle soviétique (exploration de la formule agro-rurale des APK...) au point d'être parfois qualifiée du 16^{e} république de l'URSS, l'Albanie se détache de

plus en plus du modèle version soviétique puis version chinoise pour tenter de devenir le premier Etat communiste et athée du monde (1967). Et surtout la Yougoslavie résiste au modèle imposé, s'en détache pour construire sa propre formule endogène, celle du socialisme d'autogestion et du gouvernement fédératif, et pour tenter de faire une brèche géopolitique dans la division binaire du monde et impulser une troisième voie, celle des Non Alignés et de l'ouverture sur ce qu'on appelle alors le Tiers Monde. Avec ces marques de créativité radicale on voit intervenir la propriété d'ouverture des Balkans au delà de l'aire euro-slave, et l'imprégnation culturelle associée à cette ouverture. Leur position géographique de charnière à l'échelle planétaire, et en particulier avec le monde musulman, fonctionne même pendant le communisme. En créant une nation musulmane pour donner visibilité à l'identité des Musulmans de Bosnie Herzégovine, Tito avait cherché une solution pour cette population de langue slave et d'histoire ottomane; en ne donnant pas le statut de république fédérée à la province du Kosovo en 1974 mais seulement celui d'autonomie au sein de la république de Serbie il laissait un risque d'abcès s'installer.

En bulgarisant les noms turcs en 1985, le gouvernement bulgare "préparait" l'émigration de 1989 ce qui contribua de façon voilée à une pratique de nettoyage[2], sans lendemain cette fois-ci. On a là plusieurs manifestations d'articulation d'échelle:

– d'échelle spatiale entre des situations locales de fragmentation et des enjeux de très large portée dépassant complètement l'horizon balkanique,
– d'échelle temporelle entre des politiques conjoncturelles et des structures de très longue durée.

[2] Le nettoyage ethnique, avec les drames associés, a fonctionné de façon de plus en plus fréquente dans ce qui fut le territoire de l'empire ottoman à partir du XIXe siècle, apportant toutefois une certaine stabilité ultérieure.

Toutefois ce n'est pas de cet entre deux balkanique compliqué qu'est partie la chute du Rideau de fer, mais c'est lui qui sur le flanc occidental de l'URSS en a été le plus perturbé. A cela déjà deux raisons possibles. Pour ce qui est de la non initiative de l'ébranlement, rappelons que la phase communiste, pour rude qu'elle fut, fut aussi dans les Balkans un moment de très forte modernisation des modes de vie, d'amélioration des besoins en santé et en éducation; elle fut un 'décollage' que n'a pas enregistré par exemple l'Europe centrale qui était nettement plus en avance sur ces critères. Pour ce qui est de l'intense perturbation qui en suivit, c'est que l'aire balkanique, à la différence de l'Europe centrale, reste au niveau 1 de l'entre deux géopolitique mondial, en contact triangulaire entre monde russe, monde occidental et monde musulman, et retrouve avec acuité la complexité de sa situation géopolitique interne d'avant 1945.

DEPUIS 1990, UN ENTRE DEUX D'ESPACE "INTERMÉDIAIRE" FAIBLEMENT DISPUTÉ

La chute du rideau de fer met fin à l'équilibre paralysant des peurs, provoque un *renversement* des rapports de force entre la domination de l'exogène et la remontée de l'endogène et un recommencement généralisé; les niveaux d'échelle sont modifiés, et les articulations des territorialités et des temporalités s'enchevêtrent autrement; en son début ce recommencement produit plus d'antagonismes et de contradictions que d'articulation/intégration.

1 – L'affaissement de la confrontation des forces exogènes laisse *place aux forces endogènes*. Mal connu de l'extérieur, le puzzle interne est livré à lui-même et l'espace balkanique doit *affronter la multiplicité des entités* que la férule communiste avait plus ou moins masquées. Ce renversement du rapport de forces est synonyme d'un retour aux problèmes d'une époque déjà lointaine, de la fin de l'empire ottoman et de la montée des nationalismes, et que les guerres balkaniques (1910–1913) et les traités de la Première guerre (traités de Trianon...)

n'avaient que partiellement résolus. Outre la Turquie européenne, trois sous ensembles se distinguent: l'ex-Yougoslavie; l'Albanie; les pays qui sont ou deviennent membres de l'UE (Grèce, Slovénie, Roumanie, Bulgarie) en position plutôt périphérique.

La primauté d'action des forces endogènes devient guerre en différents points du territoire yougoslave[33], là précisément où l'ancien front entre les empires ottoman et habsbourgeois – front géopolitique et front civilisationnel- fut le plus induré (les colonies de soldats-paysans, les krajina... les fines mosaïques ethniques); là où gisait aussi une confrontation antérieure entre poches de très ancien peuplement illyrien et implantation slave. Ailleurs sur la péninsule balkanique il existe d'autres mosaïques ethniques avec leur cortège de tensions (Bulgarie méridionale, Grèce du Nord...) mais ces espaces ne furent pas des confins pendant l'empire ottoman, ils étaient dans la mouvance du pôle d'Istanbul, inscrits dans un gradient plus classique d'aire d'influence de métropole, et à ce titre moins marqués par les cloisonnements.

La bifurcation géopolitique de 1989–1990 fait donc *ressurgir des structures de confins*, indurées à des époques très antérieures au communisme, dans un télescopage de temporalités. Elle n'est pas synonyme de disparition des forces externes lointaines, puisque celles-ci vont intervenir pour stopper les violences et développer leurs positions d'influence. Forces armées américaines et OTAN apportent une pacification sous tutelle pour la Bosnie Herzegovine (accords de Dayton, 1995), tout en avalisant sa partition en deux sous unités. Quand le Kosovo s'est senti assuré de suffisamment de soutiens lointains pour déclarer son indépendance, il l'a proclamée et a été reconnu par la majorité des grands pays. Parallèlement les solidarités culturelles d'appartenance à l'orthodoxie fonctionnent de façon récurrente, au sein des populations sinon chez les politiciens en charge des Etats vis à vis de la Serbie.

La fragmentation géopolitique de l'entre deux en phase 'd'intermédiarité insérée' était inattendue voire imprévisible encore dans la décennie 1980; c'est en s'appuyant sur la question des identités que les groupes nationalistes, mis sous contrôle par le régime précédent, réussissent à obtenir leur reconnaissance étatique. La lutte territoriale a délité l'ex Yougoslavie en 5 puis 7 puis 8 Etats avec le dernier en date – celui du Kosovo, 2008. Mais jusqu'où pourra continuer le processus de micro étatisation (Bosnie Herzegovine, Monténégro, Kosovo…) sans aboutir à l'asphyxie des entités nouvellement créées? Car celles-ci manquent d'une base autonome d'activités et leur entretien actuel est dans la triple dépendance de l'argent des immigrés, de l'aide internationale et des trafics illégaux[4]? Les solutions momentanées dans les 'Balkans occidentaux' (ex-Yougoslavie) sont hétérogènes mais fluctuantes à cause de la poursuite spontanée des déplacements des populations à la recherche d'une sécurité d'entre soi, ce qui fait apparaitre une progression de la purification ethnique là où on ne la voulait pas (Bosnie) et une accentuation de la multiplicité ethnique là où elle était faible (Serbie). Chaque Etat voit la sécurisation de son avenir par l'insertion dans l'UE, mais en s'efforçant d'y entrer sans chercher au préalable une concertation de voisinage[5].

[3] Le terme de guerre balkanique est abusif et véhicule une vision globalement négative que conteste M Todorova dans "*Imagining the Balkans*", 1997, New York, Oxford University Press.

[4] Les républiques baltes sont dans une situation voisine: nouveaux tigres de la Baltique au début des années 2000, en situation d'asphyxie financière depuis 2009, elles montrent combien l'effet 'petit pays' en région d'entre deux est synonyme de lieu amplificateur de tendances, de sismographe.

[5] *Slovénie et Croatie* sont presque devenues mono ethniques en 15ans. La *Bosnie-Herzégovine* reste une entité politique abstraite, en 2 sous ensembles; côté fédération bosno-croate les Croates s'en vont, coté république serbe il y a demande de rattachement à la Serbie, contraire aux accords de Dayton. La *Macédoine*, qui s'est déclarée Etat unitaire en 1992, doit faire place à la présence albanaise forte et en croissance rapide, et qui a fait reculer son statut de minorité. Le nouveau *Kosovo* indépendant aura à statuer sur la demande de scission de la région serbe du nord qui veut son rattachement à la Serbie limitrophe: changement théoriquement impossible sous peine de remettre à plat toutes les autres frontières, mais... puisqu'en pratique a été accepté l'indépendance, pourtant contraire à la résolution 1244 de l'ONU de 1999 et qui 'reconnaissait explicitement le Kosovo comme province serbe'. Le *Monténégro*, de même langue et religion que la Serbie, prend son indépendance en 2006 pour s'extirper des séquelles de guerre de la Serbie et arriver plus vite dans l'UE; avec moins d'un million d'habitants dont 43% de monténégrins, il choisit de se définir comme état multiethnique et multiconfessionnel. Quant à la *Serbie*, dont le territoire se réduit comme peau de chagrin, elle doit accueillir un nombre croissant de réfugiés serbes qui se retirent des autres nouveaux Etats, et soutenir ceux qui y restent encore, tout en gérant ses propres minorités historiques d'ailleurs en déclin (Voïvodine).

2 – Un tel renversement des configurations est une fois encore *une remise à zéro partout*, même si les formes en sont plus ou moins violentes selon les sous ensembles. Alors que sont rétablis les passages voire des esquisses de régions transnationales sur l'ancien tracé du Rideau de fer (Slovénie, Grèce septentrionale..) et le long du Danube, l'augmentation du nombre d'Etats devient synonyme de multiplication de frontières, de nouveaux cloisonnements mais aussi de nouvelles lignes où se concentrent les activités d'échange et de production; il s'agit de certaines zones frontalières (sud Bulgarie au contact avec Turquie et Grèce, sud Macédoine, ouest de la Roumanie). Malgré ces cloisonnements, les flux augmentent et trouvent de nouvelles directions, massivement vers la Grèce et Istanbul, autant que vers l'Europe occidentale. L'ampleur de la désorganisation/réorganisation économique provoque une distorsion nouvelle entre riches et pauvres, sonne la revanche des grandes villes et des nouvelles capitales, qui concentrent l'essentiel de la croissance, tandis que les campagnes se vident encore plus; les déséquilibres spatiaux qu'avaient voulu éliminer le système communiste redeviennent une dangereuse réalité. A l'émigration lointaine qui reprend ses chemins de jadis, s'ajoute la migration de passage des clandestins d'Afrique d'Asie et même d'Amérique latine en direction de l'Europe occidentale, le tout sur fond de situations de corruption et maffias.

La remise à zéro intervient aussi dans le changement de rapport entre les échelles de fonctionnement géopolitique comparé à celui de la période précédente: *l'échelle méso régionale prend le dessus*, mais sous la forme d'une territorialisation étatique très problématique pour l'avenir. Parce qu'elle se construit comme territoire étatique, avec donc une insertion au niveau de la carte politique mondiale, *la méso-échelle devient en fait paradoxalement une micro-échelle*; elle est alimentée par une passion identitaire interne, mais elle est stigmatisée de l'extérieur[6] qui pourtant l'avalise. Prendre acte de cette contradiction c'est en déplier tous les attendus politiques et culturels: les discours externes prônant le multiculturalisme ne seraient-ils qu'hypocrisie et la culture balkanique de la mixité qu'un mythe?

La remise à zéro favorise une résurgence de temporalités anciennes, en hibernation pendant la période précédente. La vigueur de la fragmentation invite peut être à *réviser la notion de culture balkanique de la mixité*. Celle-ci existe comme en témoignent la littérature, les traditions festives, les paysages faits d'une fine diversité locale où la fragmentation du relief a sa part, ainsi que les traces du grand pastoralisme de jadis. Elle renvoie à l'expérience de l'instabilité des communautés, mélangées sur l'espace au gré des pulsions des empires (colonies de soldats paysans, repeuplement de montagnes vidées par les guerres...) dans un mélange fait de *juxtaposition d'unités homogènes mais différentes* entre elles; le rapport social à l'espace y a été empreint de mobilité, la relation en réseau et le réseau d'appartenance au groupe l'emportent sur l'enracinement territorial et l'interdépendance de voisinage; la solidarité économique et affective à distance tiennent un rôle essentiel. Quant à la multi culturalité savante, elle était affaire des élites citadines, qui étaient soit originaires d'autres horizons (Arméniens, Juifs, Grecs du Phanar...), soit 'un jour avaient baisé la main qu'on ne peut mordre' et s'étaient converties à l'islam; elles furent souvent partie prenante des bureaucraties impériales, ottomane ou habsbourgeoise, soutinrent ensuite le yougoslavisme. Sous ce schématisme gît la conscience généralisée du *voisin qui est aussi l'Autre*, à la fois ami et ennemi. Une telle structure socioculturelle, totalement imbriquée dans les plus fines alvéoles de l'espace géographique, pose de redoutables problèmes de cohabitation en situation d'absence de développement économique et d'absence d'un encadrement politique accepté.

3 – Quant au *potentiel de créativité* théoriquement inclus dans la figure

[6] La peur du retour du "temps des tribus".

balkanique contemporaine de 'l'entre deux d'intermédiarité', il est particulièrement difficile à saisir. Il n'est pas dans les multiples inventions de solutions individuelles et de petits groupes dont font preuve les migrants actuels: 'les norias migratoires' sont devenues des pratiques mondialisées. Il n'est pas non plus dans les maffias aux imaginations fertiles en matière de corruption et de diffusion de contre-modèles réticulaires.

Ce potentiel réside probablement dans le *désir de sortir de l'entre deux* si souvent exprimé par les intellectuels et les politiques sur place, pour échapper aux multiples ambivalences porteuses de trop d'adversités. Mais que pourrait alors signifier spatialement ce vœu de "sortir de l'entre deux"? Cela nous parait renvoyer au contexte présent de l'européanisation et de la mondialisation.

TRISTES RICHESSES: LES RESSOURCES ET LES ATOUTS POUR UN PROCHE AVENIR

Il serait naïf et faux de croire que les Balkans puissent échapper à la situation de l'entre deux quand par leur position géographique ils sont situés au contact des aires culturelles de première grandeur que sont le monde européen occidental, l'ensemble du Moyen Orient et le monde slavo-russe. L'analyse précédente a décortiqué les boucles qui fondent l'extrême résilience du système balkanique. Peut-on dégager certaines pistes pour un proche avenir? Celles qui pourraient enrayer les boucles qui entretiennent les effets négatifs, tels les fragmentations et les réseaux cachés hors droit; celles qui pourraient convertir ce qui est fonctionnement de cloisonnement en fonctionnement de carrefour et de pont, pour qu'une certaine centralité interne apparaisse et organise l'ensemble de l'espace balkanique.

Notons tout d'abord qu'à l'échelle mondiale de la globalisation très contemporaine, le vaste "espace intermédiaire" (Kitsikis, 1999) qui correspond approximativement à ce qui fut l'espace ottoman et dont les Balkans furent un élément, n'est plus le seul point sensible du monde qui focalise toutes les attentions; il est relayé par la montée en puissance d'un autre espace intermédiaire – celui de l'Asie du sud-est au contact de la Chine (Taylor).

La situation générale reste lourde de handicaps et inscrite dans un niveau de développement matériel bas[7], lequel était repérable dès le XIXe siècle. Les remises à zéro depuis 1990 ne sont que d'apparents retours à la case de départ d'avant 1939. L'accumulation des discontinuités et des superpositions de frontières de nature diverse se poursuit, avec les méfiances qui en résultent; mais là s'arrête l'accumulation, car il n'y a pas héritage d'une accumulation de la richesse et des équipements, ni même d'une construction de liens de développement intégrant les territoires les uns aux autres – bien que certains signes d'une 'yougosphère' apparaissent timidement. Le facteur risque, à la fois géopolitique international et politique interne à la région, limite l'implantation des investissements étrangers alors que le besoin de capitaux est très important (et que les fortunes acquises sont faiblement réinvesties sur place). Les nouvelles dynamiques locales sont encore hésitantes et trop souvent associées à des pratiques économiques et sociales frauduleuses. Depuis 2008 la crise économique globale a fait plonger dans le marasme plus violemment la région que ses pôles extérieurs: les démarrages de croissance amorcés depuis les années 2000 résistent mal. Le potentiel de circulation existe et sa valorisation commence à travers les financements des corridors européens de transport et des tracés d'oléoducs et gazoducs (Nabucco, Southstream...); mais il ne faudrait pas que ces axes soient seulement les supports pour des trafics de transit au profit de centres lointains et extérieurs.

Plus gravement la profonde crise démographique qui touche la péninsule est l'expression du mal développement et de la détérioration des valeurs de confiance au

[7] Des différences dangereuses existent aussi; par exemple la Grèce versus le Kosovo, suite à l'effet d'appartenance aux deux blocs adverses pendant la Guerre Froide.

sein des sociétés balkaniques: l'émigration massive (quoique différenciée) aggrave le déclin naturel, pèse lourdement sur toute perspective de relance et construit un nouveau déséquilibre de peuplement et de densités entre le creux démographique de la péninsule et les pleins des rivages du sud-est de la Méditerranée. Si une immigration modeste se glisse déjà en provenance du moyen orient et montre la résurgence de liens orientaux, c'est surtout l'émigration qui retrouve les anciens chemins de l'exil et s'inscrit dans la longue expérience des migrations qui marquent depuis des siècles le vécu des populations locales (autre effet de répétition); cette longue expérience a aussi construit une culture de diaspora et de réseaux, utilement mobilisée actuellement.

Quant à la poursuite de l'ajustement 'un peuple-un territoire', il reste un objectif latent, alors même que la complication et la mobilité des mosaïques ethniques ne feront de cet ajustement qu'une solution momentanée (cf note 5).

Alors comment créer les conditions d'une certaine confiance intérieure, base indispensable à une construction interne durable? Comment envisager l'émergence d'une certaine centralité interne sans laquelle aucun développement endogène n'est possible? En quoi la culture de réseaux peut-elle être un atout dans un monde qui valorise l'organisation en réseaux et les multipolarités associées? Sur ces trois aspects deux entités peuvent jouer un rôle actif, l'Union européenne et la Turquie, lesquelles paradoxalement renvoient aux forces exogènes contre lesquelles s'était engagée l'individualisation balkanique à partir du XIXe siècle.

Le retour dans l'Europe politico-économique via l'entrée dans l'Union est chose faite ou en cours. Pour les différents pays l'effort consenti pour parvenir à en être membre correspond à la volonté de sortir de l'entre deux toujours périlleux; être membre de l'Union apporte une certaine confiance interne vis à vis du monde, même si d'autres désillusions apparaissent vite. Or une fois ses hésitations surmontées, l'UE a opté pour l'élargissement; elle apporte des règles de cohésion et de droit dont ont besoin les différents Etats, elle aide aux nouvelles pratiques transnationales, elle fournit une composante identitaire qui n'est pas que théorique. Dans le registre du contemporain l'UE joue un rôle qui peut s'apparenter à celui joué par les empires de jadis, avec en moins la subordination imposée par les armes.

En outre les pays balkaniques soutiennent la demande d'entrée de la Turquie dans l'Union, ce qui peut paraitre paradoxal au regard des mouvements d'émancipation nationale contre l'empire ottoman à partir du XIXe siècle. Aux raisons géostratégiques mondiales qui peuvent être invoquées, s'ajoute le facteur de la reconstruction de l'organisation de l'espace régional et la volonté de ces pays de devenir sujets et non plus objets de leur devenir[8]. Or les recompositions en cours sont affaiblies par le blocage vis à vis d'une polarité qui pourtant existe et a pleinement la fonction de pont entre orient et occident: il s'agit du rôle de la *métropole stambouliote*. Istanbul est un cas très singulier d'une continuité urbaine de première grandeur depuis l'Antiquité, à cause même de sa position au carrefour occident/orient; elle est la plus grande cité de l'Europe topographique, avant Londres et Moscou. Concevoir une dynamique de développement intégré de l'espace balkanique sans inclure Istanbul est une vision tronquée et bancale; pour autant la perspective de l'élargissement de l'Union à la Turquie renvoie à des échelles de fonctionnement et à des problèmes d'articulation qui débordent largement le monde balkanique.

Quel sens possible donner alors à une insertion de la Turquie dans l'Union[9], dans la foulée de l'insertion des pays balkaniques? Pour ces derniers la dimension des liens

[8] Dans les années 1930 déjà, il y eut un projet d'entente balkanique entre la Grèce, la Serbie et la Turquie.
[9] Dans les années 1930 déjà, il y eut un projet d'entente balkanique entre la Grèce, la Serbie et la Turquie.

économiques relancés et l'activation d'une zone d'activités autour de la mer Noire sont de prime importance (y compris avec le rôle de l'accès aux gisements énergétiques de la zone caucasienne, dont le reste de l'Union ne peut être indifférente). Par ailleurs ce serait redonner à la Turquie l'assise européenne qui fut la sienne pendant la période ottomane, lorsque ses élites étaient largement cosmopolites et originaires d'Europe et des pourtours méditerranéens; la demande turque actuelle provient en grande part des élites très européanisées et des descendants des émigrés balkaniques, qui se sont repliés vers Istanbul et l'Anatolie occidentale au rythme du rétrécissement territorial ottoman depuis le seconde moitié du XIXe siècle; mais il est vrai que cela ne concerne pas toute la population turque du présent! Enfin ce serait pour toute l'Europe la relance d'une attitude européaniste encore largement exploratoire (sinon inédite) vis-à-vis de la reconnaissance et de la construction des identités plurielles. *Identités plurielles* façonnant chaque personne et au sein des sociétés qui composent l'amalgame de l'Union, identités plurielles sous-tendues et soutenues par le respect du droit élaboré collectivement dans l'Union.

Peut être est-ce sur cette question si délicate et controversée des'… Balkans jusqu'au monde turc' que gît l'apport potentiel d'invention/créativité de l'entre deux balkanique actuel?

Cette conceptualisation d'un entre deux actuel inséré dans la longue durée nous semble à même de restituer à cette région des Balkans sa singularité et sa différence, la sortir d'une logique de décalage/retard – laquelle n'en est qu'un aspect subordonné, la sortir de l'image d'une violence qui lui serait intrinsèque sans pour autant la figer dans un essentialisme a-historique. Cette conceptualisation, qui peut ouvrir un débat porteur d'une meilleure compréhension de la région, s'inscrit dans une problématique plus large de la lecture des changements géographiques contemporains sous le signe de l'intermédiarité (Rey, 2010). ■

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THE ENVIRONMENTAL CHALLENGE AND HEALTH SECURITY IN CHINA

ABSTRACT
China has achieved impressive rapid development over the past 30 years. But China also faces the challenge of environmental change resulting from rapid economic growth and the attendant risks to human health. In this paper we described the environmental change and health risk in China from evident fluctuation of China's climate, major changes in natural hydrological condition, raw materials and energy demand, changes of disease epidemic pattern related to climate change and ecosystem damage, new health risk raised by rapid urbanization and rural environmental quality degradation. The suggestion and countermeasures were discussed.

KEY WORDS: environmental change; health risk; governance

INTRODUCTION

Both the range and rate of anthropogenic activity caused geographical environmental change in China in recent 50 years have obviously exceeded any period in history. The resultant environmental problems have occurred and some of the environmental change is irreversible. Under the background of future global warming, China will face many challenges such as rapid urbanization, shortage of energy and mineral resources, water deficiency, cultivated land and food security. The environmental deterioration and health risk will be aggravated. Some of the unacknowledged potential threats would be even more serious. Social and harmonious development will bear greater pressure. In recent 100 years, China's annual mean temperature over ground surface has increased evidently with a range of about 0.5-0.8°C, though the current extent of warmness has not yet reached the highest level over the past 2000 years [National Assessment Report on Climate, 2007; Ge et al., 2002].

During 1956–2002, the mean annual precipitation anomaly throughout the country presented a small increasing trend, drought aggravated in most part of North China and southern part of Northeast China [National Assessment Report on Climate, 2007]. The water amount that has already been used made up one-fifth of the country's total annual mean water resources averaged over years, and the total amount of the extracted groundwater occupied one-eighth of the country's total annual mean amount, which resulted in serious ecological crisis [State Environmental Protection Administration of China, 2007]. The nationwide lake reclamation has led to a loss of more than 32.5 billion m^3 of freshwater storage, particularly a rapid shrinkage of inland and drainage lake surface area, even lake dried-up, bringing lake ecological disasters [Bai & Wang, 2003].

A great amount of raw coal, building materials, iron, food and freshwater resources would be consumed to satisfy the need of socio-economic development, currently, both output of mineral products and consumption in China rank among the first in the world. Of which the output of raw coal, iron, 10 kinds of nonferrous metal and cement ranks the first in the world, phosphorite and pyrite the second and third place, and crude oil the fifth place.

In the past 50 years, environmental pollution in some places has reached the ultimate limit. On the one hand, new environmental problems of dangerous wastes, trace organic pollutants and persistent organic pollutants (POP_S) occurred constantly. Of the waste gas emitted throughout the country in 2006, SO_2 emission amounted to 25.89 million ton and smoke dust 10.89 million ton, and one-fifth of the Chinese urban population lived in an environment with serious air pollution [State Environmental Protection Administration of China, 2007]. More and more natural water bodies have lost their proper function due to increasingly serious water environmental pollution. About one-third of the water body in China is unsuitable for fish survival, one-fourth unsuitable for irrigation, 50% of the urban water source fails to reach drinking water standard, 40% of the water source undrinkable and 60–70% of the total water deficiency in cities of southern China are caused by water pollution. In 2006, the transect of the seriously polluted seven major drainage systems (water quality over Grade IV) accounted for 54%, of which 26% was categorized as worst water quality of Grade V; among the 27 major lakes and reservoirs, water quality of 13 fell into the category of Grade V, 9 below Grade IV and only two were Grade II [Li, 2000].

Offshore sea water environment becomes increasingly deteriorated. In recent years the amount of various kinds of pollutants entering China's near waters reaches about 15 million ton every year, including mainly four types of chemicals: COD, NH_3, oils and phosphate. The occurrence of red tide in China's offshore becomes more frequent, it was 93 times in 2006, and the species of toxic algae increased. Of the 237 monitoring sites of offshore sea water quality, only 19.8% reached the State Grade I sea water quality standard [State Environmental Protection Administration of China, 2007].

Solid waste discharge increases every year. In 2006, the amount of national industrial solid waste reached 1.52 billion ton, an increase of 12.7% over 2005 [State Environmental Protection Administration of China, 2007]. The urban domestic garbage produced in the country was 0.15 billion ton with an annual increasing rate of 8–10%.

With rapid urbanization and urbanization process, both the number and size of China's cities have increased. Since 1990s, China's urbanization development has been out of the normal track due to relative poor planning, legislation and management, hence resulting in serious problems of resources waste, environmental pollution and ecological damage.

The rapid changing industrialization process and economic geographic framework in the past 50 years have led to even more significant land cover change in China. Since 1980s, land for non-agricultural usage has been increased drastically; a sharp increase in urban built-up area at a rate of 850 km^2 per year was witnessed during 1984–2000 [State Environmental Protection Administration of China, 2008]. The cultivated land was lost at a rate of 949,000 hectare per year averagely in China during 1996–2004, a total decrease of 5.84% [Liu et al., 2003].

China's environmental change took place under the background of global environmental change and rapid socio-economic development of the country. Climate warming, water crisis, land cover change, environmental quality deterioration, and ecological damage, all these unfavorable factors will not only make economic development bear great pressure, what is even more serious is the health problem

brought by various environmental changes and risky aggravation, hence building a well off society in an all-round way will face rigorous challenge.

THE POVERTY RELATED TRADITIONAL HEALTH RISKS STILL PREVALENCE

The impact of indoor air pollution on health in rural areas has been a hotspot attracting attention both at home and abroad. Burning inferior coal and biological fuel (straw, firewood, dried cow and sheep dung) is a main reason causing rural indoor air pollution. Coal burning can produce large amount of CO_2, SO_2, NO_x, CO, inhalable particles, smoke dust, harmful elements of F, Cd, Cr, As, Pb, Hg, Ni, Cu, Mn, polycyclic aromatic hydrocarbons (PAH), etc. In the process of burning biological fuel, large amount of CO, smoke dust and inhalable particles can be produced. It was warned that indoor air pollution could result in the deaths of 1.6 million populations in many developing countries every year by WHO and UNEP. Mortality of respiratory system disease is high in rural China, behind the mortality of cancer and cerebrovascular and cardiovascular disease. As shown in Figure 1, the overall distribution pattern of rural indoor air pollution induced health risk is high in northern China. Besides, coal contains high fluorine and arsenic contents in part of the provinces and autonomous regions, in addition to producing SO_2 and atmospheric particle matter, large amount of fluorine and arsenic are emitted in the process of coal combustion, leading to coal-burnt type fluorine poisoning and arsenic poisoning [Zhao et al., 2003].

The endemic disease closely related with primary environment is still prevalent. At present there are still over 800,000 Iodine Deficiency Disease; though Keshan Disease and Kaschin-Beck disease have generally been effectively controlled, they are

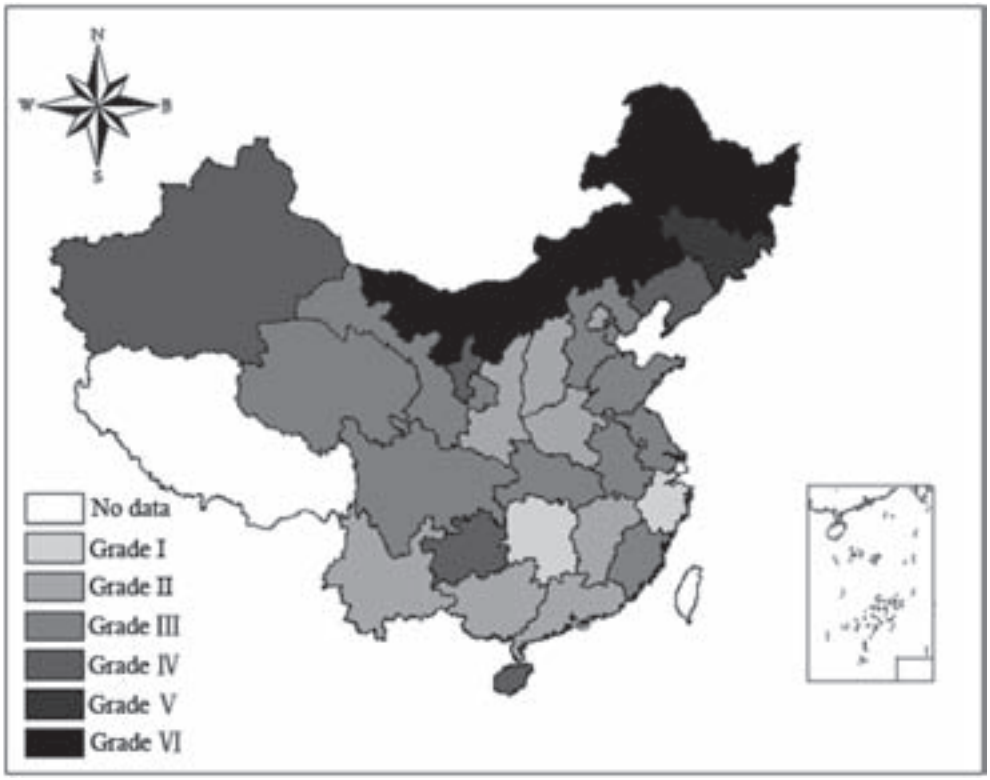

Fig. 1. Health risk of indoor air TSP in Rural of China

still serious in local areas, particularly in Southwest China. Drinking water type of endemic fluorine poisoning and endemic arsenic poisoning still endanger the health of up to one hundred million people in China, distributing extensively in 1063 counties with patients over 20 million, hence it is still an arduous task to control the disease [Ministry of Health of China, 2005].

Some of the traditional infectious diseases such as plague, malaria, schistosomiasis, brucellosis, visceral leishmaniasis, filariasis, epidemic encephalitis, epidemic hemorrhagic fever, cholera etc., mainly do harms to farmers. Besides, there are 5 million motility tuberculosis (TB) patients in China, of them about 80% of the patients come from rural area, moreover, the number of the economically less developed region in central and Western China is two times higher than that of the economically developed eastern coastal provinces.

China has basically solved the problem of hunger and adequate food and clothing. The national nutrient survey result of 2002 indicated that, in contrast to 1992, the diet structure of rural residents tended to be rational, but nutrient deficit diseases (mainly the imbalance of trace element nutrients iron, calcium and vitamin A induced anaemia, osteoporosis, malnutrition and cognitive injury) are still the main diseases harming health, especially in rural, poverty-stricken and remote minority nationality inhabited areas, they have become prominent "recessive hunger". Bradyauxesis and low weight rates of rural children under 5 years old are 17.3% and 9.3% respectively, in poverty-stricken rural area, they are as high as 29.3% and 14.4%. The rate of bradyauxesis for one year old group is the highest, being 20.9% averagely in rural area and in poverty-stricken area, as high as 34.6%. The rate of vitamin A deficiency for rural children of 3–12 years old is 11.2%, being about 3–7 times that of the urban; and vitamin A marginal deficient rate is 49.6%. As vitamin A deficiency for children under three years old is closely related with the susceptibility of diarrhoea and acute respiratory tract infection, the immunity of rural children has been seriously threatened. Moreover, diet structure is closely related with chronic disease like cancer, cerebrovascular disease and cardiovascular disease and diabetes, the change of diet structure in rural area has caused the rise of incident rate of rural chronic disease. Recent nutrient survey results indicate that high incident rate of high blood pressure in rural area has led to insignificant rural-urban gaps, but however, the rate of awareness, cure rate and control rate of human high blood pressure are still very low, being only 30.2%, 24.7% and 6.1% respectively.

HEALTH RISKS ASSOCIATED WITH RAPID ECONOMIC GROWTH AND EXPOSURE TO ENVIRONMENT POLLUTION

China's urban air pollution is still more serious [State Environmental Protection Administration of China, 2004]. The global environmental monitoring system of the WHO and UNEP once listed Shenyang, Xi'an and Beijing the top ten cities having the highest total suspended particle (TSP) concentrations in the world in 1996. In terms of the present status of the nation's cities, the air pollution generally belongs to the first stage coal type pollution. For the economically non-developed medium and small cities and the industrial cities taking coal as the main energy source, such a kind of pollution is particularly protruding. However, in the metropolis and economically developed large and medium cities, pollution began to shift to the second stage air pollution but still having both. The summary published by World Bank in 1997 pointed out that China's air pollution caused a relative high daily mortality. According to estimation there are about 111 000 excess deaths, hospitalized 220 000 people, emergency cases of 4.3 million person/time and 3 million "activity restricted days" due to pollution in China every year. The report by World Bank and the Ministry of Environmental Protection in 2007 estimated that untimely death and disease caused economic loss resulting from

air pollution in China in 2003 was 157.3 billion Yuan, accounting for 1.16% of the domestic total production output value. Among the total loss, the urban outdoor air pollution produced health loss ranked the first place, accounting for 1.6% of the urban domestic total production output value.

China is facing a dual effect of water resources shortage and water quality deterioration. On the one hand, the scope of water shortage expands constantly, while on the other, water pollution becomes more and more aggravated. More than 70% of the rivers and lakes have been polluted to different degrees, COD total discharge level was 40% higher than the environment bearing capacity, the undrinkable surface water due to pollution accounted for 40% of the total observed water bodies, 78% of the river reaches running through cities were unsuitable to be used as drinking water source; nearly 50% of the groundwater were polluted and more than 300 million people throughout the country drank unsafe water [Zhang, 2005], toxic element contents in drinking water for 0.19 billion people in rural area are exceed hygienic standard and nitrate content of 50% of the groundwater in North China are exceed hygienic standard. Though local water environmental quality has been improved after treatment, generally speaking, water environmental deterioration trend has not yet been thoroughly reversed and water pollution situation is still grim on the whole.

The industrial waste water and domestic sewage discharge of the country increased from 3.1 billion m^3 in 1980 to 6.8 billion m^3 in 2004, of which the sewage discharge into rivers reached about 5.33 billion m^3. About 61.5% of the cities had no sewage disposal plants, a considerable amount of cities have not yet set up sewage treatment charged system, sewage collection and treatment network construction lagged behind, of the existing urban sewage treatment works, only one-third can operate normally while one-third cannot operate at all. In addition to large cities, sewage has not been effectively treated in many cities and towns.

The increasingly deteriorated drinking water health problem has become "one of the most urgent survival crises in the present world". In order to remove some of the toxic substance in water, the most commonly adopted treatment method is to add chlorine in drinking water. However, as the reflection of added disinfectant such as chlorine with natural organism in water can produce various types of chlorinated sterilization by-products including trichloromethane and halogenated acetic acid [Bellar et al., 1974; Rook, 1974; Uden et al., 1983], it might cause the occurrence of various types of cancer [Carhman et al., 1981; Bull, 1982; Cantor et al., 1998]. Trihalomethane was detected from running water in 24 large and medium cities in China, and halogenated acetic acid was also detected from drinking water in some cities recently. Analysis of the trihalomethane and halogenated acetic acid contents in drinking water of China's typical cities indicated that trihalomethane in drinking water of Tianjin and Zhengzhou has exceeded the national standard. The high haloacetic acids content in Tianjin, Changsha and Shenzhen constitutes a health risk.

80% of the human diseases are related to water. The toxic substances in discarded materials such as garbage, sewage, insect pesticide and oil can easily enter the food chain through surface water and groundwater. The polluted animal and plant foodstuffs and drinking water can make people suffer from cancer and other diseases. The increase of environment toxic pollutants is the main reason for the increase of incident rate of various kinds of diseases in recent years.

The non-point source pollution caused by heavy use of pesticide and chemical fertilizer as well as sewage irrigation seriously affects soil and agro-ecosystem; hence food quality security is really something to be worried about. In recent 10 years the application intensity of chemical fertilizers on farmland throughout the country has been increasing. In 2005, the amount of application was 367 kg/hm^2, exceeded the upper limit of

the developed countries (225 kg/hm^2) by over 60%. The excessive amount can not be used by crops and absorbed by soils as wall, but lost along with the farmland surface runoff. China is a country producing and consuming large amount of pesticide. Since the 1990s, the total amount of pesticide applied and application intensity have been increasing. In 2005, the amount of application was 11.23 kg/hm^2, being 1.6 times of the average application intensity 7 kg/hm^2 of the developed countries [National bureau of statistics of China, 2006]. Of which high toxic pesticide applied occupied 70% of the total, and high toxic and high residual produced that the State forbidden to use was still produced and utilized in part of regions. Long time spray and touch pesticide can cause leukemia, and 40–45% of the leukemia patients are related with pesticide application in rural areas.

The heavy metal polluted farmland exceeded 20 million hectare in China; about 65% of the sewage irrigated farmland was polluted by heavy metals and organism to different degrees. In some of the cities of South China, 50% of the farmland was polluted by toxic heavy metals such as Cd, As, Hg and organism such as oils; in some of the cities of the Yangtze River Delta, continuous patches of farmland were polluted by heavy metals, causing 10% of the land basically lost productivity. The heavy metal polluted grain produced can be as high as over 12 million ton every year in China, of the main farm produce, exceed standard limit pesticide residual rate is as high as 16–20% [Yan et al., 2000; Hao et al., 2003].

The rapid urbanization process led to substantial increase in garbage. The annual average increasing rate of garbage is 8.42% in the world, but in China it has reached over 10%. China produces nearly 0.15 billion ton of urban garbage every year, accounting for about one-fourth of the world total. Up to now the urban domestic garbage has accumulated 7 billion ton throughout the country. Presently, China's 20% of the urban garbage are treated by filling and burying method, 20% by composting method, 5% by combustion and 5% other (piling in open air, recycling) method, harmless treatment rate of urban domestic garbage accounting for 52% in the country [Zhao, 2002]. The trouble of garbage filling and burying induced seepage pollution can not be underestimated. The current filling and burying method usually mixes large amount of toxic substance with domestic garbage, making multiple types of toxic elements concentrate and pollute soil and groundwater. The parasite and pathogenic bacteria in the polluted soil can cause human body pathogenesis.

With economy rapidly developed and food supply constantly enriched, people changed their behavior more and more obvious. The main reflections are: the increase of meat and oil consumption caused a rapid rise of supply-energy ratio of dietary fats, an apparent drop of cereal food consumption and high intake of salt.

The morbidity of human chronic disease rises constantly, and the prevalence of the corresponding danger factor becomes increasingly serious. This has not only seriously affected health of laborer population, making quality of living standard deteriorated but will also create great socio-economic burden. Of the total death of 58 million people in the globe in 2005, about 35 million died of chronic disease, of them 7.5 million Chinese died of chronic disease. In the next 10 years, the number of the disease will increase by 17% in the world. If no powerful measures are taken to control, the number of death will increase by 19% in China [Chinese Center for Disease Control and Prevention, 2006].

The proportion of death of chronic disease to the total death tends to go up constantly. At present the hypertension morbidity for adults at age of 18 or above is 18.8%, hypertension patients totals 0.16 billion, of with 0.11 billion are laborer patients at an age of 18–59. During the 10 years from 1991 to 2002, the hypertension morbidity increased 31% compared with that of the

20 years from 1959 to 1979, and the number of the patients increased more than 70 million [Chinese Center for Disease Control and Prevention, 2006].

Abnormal blood lipid level is an important danger factor of cerebrovascular and cardiovascular disease. In 2002 the number of adult blood fat abnormal patients was 0.16 billion with a total morbidity of 18.6%, among them the morbidities of hypercholesterolemia, hypertriglyceridemia and low blood high-density lipoprotein cholesterol are 2.9%, 11.9% and 7.4% respectively [Chinese Center for Disease Control and Prevention, 2006].

In 2002, morbidities of diabetes for adults at age 18 or above in large, medium and small cities and rural areas of China were 6.1%, 3.7% and 1.8% respectively. Compared with 1996, morbidity of urban patients in the 6 years went up by 40% in China [Chinese Center for Disease Control and Prevention, 2006].

Morbidity of human overweight and obesity went up rapidly. In 2002, about 0.3 billion people were overweight and obesity in China. Among them overweight rate of adults above 18 years old was 22.8% and obesity rate 7.1%. In the 10 years from 1992 to 2002, the number of residents overweight and obesity morbidity for adults at 18 or above accounted for 40.7% and 97.2% respectively [Chinese Center for Disease Control and Prevention, 2006].

CHANGE OF DISEASE EPIDEMIC PATTERN FROM CLIMATE CHANGE AND ECOLOGICAL DEGRADATION

Global warming changed climate pattern and caused even more frequent and more serious flood and drought, hence leading to rapid fluctuation of climate. Extreme precipitation events tend to increase and become more intensified throughout the country. Both average intensity of extreme precipitation and extreme precipitation value tend to intensify, especially in the 1990s, the proportion of extreme precipitation amount tended to increase. The amount of annual precipitation and extreme precipitation tended to increase in the Yangtze River and south of the Yangtze River region, and both extreme precipitation value and intensity of precipitation event intensified. Meanwhile, the frequency of drought event increased in northern China in recent over a dozen years. High temperature and heat wave increased in summer. The number of high temperature days with high temperature greater than 35 °C increased apparently after the mid-1990s. Upon entering the 1990s, the high temperature and hot summer weather occurred frequently in summer in China. In the summer of 2000, many places in North and South China were hit continuously by heat waves and heat wave process witnessed high temperature, long lasting duration and apparent increase in mortality [Qing, 2004].

The rainstorm induced flood and water logging disasters have the greatest impact with the fastest increase rate. The modern flood and water logging are characterized by high frequency rate, wide scope of influence, long duration and high affected intensity. The severe floods and water logging occurred in the Yangtze River basin (1991, 1998) and the Pearl River basin (1994, 1996) in the 1990s as well as extraordinary storm induced floods in Hebei Province in August 1996 both resulted in a direct economic loss over 10 billion Yuan. The 1998 flood disaster caused a direct economic loss of 255.1 billion Yuan. In 2005, the serious storm induced flood disasters occurred in Xijiang river, Minjiang river and Huaihe drainage basins and Hunan, Hubei, Sichuan and Liaoning provinces as well as severe autumn floods in Weihe and Hanjiang drainage basins affected about 0.13 billion people, caused a death of 1246 people and a crop affected area of 11 million hectare with a direct economic loss of over 77 billion Yuan. In 2008, 20 provinces, autonomous regions and municipalities were hit by flood disasters to different degrees. Up to June 17, the crop affected area reached 2.32 million hectare, the disaster affected area was nearly 1.13 million hectare, and impacted population reached 40.62 million, a death of 171 people and a

collapse of 133.900 rooms, with a direct economic loss of 27.7 billion Yuan [Tan et al., 2002].

Serious drought is also an extreme climatic disaster. In 2005, serious drought occurred continuously in autumn, winter and spring in southern part of South China, serious spring drought rarely seen in recent 50-odd years occurred in Yunnan Province, early summer drought took place in the middle and lower Yangtze River basin, summer and autumn continuous drought happened in northeastern part of Northwest China and Inner Mongolia, and autumn drought was obvious for a period of time in areas south of the Yangtze River and South China [Xiao & Xu, 2006]. According to estimation, the drought affected crop area was 16 million hectare, the disaster caused area 13 million hectare, the area having no harvest at all was 1.9 million hectare and 23.5 million people had difficulties in getting drinking water, the direct economic loss reached more than 20 billion Yuan throughout the country [Xiao & Xu, 2006].

Nowadays various kinds of new diseases occur frequently; some diseases that have already been eliminated or weakened become popular again and spread rapidly throughout the globe, constituting the new characteristics of epideictic of world diseases. China is a country with high incidence of numerous diseases, particularly with that of infectious disease of natural foci and the disease that human and animal commonly suffering from. With global warming and aggravation of human destruction on ecosystem, some old infectious diseases began to survive in China.

Plague (rat) is a typical natural focus-based infectious disease, and plague has been effectively controlled for a long period of time. However, as shown in Fig. 2, since the 1990s, plague cases have increased apparently and plague has spread risk.

Malaria has also spread risk, which is affected by climate and weather conditions. The abnormal weather, such as rainstorm can make mosquito propagate substantially and lead to epidemic outbreak. The distribution of malaria of China is shown in Fig. 3. The area south of 25 °N is high epidemic area of malaria. Meteorologists predicted that a rise of average 2 °C of temperature globally, the proportion of malaria affected population

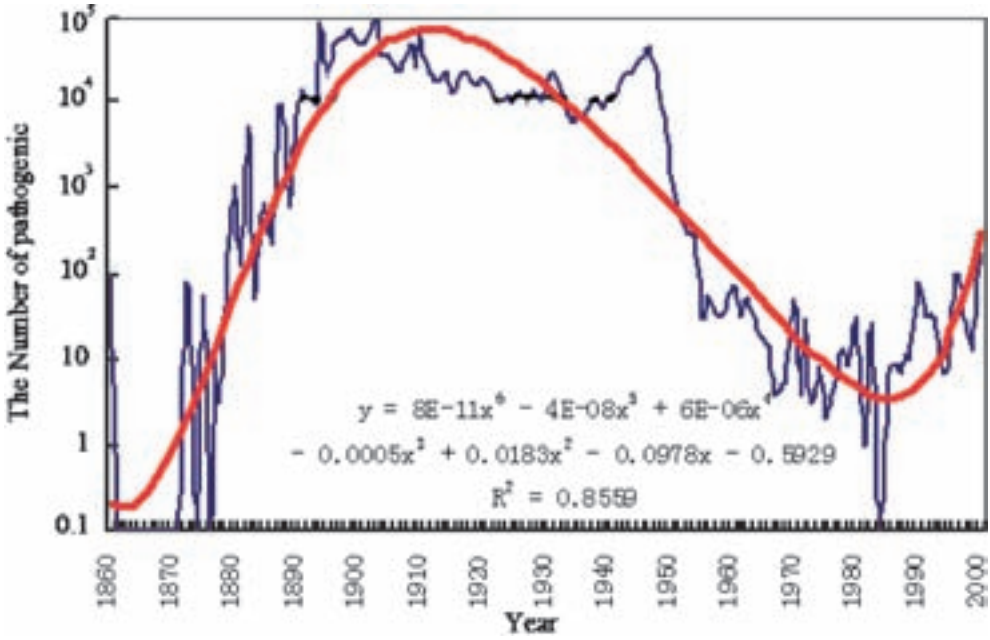

Fig. 2. Number of the incidence of plague in China

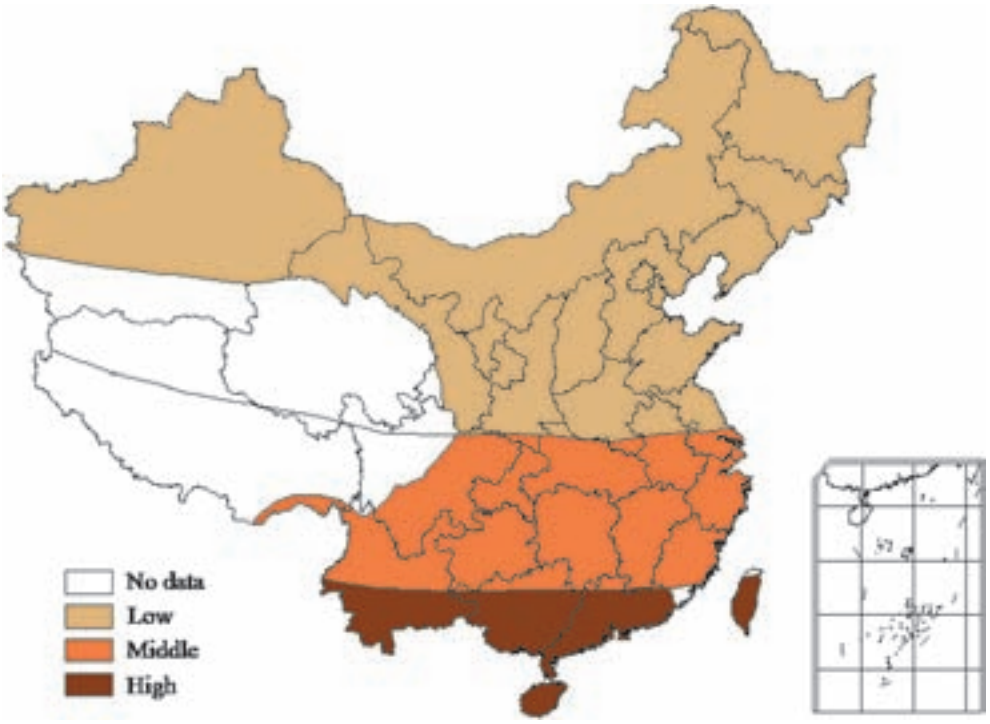

Fig. 3. The distribution of malaria in China

might increase from present 45% to 60%, an increase of newly added cases of 5 million to 8 million. Predictions of Yunnan and Guizhou provinces indicate that a rise of 1.7 °C will occur and cause the epidemic affected area extend towards north and high altitude. Besides, the frequent population movement will cause outbreak and prevalence of imported malaria from outside China. For instance, the import malaria increases every year in Guangxi and 103 malaria outbreak and prevalence points occurred in the border region of Yunnan during 1989–1996 [Jiao et al., 2006].

Schistosomiasis was prevalent in the Yangtze River Basin and 434 counties in 12 provinces (municipalities) and autonomous regions south of the Yangtze. The population in the disease affected area was 66 million, patients about 0.84 million, the scope of the affected area radiated and expanded constantly, hence part of the medium and small cities have been threatened by the disease [Ministry of Health of China, 2004]. One of the important factors to affect and control disease propagation is to change the eco-environment by converting cultivated land to lakes and leveling protective embankments in lakeside areas to divert flood water. The climate warming induced flood disaster increase is closely related with the epidemics of schistosomiasis. In recent 10 years, flood disasters happened frequently in the Yangtze River [Zhang et al., 2002].

The occurrence of SARS in 2003 and bird flu in many places of China in recent years relates closely with agricultural industry growth and rapid increasing of travel. Since early 2003, there have been many reports of outbreaks of avian influenza related with wild birds and domestic poultry in many countries. In China, the large amount of domestic poultry and pigs are close proximity to human with the fast agricultural industry expansion that resulting in exposure and transmitting virus from animal to human. At the same time, the rapid rising of travel in frequency and scale within China and in the world likely increases the infectious exposure of new emergent diseases to human such as SARS which of more than 8000 infected individuals, with over

700 deaths worldwide within just six months. These present great challenges for the control of outbreaks of new highly infectious diseases.

CONCLUSIONS AND SUGGESTIONS

China's environmental change and health problem is very complicated, characterizing mainly by the following aspects. First, China's environment and health problem was resulted from the global environmental change and China's rapid socio-economic development. Second, health harmfulness usually presents synthetic function of environmental multi-media and multi-factors. Third, environment and health problem has distinct regionality. Fourth, it is more difficult to evaluate and forecast the impact of environmental change. Fifth, it is lack of the multi-sector integrated coordination and management at present.

In order to cope with environmental change and health risk, the following suggestion and countermeasures are put forward.

To establish multi-sector high-level integrated coordinative governance mechanism to face challenge of environmental change and health risk

Environmental change can exert important impact on human health, which will not only aggravate problems concerning various aspects of public hygiene but also bring new and unpredictable problem on social sustainable development. Therefore, only by taking the impact of environmental change on human health as an important component of government management, formulating multi-sector integrated, coordinated and decision-making system and mechanism and identifying common target from the viewpoint of multiple layers of policy, education, the public, propaganda, technology and research, can effective management be formed.

The management of environmental change and health involves many sectors; hence it is not easy to perform effective management. The current China's administrative management system is still a highly traditional top down system, characterizing apparently by "block splitting and strip splitting". In light with such a kind of defect of "either centralization of power or dispersion" in management system, the state will implement a new round of reform on administrative management system. It is necessary for us to establish a new system and decision-making mechanism on environmental change and health management to strengthen inter-sectoral close coordination among various aspects of environment, hygiene and society, strengthen the linkage and dialogue among government (state and local various levels decision making departments), regions, trades, non-government organizations and public interest related personnel, and link environmental change with policies, measures and actions of health management organically.

Facing the new problem of global environmental change and health risk, it is necessary to manage the already existing and unpredictable environment and health problem from new angles and new preparations. In order to mitigate the possible impact on health due to environmental change, it is necessary to conduct disease monitoring and get to know changes of disease in geographic distribution; to strengthen environmental management; to be well prepared to cope with disasters; to improve early warning system and be ready to deal with prevalence of disease; to improve water quality and control air pollution; to enhance public education of individual behavior; and to train research workers and professionals on public health. The present urgency is to establish a high-level integrated coordinative management system and mechanism, raise the ability of the state in coping with environmental change, and directly promote the improvement of the national health level.

To improve national awareness and implement action plan on environmental change and health protection

With the progress of society, people have become more and more concerned about their own health. However, their awareness is

extremely weak in linking up environmental change with health impact, in standardizing their own behavior, and in connecting individual health with environmental change. To rise to the challenge of global environmental change, it needs the whole nation's participation, especially to standardize the whole nation's behavior with new ideological system, consciously using one's own action to mitigate global environmental change and health risk. To this end, it is specially significance to the establishment of environmental ethical viewpoint for sustainable development and raise of the nation's awareness to the challenge of global environmental change and health risk.

The core of the environmental ethical viewpoint for sustainable development is to set up truly equal and justice for human and human-nature relations, advocate harmonious development and survive and take honour together. The human equal principle required environment ethics includes intra-generation equality reflecting global common interest and intergeneration equality reflecting future interest. The principle of human-nature harmony is the fundamental principle for sustainable development.

The implementation of action plan on environmental change and health protection is an essential measure to raise the nation's awareness in dealing with environmental change and protecting health as well as to put into practice consciously. Citizens should actively promote and participate in the action, do it from themselves and protect the nation's health.

To energetically conduct research on environmental change and health risk

Global environmental change and health research is a multi-disciplinary integrated research, in light of the trend of global environmental change, the problems concerning environmental change and health research that should be solved urgently are: 1) to deepen the complexity and uncertainly of the relationship between environmental change and health; 2) to reveal the correlativity of environmental multi-media, multi-factor and multi-dose and synthetic health effect and its mechanism; 3) to set up synthetic risk evaluation system of environmental change and health security and reveal the characteristics of environmental change and key health risk areas; and 4) based on data sharing mechanism, to set up environmental change-health risk-socioeconomic relationship and the model system with prediction function and supplementary decision-making.

To establish scientific data sharing mechanism and new research method

At present, research on environmental quality and human health is restricted to the inadequacy of suitable data, sufficient material and deep data extraction. Data and materials on morbidity, mortality, population and various aspects on environment are available by the state, however, various government departments are independent of each other, and only responsible for the data of their own relevant trade and lack of data sharing and assemblage. Therefore, it is necessary to formulate jointly a data agreement to promote data exchange among various departments and set up a data sharing mechanism on environmental change and human health.

It is necessary to develop standard method for compiling environment-health data and through regular exchange between data collectors and data users to ensure the collected data possessing most useful information and spatio-temporal resolution. In order to estimate the health effect of the global environmental change, long term disease monitoring should be connected with environmental monitoring that has correlations with specific geographic positions. Meanwhile, biological and meteorological data should be collected simultaneously. The principal scientific data should include remote sensing data; long time series health data; disease propagation data; environmental, socioeconomic and

population statistical data matching health data; environmental change and biological species monitoring data; and biological effect indicators that can reflect global environmental change.

Research on environmental change and health needs to merge multiple research method including development of modeling method relating to various kinds of data and to carry out scenario analysis on environmental change and health at global and regional scales. In addition to the research method on traditional epidemiology and hygienics, it is even more necessary to have new research concept and method. To this end, seminars and training courses involving multi-disciplinaries should be held regularly to promote exchange of new ideas and concept and the development of integrated research method.

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IMPACT OF TRADITIONAL PRACTICES ON MEDICINAL PLANT TRADE IN THE RAINFOREST OF NIGERIA

ABSTRACT

A cross-sectional survey was used to assess the impact of traditional practices on trade in traditional plants within the rainforest of Nigeria. A questionnaire survey and market-based observations were used to derive data from 110 stakeholders including: plant collectors, sellers, middlemen and traditional healers. Results of data analyses indicate that: (i) plants not suitable for cultural practices were not usually used for traditional medicine. (ii) Traditional management of the forests based on open access, restricted access and closed access rights could no longer protect habitats of medicinal plants. (iii) Breakdown of management practices in the forests was common because of a twin factor: violators of regulations were not being punished; and there were increasing disputes over land boundaries among communities. (iv) Medicinal plants on regular trade were in decline. Stakeholder participation in species rehabilitation in the forests and establishment of *ex situ* gardens may sustain the medicinal plant trade.

KEY WORDS: medicinal plants, cultural practices, traditional management, stakeholder participation, traditional healers

INTRODUCTION

Trade in traditional plants in Nigeria is cultural based. It is not limited to ethnic group systems. It is accessible to all cultures existing in the country. However, the uses of traditional plants are greatly influenced by traditional beliefs practised in the realm of rituals, magic and religion [Osemeobo 2005a]. Rituals are believed to enforce achieving cure. Medicinal plants in this study refer to plants that can both be used for healing and cultural ceremonies and festivals. It is widely believed that plants suitable in traditional medicine must have roots in the traditional cultures that were pivoted in myths and folklores. As a result, plants commonly used for cultural development are the ones used for traditional medicine [Posey, 1999, Osemeobo, 2009a]. There is therefore no clear cut difference between medicinal plants and plants used for cultural practices. In most communities, plants and animals not suitable for cultural practices are generally not used in traditional medicine [Osemeobo and Omeni, 2008].

Trade in traditional medicine has thrived in Nigeria because of push factors motivating huge acceptance by the people: (i) easy to access, cheapness, respect and privacy in treating patients [Sofowora, 1993]; (ii) application of trado-medical therapy for treatment of diseases and sickness that could not been treated in orthodox hospitals (multiple bone fractures, delayed labour in women) [NPC, 2000]; (iii) conformity with traditional culture based in taboos restricting traditional office holders from being treated by strangers[Chambers, 1999] particularly members of the opposite sex [Senanayake, 1999]; (iv) high overhead costs in attending orthodox health centres in distance

places; (v) poor infrastructure (inadequate beds, drugs, medical officers, water and electricity) in most orthodox hospitals [UNSN, 2001]; and hostile attitudes of some medical workers to patients from rural areas.

Medicinal plants in the country are mainly collected from natural forests. They generate a vigorous volume of economic activity by meeting traditional medical requirements of over 124 million people on regular basis [Osemeobo, 2008]. The collectors of medicinal plants from the forests are driven by profits with no regards for the conservation of species and habitats [Osemeobo, 2005b]. Poor management practices have made the resource base for the supply of medicinal plants fragile. Access to the forests by herbal collectors is under inferior land use rights. Under inferior user rights, a holder: (i) could be asked to withdrawal from collecting medicinal plants without prior notice, (ii) must renew permits to collect plants from landholding communities on seasonal basis and (iv) could be denied access to the forests anytime even within the period covered by permits [Osemeobo, 1993].

Over the past 15 years, decreasing supply of medicinal plants generated gaps in the traditional health care system and reduced incomes to healers [Osemeobo, 1991]. Even under this scenario, the forests are harvested beyond their carrying capacities because annual supply of medicinal plants form the forests is less than what the forests can regenerate within the same period. High demand of medicinal plants encouraged intensive and extensive harvest of choice species which has created serious concerns for species and habitat conservation [Osemeobo, 2001]. Rareness of some medicinal plants that are central to medical preparations (*Acanthospermum hispidum, Vernonia amygdalina, Gloriosa superba,Psychotria vogelii, Aldornea cordifolia, Cissus arabides, Costus afer,* and *Cyclosonus afer*) has increased prices in local markets [Osemeobo, 2009a]. Unfortunately, destructive harvesting practices (de-barking, cutting of roots of plants, uprooting herbs and seedlings and harvesting of flowers and immature fruits) contributed to die-back of species in natural forests (*Pipper guineense, Baillonella toxisperma, Ricinus communis and Xylopia aethiopica*) thereby hampering the flow of materials from the forests to sustain trade in medicinal plants [Osemeobo, 2001]. Unfortunately, lack of spatial data on trends of medicinal plant trade appeared to have closed up the opportunity for stakeholder motivation in commercial cultivation of high valued medicinal plants [FME, 2003]. These deep rooted cultural practices have largely impacted the supply and demand chains of medicinal plants [Osemeobo, 2009b].

OBJECTIVES

The objective of this study was to assess traditional practices that impact trade in medicinal plant within the rainforest of Nigeria. Specific objectives were to:

1. Identify and evaluate traditional practices in the management of the forests for commercial supply of medicinal plants; and

2. Examine how traditional practices can accommodate the conservation of medicinal plants.

METHODOLOGY

1. The study areas

The study has a spatial focus on the rainforest zone of Nigeria located between latitudes 4° 30′ N and 7° 30′ N; and between longitudes 2°30′ E and 9° 30′ E (Fig. 1).

2. Sampling

All the ten state capitals located within the rainforest zone of Nigeria were used for data collection. These were Abeokuta, Ado-Ekiti, Akure, Benin, Calabar, Enugu, Ibadan, Oshogbo, Owerri and Uyo. In each state capital, a reconnaissance survey was conducted and one open market where medicinal products were sold was randomly selected for data collection.

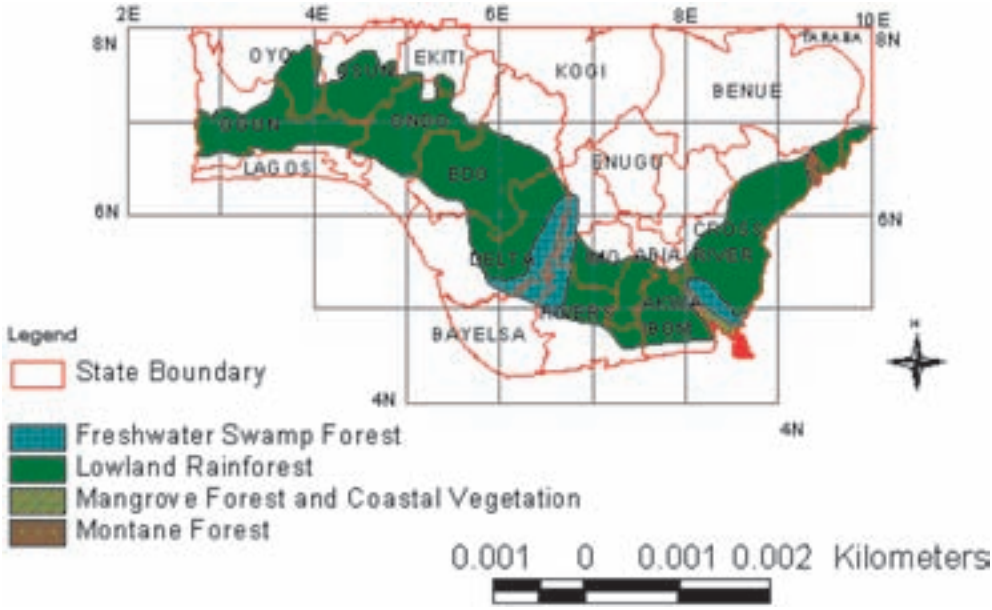

Fig. 1. The Lowland Rainforest Zone of Nigeria

3. Data collection

The data on which this study was based were collected between April 2009 and February 2010. Data were derived from 110 stakeholders including: plant collectors, sellers, middlemen and traditional healers using a structured questionnaire (Appendix 1). Physical observations were conducted in the open markets while discussions were held with groups of stakeholders. Medicinal plants were traded in products classified into four main types: reproductive propagules (flowers, fruits, seeds and nuts); vegetative structures (leaves, stems, roots and barks); whole plants (herbs) and plant exudates (gums and resins). Forty five marketable plant species and their products were observed during the survey.

RESULTS AND DISCUSSION

1. Land tenure and access to medicinal plants

Access to medicinal plants was determined by the land tenure system in vogue. Land tenure was the institutional arrangement guiding the ownership, allocation, control and use of land. The indigenous land ownership was communal made up of families with common ancestors or historically aligned. Families enjoyed clearly defined spatial user rights over different parcels of land common to them within the general land holding system. Access to medicinal plants under the communal land tenure system was free to members of a land holding family by birth or long settlement and through permits to non-members of land holding communities.

Analyses of the data in Table 1 indicate that: (i) access to medicinal plant harvest was not adequately controlled. Tenure regulations influenced access rights. Exploiters of medicinal plants had no obligation to conserve species and habitats. (ii) The least effective protection method for medicinal plants was the open access (37.7%) and followed by restricted access (32.8%) and closed (29.5%). From the market survey it was clear that plant harvest was abused: immature flowers and fruits were harvested (*Afromomum melagueta, Piper guineense*); roots of plants were indiscriminately harvested (*Garcinia kola, Hypoeses rosea*); looping of trees with fruits was carried out (*Piper guineense*); debarking of trees did not

Table 1. Traditional tenure regulations that negatively impact the medicinal plant trade

Location of respondents	Respondent opinion on tenure regulations that negatively impact the medicinal plant trade (N = 110)			
	Open access	Restricted access (permits)	Closed access	Total
Abeokuta	35	32	33	100
Ado Ekiti	39	41	20	100
Akure	38	39	23	100
Benin	46	24s	30	100
Calabar	29	30	41	100
Enugu	33	42	25	100
Ibadan	40	24	36	100
Oshogbo	42	37	21	100
Owerri	34	31	35	100
Uyo	41	28	31	100
Mean responses %	37.7	32.8	29.5	100

consider tree recovering. It was noticed that barks of trees that were formerly debarked but not fully healed were debarked again for the market (*Khaya Ivorensis, K. grandifolia*); and in most cases whole plant utilization were carried out (*Alchornea cordifolia, Aspilia Africana, Ipomoea involucrata*). About 95% of the respondents in this study claimed that uncontrolled access rights to medicinal plants under the traditional land tenure regimes led to loss of species, decline and extirpation in the study area.

2. Traditional forest management

The forests where medicinal plants are harvested were grouped into three: privately owned, stool forests and community owned. The privately owned forests (with owner-user rights) and the stool forests (with exclusion rights) appeared to favour biodiversity conservation. The owner-user rights were exercised in privately owned fallow lands. Plants of socio-cultural and economic values were protected as long as the land remained in fallow. Respondents claimed that about 25% of medicinal plants on trade were derived from privately owned fallow lands on which access to other members of the community was excluded. The exclusion rights reduced the number of people who were allowed to gain access to resources devoted for specific community uses. The forests under the exclusion rights were stool forests: sacred grooves, *bad bushes* and royal forests managed through closed season and open season for those that enjoyed sequential rights of access. Transfer rights on these forests were forbidden to assure the stability of biological resources. According to respondents, only about 5% of medicinal plants in trade were supplied from these forests.

About 70% of medicinal plants were harvested from community forests. Table 2 presents respondent opinions on the causes of breakdown of regulations in community forests. The main reasons for poor management of community forests in Table 2 was due to the fact that: (i) the management system was being eroded by free-rider issues caused by: land fragmentation for agricultural production (26.4%); (ii) poor monitoring of the forests: there were no paid guards to monitor the forests hence regulations could not be fully enforced (26.4%); (iii) communities were loosing court cases against violators of community regulations

Table 2. Causes of breakdown of community forest management

Location of respondents	Respondents opinions on causes of free-rider issues in community forests (N=110)				
	Court cases	Community disputes	Absence of guards	Land fragmentation	Total
Abeokuta	26	27	19	28	100
Ado Ekiti	30	23	23	24	100
Akure	24	12	36	28	100
Benin	20	36	28	23	100
Calabar	31	14	28	27	100
Enugu	22	20	32	26	100
Ibadan	18	24	41	17	100
Oshogbo	31	12	37	20	100
Owerri	23	23	36	18	100
Uyo	28	28	30	14	100
Mean responses %	25.3	21.9	26.4	26.4	100

(25.3%); and (iv) community disputes over boundaries of settlements were common and these created gaps in forest control (21.9%). Besides these factors, the forests under effective control of communities were becoming too small for effective management.

Fig. 2 was derived from the data in Table 2, and it presents the graphical illustration of the main causes of breakdown of community forest management which were mainly administrative laxity – the absence of forest patrol guards and land tenure issues that led to land fragmentation.

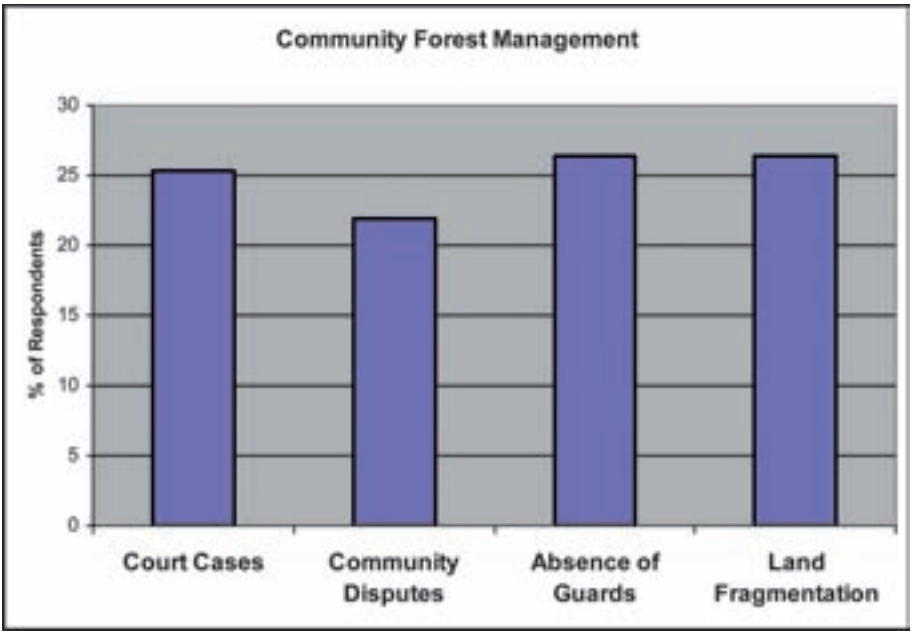

Fig 2. Causes for Brakedown of Community Forest Management

3. Traditional factors motivating the utilization of medicinal plants

The traditional culture promotes free access to traditional health care delivery and religious beliefs. These factors influenced the use and trade in medicinal plants. The data in Table 3 revealed that medicinal plants occupied a central position in the social, cultural and economic lives of the rural people. The traditional culture of the various communities relied heavily on medicinal plants for their sustenance in terms of: recreation: ceremonies and festivals (24.7%), employment generation (19.9%), health care (18.6%), income generation (18.5%) and traditional religion (18.3%) (Fig. 3).

Table 3. Factors influencing the utilization of medicinal plants

Location of respondents	Respondent views on factors in the utilization of medicinal plants (%) (N=110)					Total
	Income generation	Employment	Traditional religion	Health care	Recreation	
Abeokuta	20	14	23	15	28	100
Ado Ekiti	16	28	12	23	21	100
Akure	19	14	17	22	28	100
Benin	18	16	24	18	24	100
Calabar	19	23	20	18	20	100
Enugu	26	22	19	18	15	100
Ibadan	20	19	18	22	21	100
Oshogbo	18	16	18	23	24	100
Owerri	14	28	17	21	12	100
Uyo	15	16	15	24	30	100
Mean responses %	18.5	19.9	18.3	18.6	24.7	100

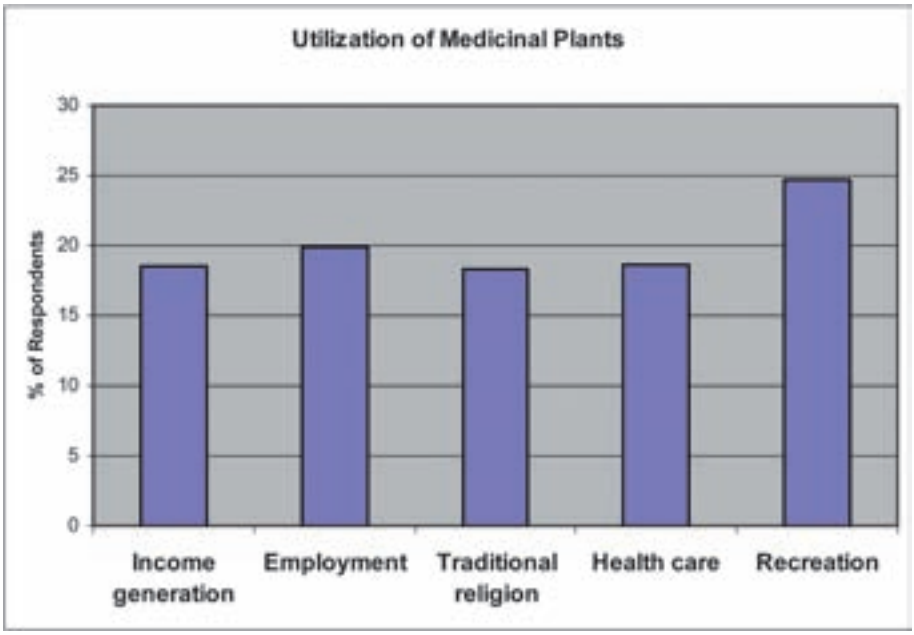

Fig 3: Factors Influencing the Utilization of Medicinal Plants

Respondents indicated that the absence of key traditional medicinal plants was leading to postponement of some cultural festivals. For example, a traditional chief in *Yoruba land* cannot be installed in the absence of *ewe ikoko* (*Newbouldia laevis*). The culture in some communities demands that the drums and masks used for cultural festivals should be carved from *sacred* tree species: *Triplochiton scleroxylon, Astonia congensis, Vitelaria paradoxum, Trichilia rubescen* and *Lawsonia inerms.* The fire wood used for cooking foods used for rituals is derived from the followings species: *Khaya ivorensis, K. granditolia, Alstonia boonei, A. congensis, Triplochiton seleroxylon, Bridelia ferruginea, Vitex doniana* and *Cordia millenii* in some cultures. The species for cultural festivals are also used for curative and or magical purposes. These multiple uses mount pressure on choice species of medicinal plants.

4. Traditional practices and medicinal plants

Respondents in this survey indicated that the traditional practices influence uses of commercial based medicinal plants. Table 4 presents the views of respondents on the status of each of the 45 species in regular trade within the rainforest areas of Nigeria and revealed that: (i) habitat loss is the main impact of traditional practice on the medicinal trade (36.2%). This was followed by over harvesting of medicinal plants (35.4%) and extirpation of medicinal plants from the forests (28.4%). (ii) Extirpation of species was an indication decline while habitat loss crated instability in the medicinal plant trade. (iii) Over harvesting of medicinal plants was an issue that had reduced the rate of species regeneration in natural forests.

POLICY IMPLICATIONS

The forests supplying medicinal plants were fragile and in decline. The traditional practices put in place to manage the forests are failing: regulations were difficult to enforce; management practices aimed at conserving the forests are broking down; and access rights is becoming a mere routine. Within the framework of these practices, the ecology of medicinal plants within their habitats is not promising for their domestication for the market: they are characterized with slow growth rate, irregular flowering and fruiting within and between species, low viability of seeds, scanty fruits, high rate of seed infestation on the forest floor and wide spread of stranglers on seedlings under canopy opening required for regeneration of seedlings in the forest floor [Lamprecht, 1978].

Challenges of *in situ* conservation of the species are an uphill task especially under difficult tenure regimes in place. Even in the face of these setbacks, *ex situ* conservation among stakeholders of medicinal plants is not bright. Many farmers are not motivated to raise market based medicinal plants in gardens due to financial constraints, lack of technical and silvicultural knowledge of plants and inadequate access to land [Osemeobo, 1990a]. Besides these are lack of infrastructures on which domestication of medicinal plants can be based. Policy-decision makers can solve the problems by providing resources to: (i) document keystone species of medicinal plants in each ecological zones and their distribution status and uses; (ii) stimulate the interests of farmers to encourage them integrate growing of medicinal plants into the traditional farming system [Osemeobo, 1990b]; (iii) conduct regular research and training on the techniques of producing medicinal plants for the market in terms of the silviculture, management and harvesting; (iv) initiate establishment of community based medicinal farms, (v) analyse market chains and policies for resource planning, (vi) monitor and evaluate the status of medicinal plants in terms of profitability and acceptance as a viable land use and (vii) combine *in situ* and *ex situ* methods to conserve habitats where medicinal plants are harvested.

Table 4. Impact of traditional practices on the status of medicinal plants regularly traded in Nigeria

Status of medicinal plants from natural forests	Respondents opinion on impacts of traditional culture on the status of key medicinal plants on trade (%). N = 110			
	Habitat loss	Over harvesting	Extirpation	Total
Canarium schweinfurthii	35	32	33	100
Zingiber officinale	21	43	36	100
Piper guineense	48	34	18	100
Afromomum melagueta	41	46	13	100
Xylopia aethiopica	38	33	29	100
Tetrapluera tetraptera	38	28	34	100
Ananthus montanus	16	40	44	100
Ocimum gratissimum	45	38	17	100
Hypoeses rosea	12	43	45	100
Thorningia sanguine	10	52	38	100
Khaya senegalensis	23	48	29	100
Tetracarpidium conophorum	11	52	37	100
Laggera alata	41	46	13	100
Rauvolfia vomitoria	38	5	57	100
Cocholospermum planchonni	13	48	39	100
Solanum indicum	48	42	10	100
Enantia chloratha	45	38	17	100
Combretum smeathmanii	55	38	7	100
Daniellia ogea	48	48	4	100
Uraria picta	16	45	39	100
Struchium spargonophora	38	49	13	100
Rothmannia hispida	29	54	17	100
Lophira procera	51	43	6	100
Annona senegalensis	36	16	48	100
Sansevieria berica	28	55	17	100
Sanseuieria guineense	11	28	61	100
Acanthus montanus	47	27	26	100
Cissus aralioides	29	14	57	100
Uvaria chamae	46	50	4	100
Callichilia barteri	24	27	49	100
Rauvolfia vomitoria	48	34	18	100
Anchomanes difformis	57	25	18	100
Marsdenia latifolia	45	8	47	100
Spathodea campanulata	34	48	18	100
Combretum racemosum	49	6	45	100
Acanthospermum hispidum	36	58	6	100
Aspilia africana	35	19	46	100
Byrsocarpus coccineus	32	51	17	100
Cnestis ferruginea	35	42	23	100
Ipomoea involucrate	53	45	2	100
Alchornea cordifolia	45	29	26	100
Bridelia ferruginea	50	7	43	100
Phyllantus muellerianu	42	50	8	100
Dissotis graminicola	39	55	6	100
Boerhavia coccinea	48	10	42	100
Mean responses %	36.2	35.4	28.4	100

CONCLUSION

Based on the results on which this study is based, it was clear that the traditional forest management practices were working against time. A central question is: should policy and decision makers gloss over the problems of conserving the forests that may jeopardize future generations in medicinal plant trade? We think not. It is well known that except the rural communities that depend on medicinal plants are directly involved in the conservation and management of the forests stability of the ecosystem cannot be realised. On this basis it is recommended that domestication of medicinal plants through stakeholder participation should be combined with enrichment planting within the forests. ■

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APPENDIX 1: QUESTIONNAIRE FOR THE SURVEY OF MEDICINAL PLANTS

Location_____

Name of settlement (town)_____

Name of market_____

Name of Respondent_____

Date of interview_____

I Demand for medicinal plants

1. What do you understand as a medicinal plant in your community?

2. Name the 5 most popular plants in traded for traditional medicine in your community.

Medicinal plants (species)	Type of products (leaves, rots, flower, bark...)
1.	
2.	

II Supply of medicinal plants

1. Where is the source of supply for the medicinal plants you use or sell? _____

2. How far is the source of medicinal plants from your village?_____

3. Has the distance of source of medicinal plants supply changed over the past 5 years? Yes_____ No_____

4. What are the reasons for changes in distance travelled for the supply of medicinal plants supply? _____

III Traditional practices affecting medicinal plants

1. Do medicinal plants have cultural importance in your community? _____

2. Give the cultural values of medicinal plants apart from healing _____

3. What type of land tenure is in vogue in your community? _____

4. What are the traditional methods of managing the forests? _____

5. What form of regulations is imposed on access to medicinal plants for trade?_____

6. Are access rights: (i) obey? _____ (ii) Violated? _____

7. What are the causes of free-rider (violation of regulations) issues? _____

8. Give reasons for your answers in N0 5 above_____

9. What are the regulations for harvesting medicinal plants for trade? _____

10. What is the cause of decline for each of the traditional medicinal plants you gave before using any of the followings: (i) habitat loss (ii)over harvesting (iii) extirpation (iv) abundance _____

IV Sustainability of medicinal plants

1. Is the use of medicinal plants popular in your village? _____

2. What is the importance of medicinal plants to your community? _____

3. Is the volume of medicinal plants Increasing? _____ Decreasing? _____ Stable?

4. Are the numbers of patients that patronise traditional healers? Increasing _____ Decreasing _____ Stable? _____

5. Do you own private herbal garden? _____

6. Will you support the community management of natural forest to conserve herbal plants? _____

7. If your answer to question 9 above is yes, how can communal conservation be strengthened? _____

8. Give the names of 5 medicinal plants that require urgent measures of conservation in your locality _____

9. Name 5 species of medicinal values that were common in the forests ten years ago that are locally extinct now _____

THANK YOU

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INDICES OF DEVELOPMENT AND THEIR PRACTICAL APPLICATION

ABSTRACT
This research work was devoted to the development of indices of social, economic and political growth, to the practical application of these indices, and to their real-world verification with actual data. The study identified the advantages and disadvantages of the application of different indices to the assessment of growth. For example, one group of indices can be calculated, with some degree of simplification, for a fairly long time-period (half a century). Another group of indices that target the full consideration of growth includes indices that consist of a number of individual indicators though calculated for a relatively short time-period (e.g., one year only). The authors introduced specific indices of economic and social growth of countries and regions that were applied to the assessment of the social, economic, and political development of the world's countries. The assessment was verified using actual data on the countries' development.

KEY WORDS: indices of social, economic, and political development, economic and social lagging.

INTRODUCTION

First, let us talk about the objective changes that determine the variation of indices under consideration over the past century. One hundred years ago, even the boldest and most insightful experts could not predict, nor even imagine, the transformations that would take place in the global economy in the 20th century. The scope and structure of the economy and the national and global financial systems that support economic growth in some cases changed beyond recognition. Scientific and technological progress has led to a huge increase in the production of goods and services that has effectively raised living standards, despite the unparalleled increase in the population of the Earth and the even greater sophistication of the political map of the world (the number of independent states of the century has increased by more than three times). A deepening of specialization and the development of markets accompanied the increase in production, which facilitated the exchange of goods and the spread of new technologies, both within and between national economies. A significant reduction of material indices in most industries, of transportation costs, and of weights of many goods (with their miniaturization, etc.) contributed to the territorial expansion of the markets.

Although the results of economic growth were not uniformly distributed across the countries and regions, the assessment of the extent of this inequality depends on the choice of indicators. The gap between the average per capita Gross Domestic

Product (GDP) between rich and poor regions of the world has risen sharply. But if the focus is on, for example, indicators of social development, which partly discounts the value of average consumption (at a reasonable level) and stress such indicators as life expectancy and educational attainment, one can acknowledge some convergence between the countries towards the end of the century, despite the persistence of significant gaps between these indicators.

Before proceeding to the calculations of the composite indices of development targeted in this study, it is necessary to understand the main macroeconomic indicators characterizing the growth of the world's economy and the distribution of the world's income over the 20th century. The two most important features of economic development in this century are its significantly greater, compared to the past, pace and unevenness in different countries and regions.

The most authoritative historical estimates of the GDP indicate that in the 20th century, the total output of goods and services was significantly greater than their cumulative production for the entire preceding period of history known to mankind. From 1900–2000, the world's GDP (in real terms) grew 19 times, with an average annual growth rate of 3%, or 3,7% per year considering the emergence of new products and the improvement of product quality, which means a 38-fold increase of the GDP for the century [Caring for the future... 1999].

The population growth rate significantly accelerated in the 20th century – the world's population increased nearly four-fold – from 1.6 billion people in the beginning of the century to more than 6 billion at the end. If we consider the aftermath of the industrial revolution (from 1750 to 1900), when the world's population more than doubled, the average annual growth rate since 1750 can be estimated at 1.4%. During the longer than thousand-year period before the industrial revolution, population growth did not exceed 0.1% per year [Caring for the future... 1999]. Tremendous growth of the population in the 20th century often led to serious concerns and doubts about the sustainability of these trends because of the limited resources of the planet.

Aggregate centennial indicators of the world's production and population reveal substantial differences between countries, as well as uneven growth in some distinct periods of 20th century. Thus, if the richest quarter of the world's population had nearly a six fold increase in the average per capita GDP over the century, the poorest quarter experienced only a three-fold increase, although in the longer historical perspective, the three fold increase in income was a significant achievement. The measure of inequality, i.e., the Gini coefficient which varies from 0 (perfect equality) to 1 (perfect inequality), shows that for 1900–2000, it increased from 0.40 to 0.48 [Human development report..., 2002].

OVERVIEW OF DEVELOPMENT INDICES

Among the traditionally used indicators, the GDP, i.e. the total or per capita (calculated based on Purchasing Power Parity (PPP) in the prices of a given year), with which income levels usually correlate, is the best-known index. It gives an idea, though crude, about the effectiveness of the total potential of resource use in different countries, as well as provides some indication of the average material wealth, which is one of the components of the standard of living of a population, irrespective of whether this material wealth results from possession of valuable natural resources, or from highly efficient economies, or from some other factors.

The so-called individual (simple) indicators include different variants of the GDP, a number of other economic indicators, indicators of public health, and indicators from the political sphere, etc., hundreds of thousands in total, as reflected in the easily available statistics. Some of them have a substantial time span (such long time-

frames do not exist for the integral indices), others have only a few years worth of data. Some of them can be called "simple" only highly arbitrarily (e.g., the Gross National Product (GNP)), in contrast to, for example, really "simple" indicators, such as Infant Mortality (IM) or the tonnage of a particular production), because they are obtained from integrated calculations.

Each of the simple indicators may be of some value in assessing development. However, as already mentioned, these traditional indicators for several reasons do not reflect many social and economic processes and phenomena of development. Various international organizations and individual countries are actively developing criteria and indicators of development that often contain very complex systems of indicators. Summing up the available international experience in this area, two approaches may be identified [Indicators of sustainable development..., 2001]:

1. Establishing an integral, aggregate indicator that can be used to judge the degree of stability and level of socio-economic development. The aggregation is usually based on four groups of indicators: economic, social, political, and environmental.

2. Building a system of indicators, each of which reflects some aspects of development. Often, the general system includes the same four groups of indicators.

The integral socio-economic index used at the macro-level is usually preferable for decision makers in assessments of diverse factors of development of countries and regions. The existence of such integral indices allows one to see how changes in any of these factors or in their ratios influence the total well-being and prosperity of the territory.

Ideally, an individual index would reflect the degree of development of the country and its dynamics would reflect the trajectory of development. In other words, if it could be constructed, it could become a kind of measure of the GDP, of the GNP, of the national income, etc., of the indices that are usually used to measure the success of economic development and levels of the economy. However, there is no generally accepted integral indicator in the world yet due to methodological and statistical problems, difficulties in obtaining data, questions of reliability and calculation strategies, etc.

Nevertheless, constructive approaches in this field are actively being pursued. Attempts to create aggregate indicators of development have been most fully realized in the development of frameworks of the UN and the World Bank [Bossel, 2001; 2002 World development..., 2003]. These international organizations offered methods allowing for the consideration of the most diverse factors in the national accounts, in indicators of national wealth, and in social, demographic, and political evaluation.

Let us consider the main currently existing integrated indices. The methodology of the UN Development Program (UNDP) that is used to compare the human potential of the world's countries is considered to be the basis for calculations of the indices that characterize economic and social development. The Human Development Index (HDI) [Human development report..., 2002] is based on four factors: longevity, measured as life expectancy at birth (it contributes the coefficient factor of 1), the achieved level of education, measured as the cumulative level of education of the adult population (weighted at 2/3); cumulative share of students enrolled in schools at the primary, secondary, and tertiary level (weighted at 1/3), the standard of living, measured by the real GDP per capita (in $US at PPP, weighted at 1).

Among integrated indices of both economic and social aspects of development, there is an index of Real Progress and Sustainable Economic Well-Being [Genuine Progress Indicator..., 2004], first developed at the

University of San Francisco, and now widely used, for example, by the World Bank. The index is a multi-component measure of economic well-being that specifies the GDP taking into account a number of internal and external non-economic conditions (externalities).

The National Wealth per Capita Index is also an interesting indicator. Its data has been published since 1995; this index was developed by a group of the World Bank's experts [2002 World Development..., 2003]. The index of wealth includes three components: human, industrial, and natural capital. The natural capital component accounts for the size of land, amount of water, and mineral resources. The production capital is calculated based on the inventory, i.e., a long-term monitoring, of the investment to depreciation ratio. The *human capital* is measured as the difference between the sum of *production* and *resource capital* and the value that at 4% of usage provides a current level of clean sustainable net national product.

The Competitiveness Index (CI) [Global competitiveness..., 2003], calculated by the World Economic Forum, considers approximately 200 different indicators, including the GDP per capita, and many characteristics of public institutions and infrastructure. Their list is extremely, perhaps, too broad. For example, the characteristics of the infrastructure and public institutions include even such unusual figures as the time of arrival of the police at the scene, the stability of consumer choice, etc. Some of the initial data are taken from statistical compilations, but at least one-half are based on the surveys of managers of major companies and professionals of some scientific and public organizations.

In the report on the global competitiveness by the World Economic Forum published in 2002 [2002 World Development..., 2003], two additional approaches were used for the assessment; each was reflected in the form of a special index. The first index is the Global Competitiveness Index (GCI), which was used in the rating of growth prospects for hundreds of countries around the world. The second approach is reflected in the Microeconomic Competitiveness index (MCI). It uses the microeconomic indicators (i.e., institutions, market structures, and economic policies) to measure efficiency of resource use.

The GCI, according to the report, is intended to determine the ability of national economies to achieve sustained economic growth over a medium-length period, while controlling the current level of economic development. The GCI is based on three categories, which, according to the authors of the report, affect economic growth in the medium and long term. These factors are technology, public institutions, and the macroeconomic environment that includes four parameters: the export potential of manufacturing, the share of added value in manufacturing, the share of high-tech production in the entire manufacturing sector, and the share of high-tech production in the export sector of manufacturing.

The MCI identifies the conditions that determine the level of productivity in one hundred countries included in the rating. The MCI has two "sub-indices"; one of them reflects the degree of "advancement" of companies (company sophistication), the second – the state of the business climate in the country. There is a close interdependence between the degree of "sophistication" of companies and the state of the business climate. But there are exceptions. In some countries (i.e., four countries of the Group of Seven – Japan, Germany, France, and Italy) the level of "sophistication" of companies is high, despite an insufficiently favorable business climate. The governments of such countries, say the authors of the report, should implement significant reforms in public policy to improve the conditions for competition within the country; otherwise national companies will sooner or later be forced to move their operations and capital abroad. At the same time, opposite examples exist.

Of particular interest is the Post-Industrial Economic Development Index (PEDI) [Gorkin, 2006]. As shown by calculations carried out by A.P. Gorkin, this index strongly correlates with the GCI however; the very purpose of its design is different. The PEDI allows one to compare the "levels of post-industrialization" of individual countries. The index was calculated on the basis of three components, each contributing equally. These components were chosen to be:

- the share of the tertiary sector in the GDP;
- expenditures on research and development as a percentage of the GDP;
- the share of internet users in the overall population.

The baseline values were normalized by the linear transformation in the interval [0, 1], then, summed, and this sum was divided by the factor of three.

This index, unlike the vast majority of the indices that characterize the economic, social, or political aspect of development, pertains to a very interesting area, namely, the theory of transition from one condition to a new qualitative (not quantitative!) condition, as described by its very name. Using specifically this and similar indices (currently, this niche is virtually non-existent) one can receive new qualitative knowledge about the threshold values of some structural changes of the systems and their reorganization.

The World Bank proposed and designed the index of Actual Savings [2002 World Development..., 2003] for the world. It is the result of correcting the Gross Domestic Savings index, i.e., the Gross Accumulation Index.

Special attention should be paid to a number of ecological-economic indices. They were first to appear in this area and now, they are widely used in various integrated assessments of sustainable development.

The Statistics Division of the UN Secretary proposed the System of Integrated Environmental and Economic Accounting (SIEEA) [Indicators of sustainable development..., 2001], aimed at integrating environmental concerns into national statistics. The latest version of the SIEEA – the product of the Statistical Management Department of Economic and Social Affairs of the UN and the UN Environment Program (UNEP) – was published in December 2003. This system describes the relationship between the state of the environment and the economy. The relationship is expressed by linking the system of national accounts adopted by the UN with environmental factors and natural resources.

"Green Accounts" [Indicators of sustainable development..., 2001] are based on adjustments of the traditional economic indicators using two variables: the valuation of natural resource depletion and environmental-economic losses from pollution. The Environmentally Adjusted Net Domestic Product (EDP) serves as the basis for the adjustment of national accounts. This index is the product of the adjustment of the Net Domestic Product.

The Environmental Sustainability Index (ESI) is defined in the report prepared by a group of scientists from Yale and Columbia universities for the World Economic Forum in Davos [Indicators of sustainable development..., 2001]. Environmental sustainability is understood to be a part of the concept of "sustainable development". Narrowing the problem allows one to obtain quantitative characteristics in the form of an index. The report justifies the possibility of constructing a simple index reflecting the progress of various countries in the area of environmental sustainability.

Speaking of the environmental indices, it is necessary to mention finally the integrated *Living Planet Index* (LPI) [Living Planet..., 2001]. This index is used in assessments of the state of natural ecosystems of the planet and is calculated in the annual reports of the World Wildlife Fund. The LPI measures the natural capital of forests and of freshwater

and marine ecosystems and is calculated as the average of three indicators: the number of animals in forests, freshwater, and marine ecosystems. Each index reflects the change in the population of the most representative sample of organisms in the ecosystem.

Indices that reflect population health play an important role in the assessments of the social sector development. The most known index is the Population Health Index (PHI) [Human development..., 2002], calculated by the World Health Organization (WHO). This index is an example of an approach "by contradiction" because it reflects the distribution of various types of diseases from malaria to cancer and HIV infection. Because a very strong correlation exists between environmental quality and many diseases, this index includes several indices of environmental conditions in addition to the actual indices of diseases. And since children are most vulnerable to some of the common diseases, the IM rate (IMR), which measures the mortality from respiratory and enteric diseases based on the standard classification of diseases per hundred thousand of children aged 0–14 years, is used. Mortality from other diseases is calculated using only the total population of the country.

However, the design of the PHI, as well as the design of many other indices, is faulty with some degree of eclecticism, because many factors, such as environmental characteristics and resulting indicators, are lumped together. The Health Index is compiled using only three basic parameters: (1) IM, (2) life expectancy of women, and (3) life expectancy of men. For all its simplicity, it has another advantage: the initial data are available from the 1950's, which allows their analysis over a large time-period. This index is widely used in the Russian national literature [Prokhorov, Tikunov, 2001, 2004, 2005].

Innovation is becoming one of the most important components of development itself and, hence, its assessment in the era of globalization. However, as was already mentioned, the assessment of innovation is one of the components in the assessment of competitiveness. In our opinion, the most precise assessment system was proposed in 2000 by the European Council in Lisbon [European Innovation..., 2001]. It was called the "European Innovation Scoreboard". The report used 17 indicators that reflect the innovative potential of countries divided into 4 groups:

– *human resources*: young scientists and engineers, people with higher education, people continuing their education, employment in medium- and high-tech industries, employment in high-tech services;

– *creation of knowledge*: public spending on research and development, expenditures of private firms on research and development, high-tech patents granted;

– *the transfer and application of knowledge*: innovation in local small and medium-sized businesses, small and medium-sized businesses involved in innovation cooperation, the cost of innovation (percentage of total turnover in manufacturing);

– *innovative financing, production outputs and market outputs*: high-tech venture capital investment, new capital in the stock market, sales of new products on markets, access to the internet, share of the information and communication market, share of added value of production in high-tech industries.

The main drawback of this total index of innovation is its use only in the European Community, but the methodology can be used worldwide.

Another interesting index, the Networked Readiness Index (NRI) was calculated by a committee of the World Bank [2002 World Development..., 2003]. The NRI includes hundreds of statistical and performance parameters arbitrarily divided into 9 groups: market readiness, the willingness of political

and legislative establishments, infrastructure readiness, readiness of individuals, companies, and governments; and finally, the efficiency of network usage by individuals, companies, and government. The index for a number of indicators included in it is akin to the Innovation Index; it has the advantage of encompassing nearly a hundred and fifty countries, but there are drawbacks: the incomplete conformity of the number of indicators used for the assessment of each country (the minimal number of indices used is 40 and the maximal number is about 100) and the presence of a large number of intentionally arbitrarily assessment parameters.

Finally, it is necessary to mention aspects of development in the field of public and state institutions. In part, these questions have been raised in the calculations of competitiveness and network readiness. However, there are a number of indices directly evaluating political and social development. Some of these indices are described in the Global Corruption Report [OECD..., 2004] prepared by the members of one of the commissions of the Organization for Economic Cooperation and Development (OECD).

The Freedom Index (FI) facilitates the assessment of political and social environments**.** The report "Freedom in the World"[Freedom..., 2003] provides an assessment of the level of freedom for 192 countries and 18 dependent territories grouped into seven categories depending on the figures obtained. The study is based on the number of parameters broken into two areas: (1) political rights and (2) civil rights. Political rights imply the opportunity to participate freely in the political process; civil rights imply the opportunity to express opinions, to organize various public institutions, and to have individual liberty. The baseline data were obtained through responses to 90 key questions from six sub-categories. The questions were presented to residents-professional and the general public of a country; the ratio of the participants in these two groups was one to two. According to this survey, the countries were grouped into seven subgroups and three groups: free, partially free, and not free.

The Index of Electoral Freedom (IEF) concludes the list of political characteristics of development [Tikunov, 2002]. The notion of electoral freedom may cause difficulties; on the one hand, this index reflects a certain measure of liberalness of a state; on the other, the political literacy of its population and the level of its culture in a general political sense and especially in respect to the election process. Referring directly to the assessment of electoral freedom, one can speak of the existence of different variants of value orientations at different levels. These levels include: the ideological level (when people are integrating notions about politics in their individual picture of the world), the civil level (when people are reconciling the power of the government and their own ability to defend their rights and interests and, therefore, in one way or another, determine their own political status), and the specifically political level (reflected in the reaction to the forms of government, to a particular regime, to political allies, to the opponents, etc.). The IEF is based on a certain set of parameters derived from data on parliamentary elections in various countries. The calculations included such parameters as voter turnout, voting against all political associations on the list, pluralism as a proportion of the votes cast for all political entities with the exclusion of the two leading parties in the country, the monolithic status as the difference between the percent of votes cast for the winning party and the percent of votes cast for the party finishing in the second place.

Baklanov P.Y. [2001] proposed an interesting approach that utilizes indicators of development quality (ecological, economic, and social, including demographic) in the form of absolute parameters and indices (annual average, short-term, and ongoing). It has been also proposed to use a system of target and constraint parameters to assess the

efficiency of development. Thus, A.E. Yakovlev [2002] points out that such milestones may include the quality of life, level of economic development, and environmental well-being. This author suggests using such parameters as the length of human life, human health, deviation of the environment from standards, level of knowledge and educational skills, income (measured by the GDP per capita), employment rate, and the degree of realization of human rights for the analyses of the quality of life. He further proposes using parameters of consumption of natural resources and parameters of damage to ecosystems in the course of economic activity (per unit of output) together with parameters of the degree of usage of energy and other resources and waste production in the economic sector to identify the levels of natural resources use in the economy (per capita and as a unit of the GDP).

There are a few suggestions for obtaining integrated assessments of sustainable development of countries and regions. An example of such methodology is the methodology developed by the UN Commission on Sustainable Development [Indicators..., 1996; Indicators..., 2001.]. Noteworthy are also the parameters proposed in the annual report of the World Bank "World Development Indicators". There have been also efforts in Russia to obtain the index of the top synthetic level. For example, A.Y. Reteyum [2004] in the book "Monitoring of Development" uses 25 initial parameters of demographics, social status of the population, economics, public consciousness, and the environment in the constituents of the Russian Federation together with the data on changes in these parameters during a twelve-year period to analyze the country's regions from the view-point of sustainable development.

There are also opinions that it is methodologically impossible to obtain integrated indices of the highest level. For example, some researchers [Mazurov, Tikunov, 2005] argue that "since the absolute stability, the identity stability, the permanence of the conditions of the social components of the worldview, etc., do not exist in principle, there are, by the same token, no universal indicators of sustainable development" (p. 36). This idea has been confirmed by an experiment to assess social sustainability. For example, in [Rubanov, Tikunov, 2005], it is argued that "in the calculation of the integrated index, qualitatively opposing values of demographic indicators and indicators of human well-being mutually negate each other; under these conditions it is of small appropriateness to speak about leadership and ranking of regions by the degree of their social stability, since the determination of the key leading factors and the determination of which groups of indicators has been given more weight is the subjective opinion of the investigator. For this reason, the authors considered it inappropriate to calculate the integrated index of social stability and have decided to confine the calculation of three partial indices that characterize the main components of social sustainability" (p. 102).

What are the methodological conclusions that can be drawn from the analysis of the attempts to find the integrated characteristics of development?

Quantitative assessments of development should not ignore the following. First, there are problems of conceptual nature associated with an ambiguous understanding of the area "development" and, as a consequence, there is an emergence of a subjective choice of specific criteria and parameters included in the assessments. Moreover, for each assessment topic, there are parameters that are traditionally used in such studies and there are those that are rarely considered in the calculations. Second, any average statistics leads to averaging the real picture of development and its levels. It is expressed in two dimensions: "vertical", or socio-economic, and "horizontal", or spatial. The first can be observed, for example, within small territories, such as the famous "cities of contrasts" (whether it is New York, Istanbul, or Moscow, where the average income of residents has little to do with the concept of

income of the average citizen). This problem has been recognized, and, in principle, may be solved by established methods (e.g., by using different assessments of inequality, such as the Gini coefficient, etc.) and it does not negate the average values as a tool for assessment of territorial development. Geographers are usually more concerned with the other side of the problem, when the averages for the entire country or the region obscure the internal structure and the presence of sharp contrasts between the finer territorial divisions. Regions of the world and individual countries differ greatly in this respect. It is one thing if the countries are in Western Europe or this is Sweden, where the contrasts between the countries and areas in general are moderate; it is another thing if the countries are in South-East Asia, specifically, if they are Singapore, Laos, Kampuchea, Thailand, Indonesia, or other countries with strong internal stratification. This problem can be overcome using, for example, a general analysis of the territories.

We can talk about a shortage or absence of required data that are simply not collected by statistical agencies. Many of the figures do not have spatial referencing necessary for spatial analyses. Not to mention the dynamics and changes in parameters over time. This may be due to changes of views, to revisions of the priorities, or to the need of considering the objective changes in a very complex, as a rule, system under investigation.

There is a separate problem of bringing parameters different in nature into the attempts to solve a common task. Aggregation of diverse parameters into a single index is a special task and it raises a number of "technical" issues addressed in the report of the UN Commission on development. The main issue when aggregating information in the indices is to define the weights of baseline indicators without undue subjectivity and without decreasing their significance. The higher the level of aggregation of information (especially heterogeneous), the more it is difficult to weigh the incomparable values. The difficult and controversial matter is the unification of the calculations for different regions and countries that have different priorities and incomparable issues. This can be best addressed by a competent selection of weights however, the consensus is extremely difficult to achieve.

One of the proposed solutions is for each country to determine for itself the weights of indicators based on existing priorities keeping in mind that the results, in this case, may be incomparable and this may hamper further analyses. A compromise solution is the use of region-specific weights for individual regions of the world for their internal analysis and the use of common weights for cross-regional comparisons.

The definition of the weights is accomplished using the Delphi method, or the so-called multi-criteria analysis, and applying methods used in the social sciences. The method of "distance to target" allows one to use the parameters reconciled in international or other legal documents. Weighted coefficients can be obtained on the basis of opinion polls (as in "Eurobarometer" that assesses social preferences) or using the Delphi method formalizing experts' opinions. Thus, the indices developed by Eurostat are weighted and they reflect the opinions of the experts and of the key groups.

International conventions, laws, and regulations can be also used for weighting. In addition, there may be simple, definitive criteria: long-term or short-term perspectives, problems at global, regional, or local levels, the depth and complexity of impact, the degree of irreversibility of processes, etc. One way or another, it is generally not recommended to use equal weights of parameters.

In order to assess index stability and the influence of various factors on the outcomes, it may be useful to complement the aggregation of information with "situation sensing". The process of aggregation should

be completely transparent. The user should understand how to transform raw data and if necessary be able to restore them. In addition, it is necessary to have a clear idea about what the index shows and what its limitations are.

The process of aggregation can be formalized as follows. At the first level, the weights of indicators in selected problems are determined in order to obtain the index for each issue. At the second level, the intermediate indices are weighted and defined according to selected criteria. At the third level, the indices of the second level are weighted and the final index is determined.

It is possible to aggregate to the level of the main aspects of development, i.e., economic, social, institutional (political), and environmental, and to obtain the index for each of these areas. The economic aspect combines economic structure, production, and consumption. The social aspect combines health, education, equality, housing, safety, and the population. The institutional dimension includes organization and capabilities of the institutions. The environmental aspect combines the characteristics of the air, land, oceans, seas, coasts, clean water, and biodiversity.

Some of the most complete systems are the systems of development indicators developed by the UN commissions. Like most other public organizations dealing with development, they are charged with four sub-areas of indicators: social, economic, environmental, and institutional; each of these areas is presented in at least one annual report. The UN experts, in the opinion of the authors, have developed the most complete system of parameters to measure development. In total, the system covers more than 130 indicators that reflect the current status, trends, and conditionally corrective action for each of these areas.

The system of indicators of the Organization for Economic Cooperation and Development (OECD) is the system recognized worldwide. The OECD consistently uses the model of the "pressure-state-response" it has developed (the model is vaguely reminiscent of the model "challenge-response" from the famous historian Arnold Toynbee). The model assumes that human activities are exerting pressure on the economy, social sphere, etc., and affect the quality of life and quantity of material wealth; the society reacts to these changes through general economic and sectorial policies and through changes in social consciousness and behavior ("reaction pressure").

The model, in this way, identifies causal relationships between economic activity and political and social conditions, helping administrations and the public to see the connection between these spheres and to develop policies to address these problems. Therefore, it is a mechanism for selecting and organizing parameters in a form suitable for those who make decisions and for the general public. However, this does not mean ignoring the more complex relationships in the systems, as well as economic and social interactions. Pressure factors, the state of the environment, and the reaction under this system are presented in detail in Table 2.

Constructive systems of indicators of development are also being developed by the World Bank. The annual "Report of the World Bank's World Development Indicators" [2002 World Development..., 2003] proves to be useful for the development of a system of indicators. The report targets the progress towards the key objectives set by the UN, i.e., economic growth and the combat of poverty. The economic growth is seen as a means of providing health care, education, security, drinking water, and preserving the environment. More than 550 parameters are analyzed to study and compare the development of the world's countries and to define opportunities to achieve the specific goal of reducing poverty in half compared to 1990.

Of great interest is the scientific and practical experience associated with studying the levels of development, gained in the EU countries. With the support of the European Commission, a number of projects conducted by leading experts in economics and sociology have been implemented; for all EU countries, a detailed analysis has been undertaken. The limitations of these studies relate only to their geographic scope confined, as a rule, to the European continent only.

Along with international organizations, separate countries made efforts to design indicators of development, especially in connection with the development forecasts and programs. Thus, a great attention to the design of a system of indicators of development at a macro level has been given in the USA. A special government team of specialists from several agencies has been assembled. The first test system of 40 macro-level development indicators has been developed by such agencies as the Departments of State, Energy, Urban Development, Agriculture, and Interior, the US Fish and Wildlife Service, and the US Environmental Protection Agency.

Each parameter of the British system of development indicators designed in 1999 reflects its specific objectives, which are described in the UK Strategy of Development. The system includes 14 basic indicators of development that can be used to identify the main trends and 150 additional (specific national) indicators.

Finalizing the review of the indices, it is necessary to mention a comprehensive approach to the development issues. There are many "streets and alleys" where one can wander for a long time, however, one should keep on target and not get distracted by details. Thus, we should not forget that social development, although it possesses relative autonomy, is largely determined by the resource potential, which, in turn, depends on the level of economic development. Therefore, it is only possible to make certain breakthroughs in social life and raise the level of welfare, which, ultimately, always determines the success of socio-economic policies, through economic development. This is the necessary but not a sufficient condition for the development of a community. It is crucial to take into account all aspects of development, not just limited to the economy as such. Although the economy correlates with the development of the social sphere, the last section of this paper will show that the same country may be at different stages of social, economic, and political development. Thus, the task is to assess the maximum level of development in general. And what is so important to regional geography is to grasp their individual and typological features arising from differences in economic, social, cultural, and political spheres.

CHARACTERISTICS OF THE LAG IN DEVELOPMENT

Considering a multi-temporal pattern of global changes in the world, it is extremely interesting to see *how many years the regions and countries are lagging behind each other in their development*. The authors offer relatively simple indices that reflect time-gaps in the countries' development (mainly the parameters that reflect their lagging behind the few world leaders). The reason for using less complex indicators of development for this purpose is simple. Any of the integrated indices (and their source data) on a global scale is calculated, in the best-case scenario, starting in the 1980's. For example, calculations of the HDI were possible in 1975, however, the index itself has not been introduced until 1990; the retrospective calculations (for a not so remote past) have been performed even at a later date [Human development report..., 2002].

The authors are proposing to calculate two simple indices for a long retrospective period, one of which will reflect the economic development and the second – the social progress.

The economic backwardness of the majority of the world's leading countries (see Table 1 and Figure 1) is calculated using three indicators: the GDP (in PPP terms) (index weight of 0,5), labor productivity in the economy (index weight of 0,25), and the estimate of the cost of productive assets (index weight of 0,25). All figures are presented in the 1990 fixed prices per capita (previously it was noted that this work considers primarily per capita indices of development). Statistical materials of the World Bank [2002 World Development..., 2003] that provide data beginning from the 1950s served as the basis for the calculations. Some sources contain information for the earlier years, but the most credible and inclusive materials on the global scale are available only for the post-war period.

Table 1. The lag in development of the countries relative to the world leaders

Country	Social index	Country name	Economic index
Australia	2000	Austria	2000
Hong Kong	2000	Belgium	2000
Israel	2000	Denmark	2000
Iceland	2000	Ireland	2000
Spain	2000	Iceland	2000
Canada	2000	Canada	2000
Martinique	2000	Luxembourg	2000
Switzerland	2000	Norway	2000
Sweden	2000	USA	2000
Japan	2000	Switzerland	2000
Norway	1998	Japan	1997
France	1998	Australia	1996
Belgium	1997	Germany	1996
Macau	1997	Hong Kong	1996
Italy	1996	Netherlands	1996
Austria	1995	Finland	1995
Guadeloupe	1993	France	1995
Greece	1993	Sweden	1995
Cyprus	1993	United Kingdom	1994
Luxembourg	1993	Italy	1994
Malta	1993	French Polynesia	1994
Netherlands	1993	Singapore	1994
New Zealand	1993	New Caledonia	1993
United Kingdom	1992	Cyprus	1991
Germany	1992	Israel	1990
Costa Rica	1992	New Zealand	1990
Singapore	1990	Spain	1989
Finland	1990	EV. Arab. Emirates	1988
USA	1988	Bahamas	1987
Barbados	1987	Brunei	1987
Ireland	1987	Macau	1987
Cuba	1987	Malta	1987
Kuwait	1987	Portugal	1987
Brunei	1986	Slovenia	1987
Denmark	1986	South Korea	1987
Antilles	1985	Barbados	1986
Portugal	1985	Greece	1986
Slovenia	1985	Kuwait	1986
Chile	1984	Czech	1985
Jamaica	1984	Argentina	1983
Guiana (France)	1983	Hungary	1983
EV. Arab. Emirates	1983	Saint Kitts and Nevis	1983
Puerto Rico	1983	Saudi Arabia	1980
Reunion	1983	Slovakia	1980
Uruguay	1983	Antigua and Barbuda	1979
Czech	1983	Mauritius	1979
South Korea	1983	Puerto Rico	1979
Guam	1982	Chile	1979
New Caledonia	1982	Estonia	1979
Panama	1982	South African R-SC	1979
Argentina	1981	Costa Rica	1978
Bahrain	1981	Malaysia	1978
Bermuda	1981	Mexico	1978
Croatia	1981	Poland	1978
Albania	1980	Russian Federation	1978
Bosnia and Herzegovina	1980	Trinidad and Tobago	1978
Venezuela	1980	Uruguay	1978

Country	Social index	Country name	Economic index
Poland	1980	Belarus	1977
Saint Vincent and the Grenadines	1980	Brazil	1977
Georgia	1979	Grenada	1977
Lebanon	1979	Croatia	1977
Macedonia	1979	Yugoslavia	1977
Slovakia	1979	Botswana	1976
Malaysia	1978	Lithuania	1976
Mexico	1978	Seychelles	1976
French Polynesia	1978	Latvia	1975
Yugoslavia	1978	Turkey	1974
Qatar	1977	Libya	1973
Libya	1977	Namibia	1972
Tunisia	1977	Oman	1972
Sri Lanka	1977	Romania	1972
Lithuania	1976	Thailand	1972
Oman	1976	Tunisia	1972
Palestine	1975	Gabon	1971
Saudi Arabia	1975	Colombia	1971
Saint Lucia	1975	Venezuela	1970
Azerbaijan	1974	Dominican	1970
Armenia	1974	Iran	1970
Colombia	1974	Kazakhstan	1970
Mauritius	1974	Panama	1970
Hungary	1973	Belize	1969
Samoa	1973	Bulgaria	1969
Syria	1973	Saint Vincent and the Grenadines	1969
Belize	1972	Saint Lucia	1969
Estonia	1972	Algeria	1968
Seychelles	1971	Bosnia and Herzegovina	1966
Trinidad and Tobago	1971	Western Samoa	1966
Bulgaria	1970	Macedonia	1966
Jordan	1970	Cape Verde	1965
China	1970	Peru	1965
Surinam	1970	Salvador	1964
Latvia	1969	Fiji	1964
Paraguay	1969	Iraq	1963

Country	Social index	Country name	Economic index
Ecuador	1969	Maldives p-ka	1963
Romania	1968	Paraguay	1963
Salvador	1968	Swaziland	1963
Turkey	1968	Lebanon	1962
Iran	1967	Guyana	1961
Western Samoa	1966	Jordan	1961
Belarus	1965	China	1961
Cape Verde	1965	Turkmenistan	1961
Peru	1965	Philippines	1961
Sao Tome and Principe	1965	Equatorial Guinea	1961
Saint Kitts and Nevis	1965	Guatemala	1960
Philippines	1965	Surinam	1960
Algeria	1964	Ukraine	1960
Nicaragua	1964	Egypt	1959
Uzbekistan	1964	Jamaica	1959
Ukraine	1964	Morocco	1958
Fiji	1964	Syria	1958
Vietnam	1963	Sri Lanka	1958
Solomon Islands	1963	Albania	1957
Thailand	1963	Ecuador	1954
Vanuatu	1962	Indonesia	1952
Honduras	1962	Azerbaijan	1951
Egypt	1962	Vanuatu	1950
Moldova	1962	Georgia	1949
Morocco	1961	Zimbabwe	1949
Tajikistan	1961	Kyrgyzstan	1949
South African R-SC	1961	Armenia	1948
Kyrgyzstan	1960	Honduras	1947
Micronesia	1960	Uzbekistan	1947
Tonga	1960	Bolivia	1946
Brazil	1959	India	1946
Maldives p-ka	1958	Nicaragua	1946
Bahamas	1957	Papua New Guinea	1945
Palau	1957	Angola	1944
Russian Federation	1957	Sao Tome and Principe	1944
Turkmenistan	1957	Moldova	1943

Country	Social index	Country name	Eco-nomic index
Dominican	1956	Myanmar	1941
Indonesia	1956	Vietnam	1940
Guatemala	1955	Ghana	1940
Kazakhstan	1955	Guinea	1940
Western Sahara	1954	Korea	1940
Bolivia	1953	Cuba	1940
India	1952	Lesotho	1940
Mongolia	1951	Pakistan	1940
Butane	1950	Gambia	1939
Korea	1950	Cameroon	1939
Guyana	1949	Mauritania	1939
Bangladesh	1945	Mongolia	1939
Pakistan	1945	Sudan	1939
Iraq	1944	Bangladesh	1938
Comoros	1944	Bahrain	1938
Kiribati	1943	Comoros	1938
Yemen	1942	Côte d'Ivoire	1938
Nepal	1941	Laos	1938
Ghana	1939	Senegal	1938
Papua New Guinea	1939	Solomon Islands	1938
Cambodia	1938	Afghanistan	1937
Myanmar	1938	Butane	1937
Gabon	1937	Haiti	1937
Sudan	1936	Cambodia	1937
Laos	1935	Togo	1937
Gambia	1934	Liberia	1936
Madagascar	1933	Nepal	1936
Senegal	1932	Uganda	1934
Eritrea	1931	CAR	1933
Mauritania	1930	Tajikistan	1932
Nigeria	1928	Djibouti	1931
Benin	1926	Benin	1930
Togo	1925	Kenya	1930
Haiti	1924	Burkina Faso	1929
Guinea	1923	Rwanda	1929
Equatorial Guinea	1923	Yemen	1928
Congo	1922	Nigeria	1928
Mali	1922	Chad	1928
East Timor	1921	Madagascar	1927
Somalia	1921	Mozambique	1927
Cameroon	1919	Eritrea	1927
Niger	1919	Congo	1926
Uganda	1919	Zambia	1925
Burkina Faso	1918	Mali	1925
Djibouti	1918	Guinea-Bissau	1924
Ethiopia	1918	Zaire	1924
Guinea-Bissau	1917	Niger	1924
Kenya	1915	Ethiopia	1922
Chad	1915	Somalia	1920
Afghanistan	1914	Malawi	1919
Namibia	1914	Burundi	1918
Tanzania	1914	Tanzania	1916
Zaire	1911	Sierra Leone	1914
Burundi	1910		
Côte d'Ivoire	1910		
Liberia	1910		
Angola	1909		
Botswana	1908		
CAR	1908		
Rwanda	1907		
Mozambique	1906		
Malawi	1905		
Lesotho	1902		
Swaziland	1901		
Sierra Leone	1901		
Zimbabwe	1898		
Zambia	1896		

In the course of the calculations, a group of ten countries with the highest values of these parameters in 2000 (the sum of these parameters represents the economic index that we discuss herein) was isolated (each of the three indicators was normalized for each year for the 50-year period within a range between 0 and 1). For the group of leaders that included Luxemburg, USA, Norway, Iceland, Ireland, Switzerland, Canada, Denmark, Belgium, and Austria, the values of the average index for the entire group for each year for the 50-year period under consideration were calculated. In the future

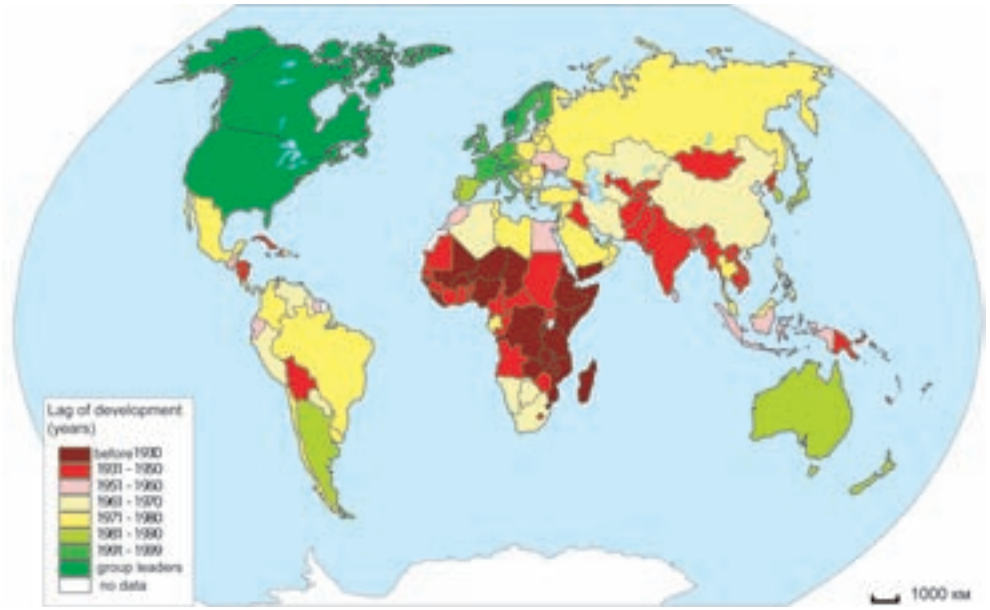

Fig. 1. The lag in the countries' economic development in respect to the group of leaders

calculations for all other countries, the value of this index in 2000 was compared with the nearest value for this or that year in the group of leaders. Based on this comparison, each country was assigned "the year of its developmental stage" relative to the group of leaders.

Considerable difficulty was associated with a very long, i.e., half a century, time-frame of the original data. Thus, we can see that, for example, the latest data on economic development go back to 1914, while the time-series for the leaders are limited to 1950. In order to expand the time-series, it was necessary to create a reference group of countries with a middle-level of development, which included Jamaica, Egypt, Syria, Morocco, Sri Lanka, Albania, Ecuador, Indonesia, Azerbaijan, and Vanuatu. When comparing the poorest countries, the year 2000 was assumed to be equivalent to the year 1950 for the absolute leaders; the time-frame was extended for another 50 years.

A similar approach was used in the calculations of *the lag in social development* (Fig. 2). To evaluate this component, a simple index was used, which includes three parameters: life expectancy for (1) men (index weight of 0.25) and (2) women (index weight of 0.25) and (3) the IMR (index weight of 0,5). It should be noted that the assessments of social and economic development are very arbitrary. However the sufficient time-series exist only for a very limited number of indices; the listed indices provide only a very general idea of social and economic spheres development.

The lags in economic development of the countries relative to the most developed countries in 2000 determined in accordance with the methodology described above suggest that the maximum gap between the countries lagging behind and the world's leaders is 86 years, or nearly a century, long. Currently, the least developed African countries (Sierra Leone, Tanzania, Burundi, and Malawi) are approximately at the economic level of Western Europe after the First World War. If we consider the fact that the largest portion of the national incomes of the poorest countries is owned by a narrow segment of their population, then it can be concluded that the average income derived by the population of these countries

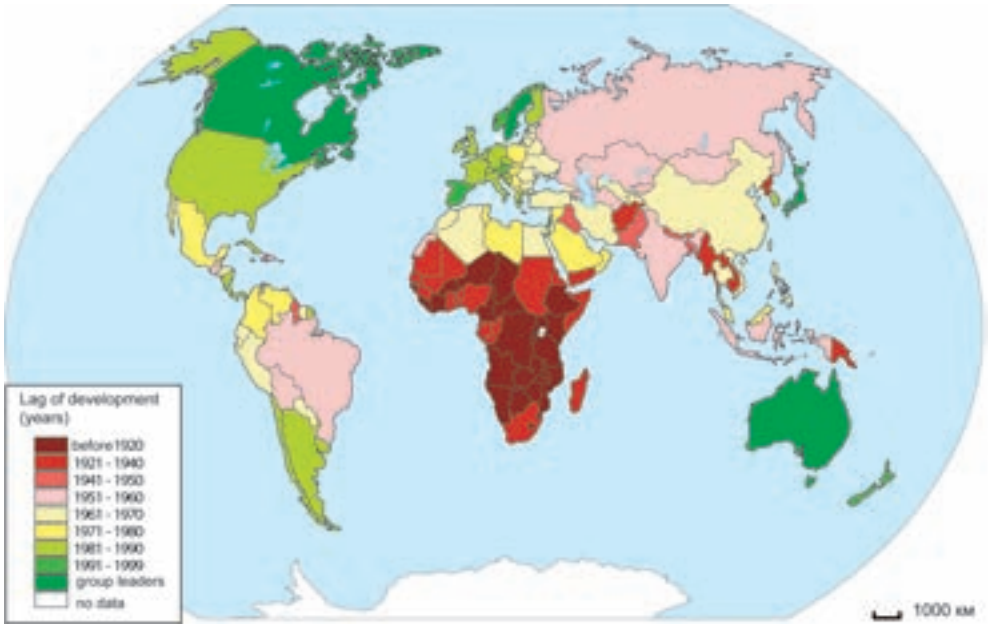

Fig. 2. The lag in the countries' social development in respect to the group of leaders

is lagging behind even further, i.e., another two decades.

The top ten countries include the USA, Canada, and small, but economically highly developed, countries of Western Europe. Neither of these countries intends to be the leader in the world's politics and plays no independent role in the economic control of the world. Using accumulation of their own and attracted capital from around the world, stability of their economies and currencies, a highly skilled workforce, and the benefits of their geographic location, these countries have reached high levels of production development and of capitalism development in industry and agriculture. In general, their per capita GDP is higher than in the so-called "leading countries" of Europe. They have a much more narrow specialization in international division of labor achieving high scores in selected areas. They are characterized by the highest per capita exports and imports among the developed countries and by the highest rate of export efficiency. The latter statement is characteristic of Canada; though it should be noted that in its development, this country depends and focuses on its "elder brother", i.e., the USA, while other countries are primarily confine their activities to the European continent.

Further analysis of the lag in the economic development can focus on a specific time step (i.e., 10-year steps: lagging behind by 10 years or less, 10–20 years, etc.). This time-step was used to isolate the groups of countries.

The first group, which lags 10 years or less behind the leaders, includes countries that belong to the so-called major European countries, all members of the G-7, without the USA and Canada, some of the European small and highly developed countries (Netherlands, Sweden, and Finland), and a number of states with small territories and populations that grew economically due to the export and transit of goods and services (Singapore and Hong Kong) or of unprocessed raw materials (e.g., New Caledonia).

In total, this group includes 16 countries; the place of each country in this group is fully justified. It is well known that the G-7 countries are the most developed in the

world in terms of economic and scientific-technical potential, have the most diversified economies, and the largest human potential among the economically advanced countries (according to the typology suggested by V.V. Volsky [1966]). Nevertheless, the calculations showed that the USA and Canada are at least several years ahead of their major European partners in economic development.

There are reasons for this situation. Development of the EU should be evaluated primarily in comparison with its main competitors: the USA and Japan. The EU lags behind in expenditures on science, in the degree of production concentration, and in systems promoting export, but it is ahead in bureaucratization of business. "Europe pushes itself out of the world's markets not so much because of their prices, but because of flaws in the economic regulations" [Shishkov, 1999]. The analysis by the well-known consulting company "McKinsey" of the comparative position of Europe and its competitors in the six areas of machinery producing industry, from electronics to automobile manufacturing shows that the speed of increase of the array of the regulatory documents in the EU clearly contrasts the slowness in the development of the new technologies. As a result, the EU is left with "though better distributed but an overall smaller piece of the economic pie". The degree of backwardness of these countries is not so great. More than half of them fit into the five-year lag, and the absolute indices of the lag are small.

The pattern of decrease in the countries level of development indicates that their number in each lag interval increases until the 20–30-year interval. There are 16, 18, and 36 countries in the first, second, and the third of the above-mentioned intervals, respectively; however, there are less than 26 countries in the fourth interval. Thus, a large group of the world's countries are between 1970 and 1980 in their development level relative to the world's leaders. If the fourth group of the countries is included, most of the countries fall between 1960 and 1980. These groups consist of a large number of countries with large economies and populations. These groups include Russia (which is "in 1978" relatively to the world's leaders), Mexico (1978), Brazil (1977), Turkey (1974), Thailand (1972), China (1961) and many other large countries. The total population of this group is about one-half of the world's total. Twenty-five countries are in the 1930–1940 interval, 21 countries are in the 1940–1950 interval; this interval also includes giant India (ironically, the year 1947

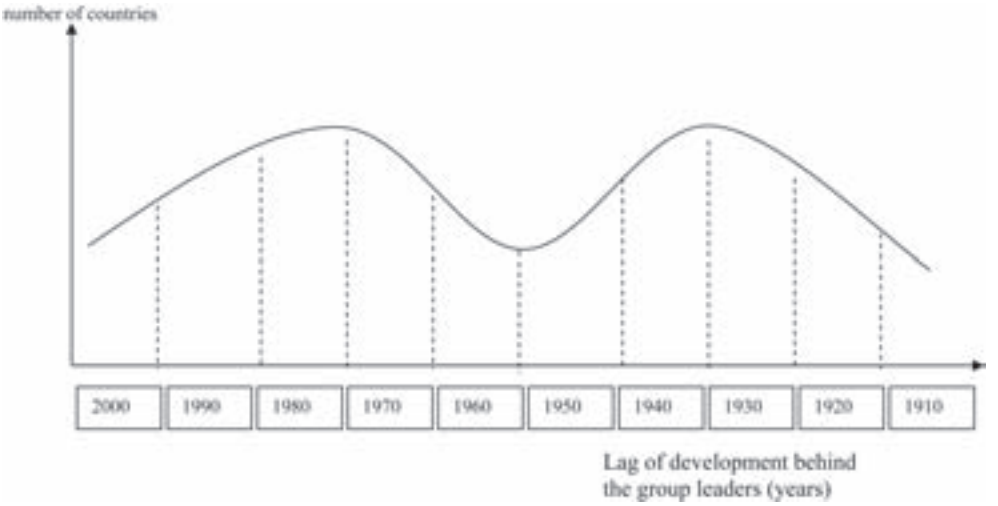

Fig. 3. Distribution of the countries by the lags in their economic development

is the year of its independence from Great Britain). The smallest group of the countries (10) is in the 1950–1960 developmental interval. There are 20 countries with the development below the 1930 level (which also includes 4 countries that are below the 1920 level) located on the African continent (with the exception of Yemen).

Fig. 3 presents a "double-peaked" graph with a normal distribution of the countries only at its edges and with a drop in the middle. Thus, assigning a value of 1 to the countries (without their GDPs, population, etc.), we obtain a bi-polar distribution. The two poles consist not of the leaders, or of the outsiders, or of the countries of the middle range, but of two groups which level of development may be arbitrarily called "above-average" and "below-average". This situation apparently reflects a quite unexpected differentiation into industrial and post-industrial countries. The graph shows two main groups of the countries, one at each stage, and the transitional interval between 1960 and 1950.

The second group consists of moderately developed countries of Western Europe – Spain, Portugal, and Greece. Despite their undeniable progress, the EU's support, etc., these countries are still lagging behind the main leaders in development of productive forces. There, especially in rural areas, the role of governmental sectors is strong (not so much in agriculture, but in industries intentionally designed to improve the economic structure). The governmental sector provides a significant number of jobs; however, wages and labor productivity are low. For example, Portugal had one of the highest levels of employment throughout the EU at the time when it included 15 countres (EU-15), but its labor productivity was at the level of Southern Italy and the least developed areas of Spain.

The same group includes Israel and New Zealand, small and not very developed countries of the "resettlement capitalism" with a comparatively narrow specialization in the International Division of Labor (IDL), compared, for example, to Australia and Canada; they are away from the major world trade markets. This group also includes rapidly developing countries of Central and Eastern Europe (CEE) (e.g., Slovenia and Czech Republic) and small "petrodollar" countries with hypertrophic share of mining, chemical, and petrochemical industries. Theses countries (e.g., UAE, Kuwait, and Brunei) and Southern European countries have lower levels of employment and its various fictitious forms. The same applies to many CEE countries included in this group: the Persian Gulf and Caribbean islands countries (Bahamas, offshore countries, and the "flag of convenience" countries, i.e., Barbados, St. Kitts and Nevis, or the so-called countries – "landlords"). This group also includes the countries whose economies depend upon their stronger economic neighbors ("masters") (Republic of Korea and Macao). Furthermore, this group includes Argentina, a highly-urbanized country with rich natural resources and the first in its region to have embarked on the path of capitalist development; however, at some point in its development, this country fell into a stage of a lengthy structural crisis.

The 4-year interval (from 1990 to 1987) includes over 60% of the countries from the second group. The 5-year interval (1990–86) includes almost 80% of the countries. Therefore, the core of these countries gravitates toward the preceding group; one way or another, the lags in their development are greater than those of the countries from the first group.

The share of CEE countries in the third group (36 countries) is growing. This group consists of the republics of the Former Soviet Union, Poland, Romania, and Croatia; countries-"landlords" (Antigua and Barbuda, Trinidad and Tobago, and Puerto Rico); and the Latin American countries (including the "key" countries – Brazil and Mexico).

This group, which lags behind the leaders by 20–30 years, consists of the so-called

"countries of externally-oriented adaptation development" or "small countries of concession development". The first type includes, for example, countries that have strong averages in the majority of economic indicators such as Libya, Turkey, and Tunisia. In many respects, they are similar to the countries of the second type (Gabon, Botswana, Namibia, and other leaders of sub-Saharan Africa) which are also former colonies that only recently gained their independence. Being underdeveloped industrially, these countries produce raw materials, simple products, and are too heavily dependent on the world market. The countries of Southeast Asia (Thailand and Malaysia) form a special temporal subtype within this group; their development is due to the transfer of a number of labor-intensive and ecologically taxing productions from more developed countries and a large involvement of transnational companies.

In general, this group of countries, which also includes Russia, is highly dependent on foreign capital either in the form of direct investment or in the form of export revenues from, as a rule, a limited number of products. Of course, the lag in these countries' development is rather large (i.e., more than 20 years). Thus, if the first group lags behind the leaders by 4–6 years on average, the second group is behind by 5–7 years, and most countries of the third groups are lagging behind by 7–9 years.

The first three groups include almost all countries that play the key roles in the economic development of their macro-regions. The exceptions are the largest countries of Asia (e.g., China, India, Indonesia, and Pakistan), which lag further behind the ten leaders. With the exception of theses Asian giants, the first three groups have most of the population of their respective regions.

The economic significance of the groups that are lagging 30 years or more is small, but they are the home to most of the world's population. This group of countries includes the states with poor economies and relatively small populations (their number is especially large in the last two 10-year intervals). The group also includes countries with enormous human potential and strong economies that, however, have small populations and countries that still cannot fully carry out structural reforms and get back on track to the level of market development, which would be beneficial for many social strata (e.g., the republics of the Former Soviet Union).

Countries whose development is between 1940 and 1965 are located on all continents. Except for a number of the major powers with substantial population and economic potential (China, Pakistan, Egypt, Indonesia, India, etc.), these countries are mostly less-developed; in a long run, they are unlikely to reduce the lag even behind the neighboring groups with above-average economies. In the latter group (1940 and earlier), as already mentioned, there are many African countries that emerged during the second half of the 20th century from the former colonies. There are about 50 of them and these are mostly least developed countries according to the UN list [Human development..., 2002]. The list is based on three criteria: a very low per capita income, a very low share of processing manufacturing in the GDP, and a very high level of illiteracy. This list includes 31 countries in Africa, 5 countries in Asia, 4 countries in Oceania, and 1 country in Latin America, with a total population of 355 million people on the date of the list's release. The entire list of countries (except Bolivia) could be found in groups that lag behind the leaders by 60 or more years.

THE CORE RESULTS OF THE ANALYSIS OF THE COUNTRIES' LAGS

What are the trends of the past century and what should we expect in this century? A more detailed analysis of some parameters not included in the index (e.g., the GDP in real prices) allows one to discover some interesting facts about differentiation in the 20th century. At the end of the century, the

GDP per capita of many poor countries was even lower than that of the leading countries in 1900. According to the same data of the World Bank [2002 World Development..., 2003], the average for Africa in 2000 ($US 1900) was significantly lower than the average for Western Europe and the countries inhabited by Western European émigrés (Australia, Canada, New Zealand, and USA): in 1900, $3090 and $4020, respectively. The average for Africa per capita GDP in 1900 ($500) was approximately 9 times lower than that of England which was, at that time, the richest country in the world. In 2000, this indicator was 20 times lower that this parameter of the richest countries in the world. The gap between rich and poor countries, measured in these terms, has grown enormously. Thus, the main feature of economic growth, if it is measured in the average per capita GDP, was the "rampant inequality".

The trends described above certainly slow down global economic development. They force out even further many developing countries (that are, in fact, are lagging behind even greater) from the mostly dynamically growing areas of the world's economy. Thus, in the 1980s and 1990s, a rapid growth in trade in manufactured goods, services, and knowledge-based products was observed. However, along with developing countries that have achieved good results, there were those that just dropped out of the overall development process. Exports of finished products should have been a step to reform their economies and create jobs. However, only 33 countries have managed to maintain the annual GDP growth at 3% in the period between 1980 and 2000. In 59 countries, mostly in sub-Saharan Africa, in Eastern Europe, and in the CIS countries, the GNP per capita has declined [Tikunov, 2002, 2009].

Many experts argue that the gap between the incomes of the poorest and the richest countries will continue to increase. This is clearly seen from the comparison of the share of the world's income earned by the world's richest and poorest one-fifths of the population. While in 1950, 20% of the world's population in the richest countries accounted for 70% of the world's income, the poorest countries received only 2,3% to 20% of the world's income; in the late 1990s, these values were 80% and 1,4%, respectively [Tikunov, 2002].

It should be noted that with a different selection of variables, the gaps may also look differently. The set of parameters that we used in our analyses may be considered as "soft" and somewhat gap-smoothing. If we take the GDP, not at parity terms, but in real terms (as in the examples given above), the size of the gaps between the two "poles" will at least double. This set of parameters can be disputed, though the authors find it to be one of the most reasonable and balanced approaches to the objective assessment of economic development.

The analysis of the countries lagging behind in *social development* shows longer time-lags separating the leaders and the outsiders (104 years) compared to the analysis of the economic index (86 years). This can be attributed to several causes.

The first cause, as it was already mentioned in respect to the countries whose "development is externally-oriented and opportunistic" and to "small countries of concession development", is associated with development based on foreign capital through one or two fields of some rare resource exploitation that only leads to a higher GDP, but not to the prosperity of their citizens. Principal cash flows go outside such countries leaving a mass of people without social protection. Export earnings from the sales of resources do not solve problems of either employment or development.

The second cause is the growth of the average per capita GDP in the poorest countries through a narrow stratum of wealthy citizens. This process too does not reduce cross-country disparities. Furthermore, the revenue growth for 2–3% of a country's citizens cannot lead, for example, to an increase in life expectancy of its entire population. In-

country income differentiation leads to the situation that more people live below the poverty level in such countries, for example, as China and India than the total population of most of the developed world. Indonesia, Nigeria, and some regions and countries with smaller populations most of whose incomes are below the subsistence levels adopted in these countries, are developing and distributing incomes unequally. Despite the fact that the share of the world's poorest population decreased slightly (judging from the average parameter for countries in general), their absolute number still remains appalling, as rapid population growth with all its consequences took place specifically in the poorest countries.

The third cause relates to the fact that many countries that focus on the distressed economies are lacking resources for the social spheres; family planning programs, health and safety standards in the treatment of various diseases and in childbirth are missing or not working. In developing countries, millions of mothers and babies die each year from complications after childbirth when a woman gives birth too often or when she is too young or too old. Every day, over 31 thousand children under 5 years of age die, many because of the low birth weight and other pregnancy-related complications. In addition, each year more than 585,000 women, at least one per minute, die from causes related to pregnancy and childbirth and 99% of these deaths occur in developing countries [Bolotin, 2001].

The spread of AIDS and some other viral diseases represents a specific case. In many African countries, even in relatively well developed (e.g., Botswana, Namibia), the momentum to control the HIV infection before it became widespread was lost because of the recent poverty and illiteracy. Now, even the enormous costs of combating the infection are ineffective and the number of carriers has already reached 40–50% of the total adult population.

In addition to improving the health of mothers and their children, family planning programs have contributed significantly to reducing population growth. However, the rates of population growth are still maximal in the least developed countries. There is a huge demographic pressure on the economically active population due to an extreme proportion of children (up to 50% of the population) that decreases the effectiveness of any social programs. There are also psychological adaptation consequences that are, at the same time, the causes of the countries' chronic underdevelopment; these consequences are associated with a reduction of peoples' exigencies, i.e., requirements to their health and life itself. For instance, Hindu traditionally do not consider death a disaster, many people can live without air conditioning, communications, etc., without feeling remorse about it. All this is especially true for the least developed countries.

As for the classification of countries based on the level of social development, in general, a strong correlation between the level of economic development of countries and their achievements in the social sphere (which, of course, is not surprising) exists. The first places in the list are occupied by small highly developed countries of Western Europe, the countries of the "resettlement capitalism", and, finally, by Japan and Hong Kong. The first 10-year lag period includes nearly all the remaining EU countries, Singapore, and Macao. The next group of countries with a lag in social development of 10–20 years, includes the oil-dominated Middle East countries, most countries in CEE, Latin America, Chile, Uruguay, Argentina, Mexico, and the Caribbean that primarily depend on export. The 11-year lag of Costa Rica is also consistent with its level of development. In Cuba, the 13-year lag is associated with a high contribution to the index of life expectancy that is high, as on most tropical islands, and is also due to a good medicine, the pride of the regime of Castro. The end of the list is practically the same as for the economic index: it includes only sub-Saharan Africa.

Let us discuss the distribution of countries by the groups presented in Fig. 4.

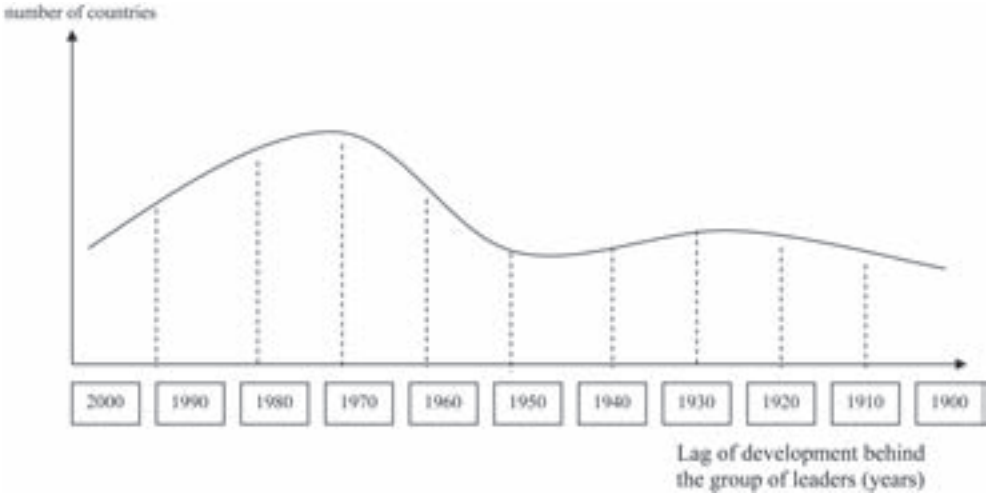

Fig. 4. The distribution of the countries lagging behind in social development

The graph shows the clearly defined second peak in the distribution of the countries. The countries lagging more than 50 years behind the leaders are distributed relatively evenly. Interestingly, the first 30-year period includes significantly more countries than in the case of economic development, although the overall number is more extended. It turns out that the big gaps are due to the outsiders, which was explained previously, while all developed countries and most of the second tier, i.e., Eastern Europe, the most advanced Latin American countries, and Asia, are in the 30-year lag interval. Czech Republic, Slovenia, and Poland fall into the 20-year lag, which is close to their economic performance. However, the lag of the majority of the CIS countries is increasing; for example, Russia appears to be "in the year of 1967".

The index of social development, as in the case of the index of economic development, may be also categorized as "soft". Thus, if the index includes the per capita expenditures on health, the gaps will grow almost tenfold. However, in the authors' opinion, the "soft" version of the index, reflecting the main health indicators, has also a right to exist.

THE INTEGRATED DEVELOPMENT INDEX

The second part of our work, as already mentioned in the beginning of this paper, is dedicated to the integrated indices of development (economic, social, political, and general) and is based on the widest possible number of the baseline parameters. Having set the task, a risky move had to be made, consolidating the existing indices that are described in the first section of the paper (rather than consolidating simple parameters, as currently accepted).

The economic index includes the GDP (in PPP terms), the CI, the industrial component of national wealth, the index of real progress, and the index of sustainable economic well-being. The social index includes both health indices discussed in the overview section of this paper and the human component of national wealth. The political index includes the IEF, FI, and CI. All these indices were mentioned in this paper previously, so we will not detail them any further. All parameters have equal weights because it is difficult to judge their relative importance. The components of the integrated index obtained herein were weighted based on the expert opinion of the authors as follows: economic (0,4), social (0,35), and political (0,25).

As a result, the overall index includes a large number of basic characteristics and it is possible that some parameters could have been even partially duplicated. This methodology of calculations, when everything is lumped together, is very easy

to condemn. However, the feasibility of the index is difficult to doubt and the probability of any random deviations tends to zero (the other side of this issue is the mutual cancellation of some particular features or their wearing-away). It is equally appropriate to criticize the methodology and to argue that this index has collected in itself all the best of many attempts to assess development.

Table 2. The overall integrated development index and its components

Country	Economic	Social	Political	Overall Integrated
Sweden	7	2	5	1
Norway	5	1	10	2
Switzerland	3	4	12	3
Iceland	9	3	4	4
Luxembourg	1	10	9	5
Canada	6	7	6	6
Denmark	4	13	2	7
Australia	8	5	11	8
United States of America	2	9	16	9
Netherlands	13	6	7	10
Finland	12	15	1	11
United Kingdom	16	12	13	12
Belgium	15	8	21	13
Japan	10	11	27	14
Germany	11	18	18	15
Austria	17	16	15	16
France	14	17	20	17
Ireland	20	14	17	18
New Zealand	26	21	3	19
Hong Kong	21	26	14	20
Italy	22	19	23	21
Spain	27	20	19	22
Israel	24	22	38	23
Cyprus	28	25	28	24
Portugal	40	23	22	25
Malta	43	33	8	26
New Caledonia	25	39	29	27
Singapore	19	28	55	28
Slovenia	37	29	25	29
Greece	36	24	53	30
Barbados	39	27	46	31
Macau	34	41	39	32
Republic of Korea	31	30	61	33
French Polynesia	29	53	32	34
Taiwan	38	37	43	35
Bahamas	30	52	36	36
Chile	48	46	24	37
Estonia	47	44	40	38
Hungary	50	40	41	39
Saint Kitts and Nevis	44	55	30	40
Czech	49	32	59	41
Puerto Rico	42	58	54	42
Poland	62	35	56	43
Uruguay	77	43	26	44
Seychelles	52	36	79	45
Costa Rica	68	45	47	46
Yugoslavia	55	48	69	47
Kuwait	23	49	119	48
Slovakia	65	42	62	49
Antigua and Barbuda	41	61	77	50
Lithuania	75	47	44	51
Bahrain	35	38	121	52
Brunei	32	31	137	53
Mauritius	58	68	48	54
Latvia	60	54	73	55
Argentina	67	34	92	56
Mexico	56	60	74	57
United Arab Emirates	18	51	149	58
Malaysia	46	63	91	59
Saint Lucia	71	74	37	60
Trinidad and Tobago	64	59	70	61

Country	Economic	Social	Political	Overall Integrated
Croatia	72	50	71	62
Brazil	54	71	75	63
Belize	73	72	49	64
South Africa	45	115	45	65
Panama	83	64	60	66
Bulgaria	92	62	58	67
Guyana	74	93	50	68
Saint Vincent	81	98	33	69
Grenada	63	95	68	70
Thailand	66	77	89	71
Macedonia	90	65	78	72
Jamaica	88	81	64	73
Surinam	110	80	35	74
Colombia	84	67	97	75
Fiji	80	83	84	76
Botswana	69	130	42	77
Namibia	61	129	57	78
Bosnia and Herzegovina	86	70	101	79
Belarus	59	57	163	80
Cape Verde	101	104	31	81
Tunisia	70	94	95	82
Russian Federation	57	69	152	83
Saudi Arabia	33	76	181	84
Oman	51	82	145	85
Romania	93	75	90	86
Venezuela	89	73	111	87
Libya	53	66	180	88
Turkey	79	99	96	89
Dominican Republic	91	96	82	90
Albania	94	97	76	91
Jordan	87	92	98	92
Mongolia	97	121	51	93
Peru	116	85	72	94
Samoa	105	113	52	95
Kazakhstan	82	79	151	96
Philippines	111	88	93	97
Salvador	103	109	81	98

Country	Economic	Social	Political	Overall Integrated
Lebanon	95	84	143	99
Ukraine	109	78	131	100
Paraguay	129	87	87	101
Sri Lanka	117	101	88	102
Papua New Guinea	102	136	67	103
Georgia	121	90	103	104
Cuba	106	56	175	105
Iran	76	108	166	106
Ecuador	113	100	120	107
Sao Tome and Principe	144	127	34	108
Algeria	98	110	134	109
Gabon	100	122	117	110
Maldives	115	86	144	111
Solomon Islands	119	128	80	112
Armenia	131	102	100	113
Moldova	120	111	108	114
China	108	107	133	115
Turkmenistan	96	89	179	116
Iraq	85	105	176	117
Swaziland	78	137	146	118
Morocco	99	131	126	119
Bolivia	124	118	114	120
Azerbaijan	122	91	158	121
Indonesia	118	116	130	122
Lesotho	138	141	65	123
India	125	132	99	124
Egypt	114	124	129	125
Ghana	136	133	83	126
Kyrgyzstan	123	106	142	127
Guatemala	130	123	112	128
Uzbekistan	127	103	160	129
Honduras	145	119	109	130
Syria	107	114	177	131
Nicaragua	148	126	113	132
Congo	128	145	123	133
Korea	112	125	178	134
Vietnam	135	112	161	135

Country	Economic	Social	Political	Overall Integrated
Guinea	104	162	141	136
Equatorial Guinea	126	120	170	137
Comoros	146	138	115	138
Benin	163	164	63	139
Tajikistan	153	117	147	140
Senegal	150	161	94	141
Gambia	147	156	107	142
Mauritania	134	159	125	143
Madagascar	169	154	85	144
Myanmar	132	135	174	145
Zimbabwe	133	150	154	146
Butane	157	140	136	147
Central African Republic	137	173	122	148
Djibouti	155	158	116	149
Kenya	152	151	132	150
Nepal	173	148	104	151
Liberia	139	142	167	152
Cambodia	164	134	139	153
Pakistan	143	149	156	154
Mali	171	182	66	155
Angola	140	169	135	156
Cameroon	141	147	169	157
Togo	159	146	148	158
Laos	151	139	172	159
Malawi	167	167	110	160
Zambia	156	168	128	161
Mozambique	176	177	86	162
Côte d'Ivoire	142	166	159	163
Bangladesh	166	144	153	164
Sudan	149	143	182	165
Yemen	161	153	150	166
Tanzania	165	165	127	167
Uganda	160	152	157	168
Burkina Faso	170	180	102	169
Nigeria	162	157	155	170
Niger	177	181	105	171
Guinea-Bissau	178	171	118	172
Sierra Leone	181	179	106	173
Haiti	168	155	165	174
Afghanistan	154	174	162	175
Ethiopia	180	175	124	176
Zaire	158	172	164	177
Chad	175	170	140	178
Rwanda	174	163	168	179
Burundi	182	178	138	180
Eritrea	179	160	171	181
Somalia	172	176	173	182

What are the main conclusions that can be drawn from examining the data presented in Table 2 and shown in Figures 5 and 6? Let us analyze this index as a whole, together with its components.

First, as expected, the first group (Table 3) includes the richest countries with the highest integrated indices of 1 to 40, including all EU-15 countries, Japan, all countries of the "resettlement of capitalism", except for South Africa, and some of the richest island states and territories (Malta, Cyprus, Singapore, and New Caledonia). Western European countries outside the EU (Switzerland and Norway), and some CEE countries also fall in this group. The countries in this group are characterized by a relatively proportional structure of the index without any sharp predominance of any one component (parameter). This could be explained by the fact that countries at a high level of development, in general, have a balance between economic, social, and political spheres.

Dramatic differences in the positions in terms of economic and social development are observed only for two countries: the Bahamas and New Caledonia. The Bahamas earn most of their income from hosting the environmentally hazardous activities and components of the infrastructure (the world's largest oil refining and cement plants, terminals for transferring crude oil

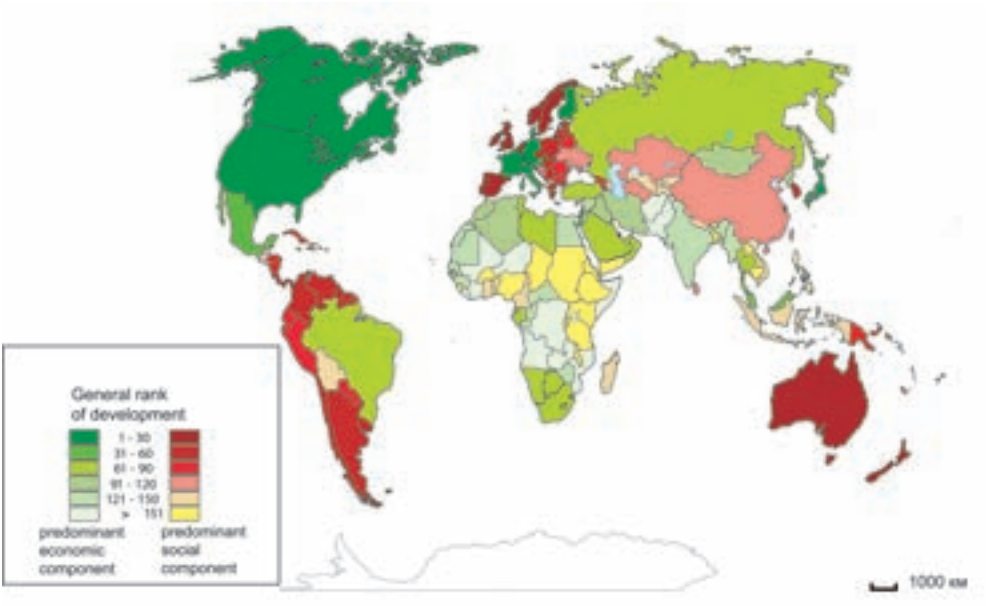

Fig. 5. The relation between economic and social development

from supertankers to conventional deep tankers that may be received by the US East Coast ports). Accredited external tenants in New Caledonia are engaged in processing of mineral resources providing nickel, chromium, cobalt, alloys, and their products for the external market. For all practical purposes, these territories belong to large transnational corporations, which use them at their own discretion as "free economic zones", simultaneously increasing, however, their GDP. In both countries, there are only small portion of population engaged in profitable export sector, but social problems (although the lag in this sphere behind the economic sphere is noticeable) are not as

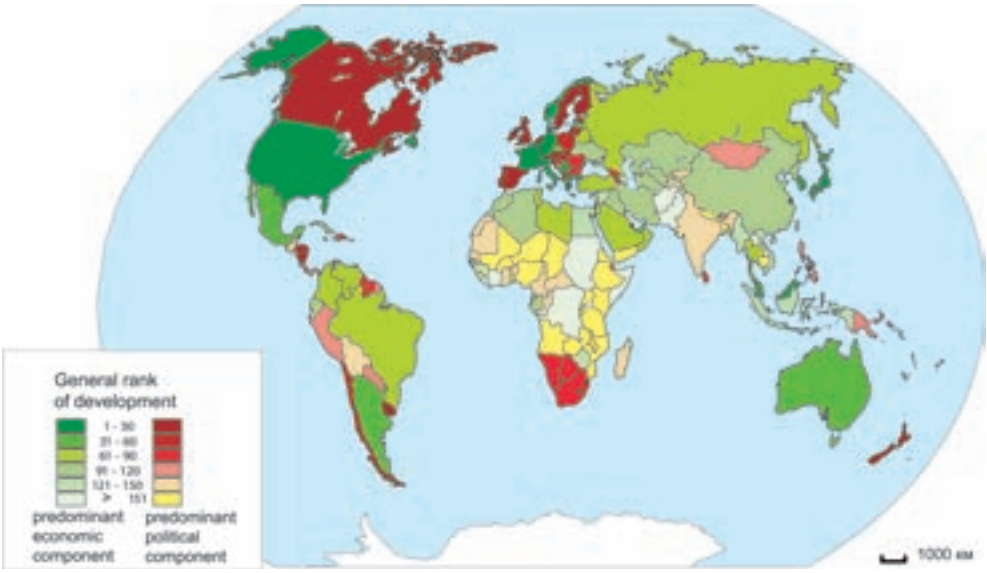

Fig. 6. The relation between economic and political development

Table 3. The grouping of the countries according to the level of general development considering its components

Rich				Moderate-level				Poor			
Socially advanced		Socially lagging behind		Socially advanced		Socially lagging behind		Socially advanced		Socially lagging behind	
Politically advanced	Politically lagging behind	Politically advanced	Politically lagging behind	Politically advanced	Politically lagging behind	Politically advanced	Politically lagging behind	Politically advanced	Politically lagging behind	Politically advanced	Politically lagging behind
Austria	Australia	Hong Kong	Bahamas	Belize	Argentina	Albania	Antigua and Barbuda	Armenia	Azerbaijan	Angola	Algeria
United Kingdom	Barbados	Denmark	Germany	Bulgaria	Belarus	Botswana	Bahrain	Bangladesh	Vietnam	Benin	Afghanistan
Hungary	Belgium	Canada	Costa Rica	Bosnia and Herzegovina	Guyana	Brazil	Bolivia	Indonesia	Burkina Faso	Gabon	
Ireland	Greece	Saint Kitts and Nevis	Luxembourg	Lithuania	Brunei	Dominican Rep..	Grenada	Burundi	China	Gambia	Guinea
Iceland	Israel	Finland	Macau	Macedonia	Venezuela	Cape Verde	Jordan	Butane	Cuba	Djibouti	Egypt
Spain	Italy		New Caledonia New Caledonia	Panama	Kazakhstan	Mauritius	Kuwait	Haiti	Kyrgyzstan	Zambia	Zaire
Cyprus		Singapore	Peru	Colombia	Mongolia	Libya	Ghana	Laos	India	Zimbabwe	
Malta	Norway		USA	Poland	Latvia	Namibia	Malaysia	Guatemala	Maldives	Congo	Iraq
Netherlands	R. Korea		France	Romania	Lebanon	Salvador	Mexico	Guinea-Bissau	Sudan	Lesotho	Iran
New Zealand	Taiwan		French Polynesia	Slovakia	Seychelles	Samoa	UAE	Honduras	Turkmenistan	Mauritania	Cameroon
Portugal			Switzerland	Surinam	Trinidad and Tobago	Saint Vincent	Oman	Georgia	Uzbekistan	Mali	Korea
Slovenia			Japan	Uruguay	Ukraine	Saint Lucia	Puerto Rico	Yemen	Ecuador	Mozambique	Côte d'Ivoire
Chile				Philippines	Czech	Yugoslavia	Russia	Cambodia	Eq Guinea	Niger	Liberia

Rich				Moderate-level				Poor			
Socially advanced		Socially lagging behind		Socially advanced		Socially lagging behind		Socially advanced		Socially lagging behind	
Politically advanced	Politically lagging behind	Politically advanced	Politically lagging behind	Politically advanced	Politically lagging behind	Politically advanced	Politically lagging behind	Politically advanced	Politically lagging behind	Politically advanced	Politically lagging behind
Sweden				Croatia			Saudi Arabia	Kenya		Papua New Guinea	Morocco
Estonia				Jamaica			Thailand	Comoros		Senegal	Myanmar
							Tunisia	Madagascar		CAR	Pakistan
							Turkey	Malawi			Swaziland
							Fiji	Moldova			Syria
						South Africa	Nepal			Somalia	
								Nigeria			
								Nicaragua			
								Paraguay			
								Rwanda			
								Sao Tome and Principe			
								Sierra Leone			
								Tajikistan			
								Tanzania			
								Togo			
								Uganda			
								Chad			
								Sri Lanka			
								Eritrea			
								Ethiopia			

prevalent as in many more populated export-oriented countries in Africa. Incidentally, the example speaks in favor of the method used. It reflects objectively the relations between the elements for even territorially small and information-wise complicated, for the assessment, countries with small populations and large exports, for which data are usually not very accurate.

In two other countries, the Republic of Korea and Singapore, the economic component very much dominates over the political one. On the economic and overall developmental level, they are flush with the world's leaders, while the political component of their development is clearly lagging behind (these countries have a high level of corruption).

It should be mentioned that some dominance exists of the economic factors over the social factors in the major developed countries (USA, Germany, Japan, and France). This situation, of course, is not due to the lack of social safety net, but rather due to the enormous scale of the economies of the nations that are the main economic partners for many countries in the world and the dominant players in the respective macro-regional markets. Therefore, countries with smaller populations and economies (but not the dwarfs), with a particular specialization in the IDL (Ireland, Sweden, Netherlands, and Austria) occupy more prominent positions in these ranking-series of the level of social development. The main reason for this situation is that the larger countries in this category have significant internal contrasts associated with the major part of their population, as well as regional contrasts that always complicate the implementation of general social policy. Many small countries in Europe are known for their solid material aid and subsidies for their people (e.g., Sweden).

The second group includes countries with the average level of general development (positions 41 to 100). This group is dominated by three types of regional types of countries: Latin America, Eastern Europe (including Russia and other republics of the Former Soviet Union), oil-producing countries of the Middle East, and several most developed countries of the African continent.

This group is divided into two subgroups. The first subgroup is characterized by a significant predominance of the economic factor over other factors (major export specialization for a small number of products). Thus, Russia and the Gulf states are dependent on exports of hydrocarbons. Mexico is working for the U.S. market. In varying degrees, the development of most of these countries is determined by the conjuncture of the world market prices on raw materials and agricultural products, as well as by the unstable demand for simple consumer electronics. The second subtype, which includes countries with more balanced and harmoniously developed economies, by contrast, is characterized by the predominance of the social sphere that fits in the logic describe earlier.

The third largest group consists of the least developed world's countries. First, this group includes the most populous (mostly Asian) countries. They may have a significant volume of gross economy, a prominent place in the IDL, and the important achievements in the application of modern technologies. However, they also have the overwhelming poverty of the masses and internal regional disparities (especially considering the fact that China, India, Pakistan, and Indonesia are the countries that are not only populous but with enormous territories).

Often, the commodity-money relations in the countries of this group have not even reached relative maturity: 60–80% of the population is rural where subsistence farming and the remnants of pre-capitalist relations still dominate. However, the most developed areas are already included in the market where a large national capital has emerged; there is an increasingly strong position of transnational companies that target the ultra-cheap labor force and a potentially huge consumer market. Indonesia has moved farther along this road as an

exporter of oil and mineral resources. Some of its figures are close to those of the middle group. The third group includes, among others, many former Central Asian republics of the Soviet Union; the level of development of the political systems (political component of the index) has proven to be even lower than their economies.

There is a more uniform distribution of the second and third groups by the identified subgroups. The third group quantitatively identifies the poor countries whose scarce natural resources do not allow to count on any large-scale exports and, therefore, on large profits (Bangladesh, Guatemala, Chad, etc.). Their opposites are the countries that have occupied the niche in the IDL specializing in export production of an individual commodity without controlling its world prices. One way or another, Egypt is known in the world for its cotton and oil, Morocco – for its phosphates and citrus, Algeria – for its gas and subtropical crops, Guinea – for its bauxite, Côte d'Ivoire – for its cocoa, coffee, rubber, etc. Their commodity exports by value greatly exceed the scale of exports from poor countries of the third group and the social component lags behind the economic. These countries are like the younger brothers of the second group with the dominance of economic development that specializes in the production of more complex, including finished, products.

In contrast, the countries of the third group are not market-forming centers of their macro-regions. These countries are: Mexico and Brazil in Latin America, Russia in the former Soviet Union space, Malaysia and Thailand in Southeast Asia, South Africa in Africa, and the Gulf countries, led by Saudi Arabia, in the Middle East (though the roles of Iran and Iraq have reduced substantially by the stagnation of their economies and military-political pressure from the West on the regimes that represent the threat to the Western world). Egypt, enjoying the best in the world quality of its cotton, is forced to almost completely sell it abroad because the quality of Egyptian fabric does not meet international standards and because technological level and production culture are low.

Transitioning from the first group to the third, there is an increase of intra-group disparities in the levels of development. On the one hand, it puts less prosperous countries, for example, the first group, with more severe social and, in the presence of national minorities, ethnic problems, a step below. On the other, the presence of a buffer zone in the form of moderately developed countries provides a more rapid emergence of new technologies, communications, etc., and creates a potentially huge market for goods and services and the conditions for integration into a single economic space (EU, NAFTA, MERCOSUR). The countries of the third group, generally speaking, can only rely on the export of their limited resources, and plea with local gods for favorable world commodity prices.

In conclusion, it should be stated that the design of the development indices, both general and specific that are applied to particular spheres (e.g., complexity of road networks, health, education, living conditions, etc.) is of a great interest. This area of study is far from been exhausted. The authors are hopeful that the work presented in this paper revealed new and not always obvious possibilities that can be explored in the future research. A more detailed geographic analysis can be found in the book [Tikunov, 2009].

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JAMES CROLL – SCIENTIST, WHO LEFT HIS TIME BEHIND

In January 2011 it will be 190 years since an outstanding Scottish scientist James Croll was born. He was versatile researcher and was interested both in life science and humanities (for instance, philosophy). However, he made the most contribution for the development of the orbital theory of paleoclimate. Nevertheless, it seems that this achievement is not recognised enough yet. It became even more obvious nowadays, after almost 150 years since his first work was published.

The orbital theory of paleoclimate was first proposed by J. Adhemar [Adhemar, 1842]. This theory was created to explain the existence of glaciations in the geological past [Croll, 1875; Imbrie, Imbrie 1986]. J. Adhemar connected the climate change with the precession of the equinoxes and thought that glaciations would occur in that hemisphere, where the day of winter solstice coincides with aphelion. That will increase the seasonal contrasts of insolation in the certain hemisphere, in other words long cold winter and short hot summer. In the opposite hemisphere contrasts of insolation will be lower so that mild short winter will be followed by a long chilly summer. According to J. Adhemar, precisely long cold winter is the reason of glaciations in the first mentioned hemisphere. Therefore, in the other one there will be interglacial period.

However, his theory was denied by English astronomer J. Herschel and also by an outstanding German naturalist A. Humboldt [Croll, 1875, Imbrie, Imbrie, 1986]. They both showed that the average temperature of hemisphere can be defined by the quantity of solar energy calories, which it gets during ***the whole year***, but ***not half a year***. And as the change of annual quantity of solar energy combined with the precession, equal to zero (thus, for instance, reducing of winter insolation is compensated with increase of summer insolation) for any of hemispheres, therefore there are no contrary changes in climate of that hemispheres. In this way, there are no reasons for global climate change, particularly for the start of glaciations.

Nevertheless, J. Adhemar's orbital hypothesis was claimed once more by J. Croll 20 years later, in his "Theory of secular changes of the earth's climate" [Croll, 1864, 1867, 1875]. Despite the fact that Croll also thought that climate circumstances, characterised by long winter, lead to the glaciations in the exact hemisphere, his theory was a big step forward explanation of orbital insolation variation impact on global climate changes. Wide erudition and thorough approach to the problem attracts attention to the author. Since the beginning Croll examined impact Earth's inner reserves of heat on its own climate hypothesis, Earth's passage in "warm" and "cold" parts in outer space hypothesis, possible change of Sun constant hypothesis, distribution of land and water hypothesis and many others. In fact, he showed, that all mentioned factors could not be a reason for a glacial–interglacial cycles. He came to the conclusion that the most possible reason for the repeating glaciations could be orbital variation of the insolation.

Croll had begun his work 20 years after the book of J. Adhemar had been published and till publishing of his main work "Climate and time in their geological relations" [Croll, 1875] science have moved on a lot. He knew achievements of astronomy, physics, meteorology and geology very well. He also knew point of view of Humboldt and Herschel mentioned bellow, that year

quantity of heat during the analyses of global climate fluctuation should be counted. Croll understood that ***direct*** insolation impact of orbital variation on global climate is meaningless, because eccentricity of insolation is very few and annual global changes of insolation connected with the fluctuation of 2 other orbital elements (precession of the equinoxes and obliquity of the ecliptic) is zero. He recognised his idea was eccentric; nevertheless he was sure it explained the connection between orbital insolation variation and glaciations. He wrote [Croll, 1875, p. 13], "There is, however, one effect that was not regarded as compensated. The total amount of heat received by the earth is inversely proportional to the minor axis of its orbit; and it follows therefore, that the greater the eccentricity, the greater is the total amount of heat received by the earth. On this account it was concluded that an increase of eccentricity would tend to a certain extent to produce a warmer climate. All those conclusions to which I refer, arrived at by astronomers, are perfectly legitimate so far as the direct effects of eccentricity are concerned, and it was quite natural, and, in fact, proper to conclude that there was nothing in the mere increase of eccentricity that could produce a glacial epoch. How unnatural would it have been to have concluded that an increase of the quantity of heat received from the sun should lower the temperature and cover the country with snow and ice! Neither would excessively cold winters, followed by excessively hot summers, produce a glacial epoch. To assert, therefore, that the purely astronomical causes could produce such an effect would be simply absurd... The important fact, however, was overlooked that, although the glacial epoch could not result ***directly*** from the increase of eccentricity, it might nevertheless do so ***indirectly***. Although an increase of eccentricity could have no direct tendency to lower the temperature and cover our country with ice yet it might bring into operation physical agents which would produce this effect."

By physical agents Croll meant feedbacks. He wrote [Croll, 1875, p. 74–75], "There is one remarkable circumstance connected with the physical causes which deserves special notice. They not only all lead to one result, viz., an accumulation of snow and ice, but they react on one another. ...in regard to the physical causers concerned in the bringing about of the glacial condition of climate, cause and effect mutually reacted so as to strengthen each other." Thereby J. Croll was the first one who took into consideration influence of positive feedback, which increased orbital dependent variation of insolation and transformed that variation into global climate change – glaciations and interglacial periods. That is the main achievement of his theory, and to our mind, is the most important discovery in paleoclimatology. And its consequences are not recognized enough yet.

Croll examined mostly two mechanism of positive feedback: 1) between temperature and area of snow cover and ice cover (Albedo connection), and 2) between global temperature and displacement of ocean stream. He placed the second mechanism as more important, and previously had shown the big influence of Gulf Stream on the climate conditions of Europe. High value of orbit's eccentricity *e* is the precondition of proposed mechanism realization, he thought. Also he supposed that only particularly long cold winters, connected with increased value e and accompanied by unusual fall of snow, would support the mechanism of positive feedback working. And it will lead to a further temperature drop; *despite that winter insolation drop have been followed by the relevant rise of summer insolation.*

To calculate the changes of eccentricity during 3 billion years before 1800 year and 1 billion year after, J. Croll used formulas and data of Le Verrier. According to his calculation, the highest eccentricity value was during the period of time from 980 till 720 thousand years ago and from 240 till 80 thousand years ago. Exactly with those periods of time he connected the possibility of glaciations. Therefore, J. Croll was the first one who used astronomic calculation (eccentricity variation

calculation) for paleogeoraphy events geological age assessment. In accordance with J. Croll, the last glaciations on Earth have finished around 80 thousand years ago.

Thereby, according to the theory of J. Croll, glaciations had happened especially during the periods of high eccentricity value. Both of the hemispheres were subject to glaciations during these long periods of time alternately, approximately every 10,5 thousand years (time of half-cycle precession), and particularly that hemisphere, in which according to precession changes, the day of winter solstice matched with the passage Aphelion. At the same time, in the opposite hemisphere conditions were extremely warm. Obviously, that kind of glaciations cannot be named global. Periods of time with intermediate eccentricity values were interpreted by J. Croll as interglacial periods and were compared with deposits, divided glacial horizons.

In his book J. Croll created a special chapter for climate impact of obliquity variation ε, which he did not take into consideration in his theory preliminary. Partly the reason was that exact data of changes of angle ε during the time were known later than data of precession and eccentricity by Stockwell in 1873 and Pilgrim in 1904 [Croll, 1875; Imbrie, 1982]. Nevertheless Croll recognized the importance of taking into consideration variation of mentioned orbital element.

He wrote in the beginning of 25th chapter of his book: "There is still another cause which, I feel convinced, must to a very considerable extent have affected climate during past geological ages. I refer to the change in the obliquity of the ecliptic. This cause has long engaged the attention of geologist and physicist, and the conclusion generally come to is that no great effect can be attributed to it. After giving special attention to the matter, I have been led to the very opposite conclusion. It is quite true, as has been urged, that the changes in the obliquity of the ecliptic cannot sensibly affect the climate of temperate regions; but it will produce a slight change on the climate of tropical latitudes, and a very considerable effect on that of the Polar Regions, especially at the poles themselves."

Croll discussed climate influence of variation obliquity using calculations of Mr. Meech [Croll, 1875, pp. 399, 400]. In accordance with those calculations, when obliquity increases, the annual quantity of Sun heat rises up in high latitudes and goes down in the low latitudes. Though, relative changes of heat are much more significant in the high latitudes than in low latitudes. So based on these calculations, Croll have shown that reduction obliquity should help glaciations in high latitudes of both hemispheres, because reduction **ε** would lead to the reduction of temperature, grow of snow and ice cover and influence of mentioned positive feedback, reinforcing the initial fall of temperature. Thereafter, increase **ε** should lead to warming and snow and ice thawing in polar areas. (It should be noted that at that time it was unconventional result, because some of the researchers, who were criticized by J. Croll, thought that increase obliquity leads to the opposite result as fall of temperature in the high latitudes, for instance caused by lowering latitude of polar circle).

Fluctuation of terrestrial axis incline leads to single-phase changes of climate conditions in high latitudes of both hemispheres. So, it could reinforce climate influence of precession-eccentricity glaciations mechanism, suggested by J. Croll theory, in one hemisphere and reduce it in another. For example, fall of temperature in mentioned hemisphere would reinforce, if point of winter solstice in Aphelion matched with the minimum value of angle **ε**; and it would go down, if the incline angle was in its maximum value at that time. Croll realized that this fact makes his theory more complicated, though he did not discuss it in more details. Nonetheless, he pointed one more phenomenon connected with the increase obliquity – grow of ocean level caused by thawing of snow and ice in Polar

Regions. It's important to mention that to proof his conclusions Croll widely used geological data available at that time.

However, in the end of 19th century essential contradictions between the theory and empiric data were discovered. Both American and European scientists came to the conclusion that the glaciations had finished 10 thousand years ago but not 80 thousand years ago as it was according to the theory. That was the main reason for the J. Croll theory to fail. Divergence of the theory with the empiric data shows its inefficiency and invalidity. At the present time we can say that the biggest mistake in his theory was assumption that glaciations are depended only on seasonal contrasts of insolation, conditional precession, modulated eccentricity changes. This conclusion comes from the common nowadays fact that Pleistocene glaciations occurred in both hemispheres simultaneously. And it doesn't match with antiphased influence of precession, but coordinate with minimum eccentricity value, exactly in the time when the precession changes are minimum, and not maximum as J. Croll theory said. Besides that, oxygen isotope analysis of deep-water columns data showed that precession has the least influence on global changes of the last billion years.

Of course it's easy to come to this conclusion nowadays, from the position of modern knowledge. But in the second part of the 19th century when geologists had just started to realize the scale of geological time changes, when only first steps in studies of heat nature and heat exchange have been done, when the planet Neptune have been discovered not long time ago, J. Croll theory was a huge step towards realizing of interaction between astronomic and earth factors determine climate conditions of our planet during the last billion years. His work passed ahead its own time, especially in part of introducing factors of positive feedback, determined intense and globalism of orbital variation insolation.

In the end of examination of J. Croll's theory, we would like to underline the main results of his work.

1. J. Croll agreed that only orbital variation of insolation could not lead to the global climate fluctuations. Though he made a conclusion that these fluctuations could occur with an extra impact of "earth physical agents". He was the first one who took into consideration positive feedback, reinforcing insolation variation impact during developing of climate changes, and suggested their concrete action mechanisms.

2. J. Croll is the author of astrochronology method, because he was the first one who evaluated the age of glaciations through the comparison of time of their existence with theoretically calculated intervals of maximum eccentricity value time.

3. He was the first one who suggested common mechanisms of climate variation influence of all three orbital elements.

4. He was among first who paid attention to the fact that any of boulder-period theory should explain not only existence of glaciations but also inter-glacial periods, and has shown the advantages of orbital theory in explaining multiplicity of glaciations.

However, many of his achievements have been forgotten. In particular, his name has been never mentioned among the founders of astrochronologic method. But the biggest regret is that his main achievement has not been appreciated at true value – discovery of positive feedback in climate system. At the same, the reason why J. Croll had started examination of positive feedback was also forgotten. The reason was *necessity of recording of hemispheres full annual insolation variation influence in explanation of global climate fluctuations.* The last thesis has been strongly proven in the progress of Milankovich theory and his followers.

Not forget to mention that M. Milankovich had started his research 50 years later than J. Croll. His interpretation of orbital theory of paleoclimate was different from previously developed theories of Adhemar, Croll, and others in part of orbital conditional

insolation variation mathematically accurate calculations at the upper atmosphere border. The main idea of his theory is that he attached direct paleoclimate value for counted discrete (for the summer caloric half year and in latitude 65 North) insolation variation during last 600 thousand years. For instance, the least value of summer insolation in latitude 65 North was interpreted him as glaciations. Moreover, he supposed there's linear relation between calculated summer and winter insolation of different latitudes and summer and winter temperature in these latitudes [Milankovich, 1930]. Hereby, theory of Milankovich has made dual effect on the development of orbital theory of paleoclimate.

From one hand, it was a step forward, related with mathematically accurate calculation of insolation. However, from the other hand progress of orbital theory had been discarded in far past, to the times of Adhemar, because Milankovich did not take into consideration reasonable conclusion made by Herschel and Humboldt. To explain the global climate fluctuation he used calculations of semi-annual insolation under the individual latitude! Therefore in his research Milankovich was not in need of using theory and development of positive feedback mechanisms suggested by J. Croll. (He used it mostly for identification the result of climate variation obliquity impact, what have already been done by J. Croll before.)

Thus it's obvious that the famous publication by J. Hays, J. Imbrie, and N. Shackleton [1976] discovered significant contradictions between the Milankovich theory and empiric data [Imbrie et al., 1993; Bol'skakov, 2003 a, b]. Attempts made by followers of Milankovich to solve these contradictions have led only to the new problems [Bol'shakov, 2008]. The main disadvantage in their works [Berger, Loutre, 1991; Berger et al., 1998; Imbrie, Imbrie, 1980; Imbrie et al., 1993 and many others] is use of mean monthly or even daily insolation variation under the individual latitude for paleoclimate interpretation and simulation. Obviously, it's even worse case scenario than use of semi-annual insolation by Milankovich. We think that it could be one of the main causes for the theory of Milankovich and his followers problems, such as 100 thousand years period problem, problem of Middle Pleistocene Transition etc.

Hereby, fall into oblivion of the main points of J. Croll paleoclimatic theory prevented the progress of orbital theory of paleoclimate. We have no doubts that, if influence of the positive feedback on climate, discovered by Croll, would have been taken into consideration seriously, then modern paleoclimatology would be on the higher stage of development itself. And it would definitely have more concrete point of view towards greenhouse effect particularly, and on anthropogenic influence on climate in general. Unfortunately, it seems that an outstanding discovery made by J. Croll appeared far too early.

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Vladimir A. Bol'shakov, Andrey P. Kapitsa

THE ARCTIC: A DIALOGUE FOR DEVELOPMENT

In September 2010, Moscow hosted the International Arctic Forum "The Arctic – Territory of Dialogue". The Arctic Forum focused its attention on elements of sustainable development in the Arctic region, i.e., ecology, economics, infrastructure, social services, security, and geopolitics. The forum was attended by many Russian experts and many well-known politicians and experts from leading research centers of the Arctic countries (Canada, Denmark, Finland, Iceland, Norway, Sweden, and USA), as well as by participants from France, Germany, Netherlands, and other countries. Scholars and public figures from the European countries, representatives of the NATO, the Organization for Security and Cooperation in Europe and other institutions were also present at the conference. The Chairman of the Board of Trustees of the Russian Geographical Society (RGS), Prime Minister of the Russian Federation, Vladimir V. Putin, addressed the Arctic Forum in his key-note speech. Mr. Putin formulated the principles of Russian national policy in the Arctic. It is symptomatic that these principles were supported in the speeches of high-ranking officials from Western countries, in particular, in the speeches of the Reigning Prince Albert II of Monaco and the President of Iceland, O.R. Grimsson, who specifically emphasized the protection of the natural and cultural heritage of the Arctic.

The Arctic Forum was the first major socially significant event in the life of the RGS that has been virtually revived in 2009. The interest of the RGS to the Arctic issues as a priority area for this country's oldest scientific society is profoundly logical. This interest is associated not so much with the fact that Russia is the world's largest polar power, but rather with the place occupied by the Arctic region in Russian history, geography, economics, and culture.

The Arctic Forum has repeatedly stated that Russia is increasing its presence in the region. There are clearly seen "contours" of modern strategies for the development of the Russian Arctic focused on its sustainable development. Russia will consistently defend its national interests in the Arctic which is unachievable outside the appropriate scientific approach traditionally associated with geography. The RGS President Sergei Shoigu expressed this idea in his welcoming speech, "Today we, more than ever, need national geography. Geography, which contributes to the national interest…At the beginning of the 21st century, when the time faces us with new challenges, we need modern geographic research and integrated methods and approaches." These words emphasize the call to revive the traditions of the RGS known for its outstanding work for the benefit of the nation. The RGS President also stated that publication of the modern National Atlas of the Arctic should become an important step towards pursuing these national goals, obtaining a cartographic interpretation of the geographical aspects of sustainable development, and developing a database for further research in this region.

The RGS Honorary President, Academician V.M. Kotlyakov, the RGS Vice-President, Academician N.S. Kasimov, other RGS executives, members of the Board of Trustees, and volunteers from many Russian cities took part in preparation for the Arctic Forum and its work.

A multifaceted dialogue of the Arctic Forum was mainly confined to the three areas: *"Environment in the Arctic: Climate Change and Impacts of Human Activity," "Natural Resources in the Arctic: the Source of Wealth in the Region and the Area of Cooperation," and "Sustainable Development of the Arctic: Problems and Prospects."* The titles of these areas reflect a modern vision of policy priorities of the Arctic countries. The three plenary sessions of the Arctic Forum covered the most pressing problems related to studies of the development of the Arctic. The reports presented in the first section included: *Assessment of Climate Change Impact on the Arctic Environment and their Consequences* (V.M. Katsov, A.I. Voyeikov Main Geophysical Observatory; Y. G. Winther, Norwegian Polar Institute); *The Natural Heritage of the Arctic in National and Global Politics* (B. Eichbaum, the World Wildlife Fund, USA; Yu.L. Mazurov, M.V. Lomonosov Moscow State University); and *Conservation of Biodiversity in the Arctic* (V.V. Rozhnov, A.N. Severtsov Institute of Ecology and Evolution).

The second section addressed the following issues: *Resource and Natural Potential of the Arctic, its Assessment* (L.I. Lobkovsky, P.P. Shirshov Institute of Oceanology; C. Markusen Geological Survey of Denmark and Greenland); *Efficient Development of the Arctic Resources* (V. Alekperov, LUKOIL); *Ensuring Safety of Economic and Infrastructure Projects in the Arctic* (I.A. Veselov, Russian Ministry of Emergency Situations; H. Schreiber, the World Bank, Germany); and *Legal and Institutional Frameworks for Ensuring the Balance of Interests in the Arctic* (A.V. Vasilyev, Ministry of Foreign Affairs of the Russian Federation, Russia's representative to the Arctic Council; R. Rafaelsen, the Norwegian Barents Secretariat; V.D. Kaminsky, All-Russian Research Institute "Oceanology").

The presentations of the third section included: *Cooperation for Development of the Arctic Territories* (P. Wohl, the Northern Forum, USA); *The Development of Regional Transportation Infrastructure* (V.I. Peresypkin, Central Marine Research and Design Institute of the Navy; L. Brigham, University of Alaska, Fairbanks); *Investment Attractiveness of the Far North, the Growing Points* (M.V. Slipenchuk, RGS), *The Role of Higher Education Cooperation in Building a Sustainable Arctic Region* (Mauri Yla-Kotola, University of Lapland, Finland), *Russia's Strategy of the Arctic Development up to 2020* (A.N. Pilyasov, Council for the Study of Productive Forces, Ministry of Economic Development of the Russian Federation and RAS).

The words «Arctic – the territory of the dialogue" were also included in many shorter presentation at the Arctic Forum's sections. The organizers of the Arctic Forum have not spared time and effort to ensure that these presentations were included in the Arctic Forum's sections, a decision which proved to be very rewarding. First, many presentations stressed the need for not being limited to just the issues of exploitation of potential resources of the Arctic, but of also focusing on the conservation of biodiversity and natural and cultural heritage (V.V. Rozhnov, A.A. Tishkov), on the development of ecological tourism (N.G. Ovsyannikov), etc. The idea of geo-information support of the Arctic research activities, of a geo-information portal creation, of coordination efforts for the compilation of the digital database based on the standards of the world's data centers (V.S. Tikunov) was also well received.

Adequate environmental policy and sustainable development in the Arctic region were widely presented in the agenda of the Arctic Forum. They were the themes of the key-note presentations. Thus, V.V. Putin made a crucial statement, "I support, endorse, and will support everything that is related to minimizing the negative impact of mankind on climate change and nature. I will support, as well as will the Russian government and all the leaders of Russia, all our efforts related to the conservation of nature." Such a statement could not but encourage the priorities for environmental policy in the Russian Arctic and beyond.

Speaking at the concluding session of the Arctic Forum, the President's envoy on the Arctic and Antarctica, A.N. Chilingarov, praised highly the scientific and political significance of the Arctic Forum. He, like other Russian and foreign participants, supported the continuation of dialogue on the Arctic under the RGS's umbrella and the transformation of the Arctic Forum into a permanent platform for discussions on the most urgent issues in the region.

The work of the Arctic Forum was covered by Russian and international media. However, according to many participants, the coverage was obviously insufficient for the timely inclusion of ideas and suggestions expressed at the meeting into the practice of environmental management. There is an urgent need for a complete publication of the entire collection of materials presented at the Arctic Forum in both its working languages (English and Russian) and in electronic and traditional book formats.

The Arctic Forum was a reaffirmation of the well-known saying by M.V. Lomonosov that, "Russia's wealth will grow through Siberia and the Arctic Ocean". That is why, for the implementation of this prophecy by the genius founder of Russian geography, the immediate mobilization of science in order to respond adequately to the challenges of the modern era in the Arctic becomes so urgent.

Yury L. Mazurov, Vladimir S. Tikunov

INSTRUCTIONS FOR AUTHORS, CONTRIBUTING TO "GEOGRAPHY, ENVIRONMENT, SUSTAINABILITY"

AIMS AND SCOPE OF THE JOURNAL

The scientific English language journal 'GEOGRAPHY, ENVIRONMENT, SUSTAINABILITY' aims of informing and covering the results of research and global achievements in the sphere of geography, environmental conservation and sustainable development in the changing world. Publication of the journal will be aimed at foreign and Russian scientists – geographers, ecologists, specialists in environmental conservation, natural resource usage, education for sustainable development, GIS technology, cartography, social and political geography, and also – on field studies in the sphere of environmental science. Publications that are interdisciplinary, theoretical and methodological are particularly welcome.

Among the major sections of the journal will be: basics of geography and environmental science; fundamentals of sustainable development; environmental management; environment and natural resources; human (economic and social) geography; global and regional environmental and climate change; environmental regional planning; sustainable regional development; applied geographical and environmental studies; geo-informatics and environmental mapping; oil and gas exploration and environmental problems; nature conservation and biodiversity; environment and health; education for sustainable development.

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4. The optimum volume of manuscript is 0.2–0.5 of author's sheet (or about 3000–5000 words). On occassion in coordination with edition can be accepted methodological, problem or reviews in volume up to 0.7–1 author's sheet.

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