

Issues of combined studies of mountains and plains of the Central Asia and nature – anthropogenous processes management in the system of mountains – plains

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Large volume of contemporary information on dynamics of natural processes, accumulated by sciences on Earth during recent decades, requires an unordinary approach to summarization and shifting of accents in researches on the analysis of complicated interrelations (i.e. conjugation of natural systems), determining development of landscape cover (a biosphere).

These issues are of principal importance for further development of theoretical research, and also they are of practical importance for the development of nature conservation strategy.

We want to underline that there exists a global interrelated process, which we would like to indicate as interaction (conjugation) of high mountainous areas and plains, which can not be ignored without dangerous consequences. Because what happens in the mountains makes an impact on the valley. And vice versa – all what happens in the valley makes an impact on mountains. For example, drying of the Aral Sea enhanced the aeolian (chimney) transmission of dust and salt into mountains amphitheatres of the central Asia and leads to accelerated melting of mountainous glaciers, change of chemical composition of waters and local soil cover (Alibekov 1996, 2002).

Mountains not only provide necessary resources (including, for instance, a half of global stocks of fresh waters), providing for vital capacity of the world system, but also in case of wrong management of these resources can potentially make a devastating impact of lowlands. Such impact can be a result of not only natural processes due to geological violations, floods, reservoirs sedimentation and land slides under the impact of gravity, as well as the result of mass migrations of impoverished population, who even more will enhance pressure on urban infrastructure of valleys and, thus, will aggravate sectoral conflicts. Such phenomena were observed more than once in some foreign countries and even in the neighboring Tajikistan. Then, study of such theories (i.e. conjugation of mountains and plains) is relevant not only in the interests of resolution of acute problems of nature conservation, but also from common scientific point of view. Indeed, namely here the problem of territorial interaction (conjugation) of society and nature is viewed at its full capacity, in all its depth and complexity. Thanks to it, such territories as mountains and plains of the central

Asia provide great opportunities to a researcher for building up of various models of the system Nature – Society, an on this basis wide perspectives shall open for identification of principles of interaction of nature and society and development of a strategy and tactics of optimization of this interaction.

Thus, practical requests in this case coincide with requirements of development of theory. If before attention of scientists was attracted primarily by vertical connections in natural systems, then currently the accent must be shifted to study of integration, i.e. of horizontal connections, without knowledge of which it is not possible to understand the structure of large regions and of biosphere as a whole. On the other hand, such knowledge creates the foundation of effective use of an universal space.

For a long time in ecology, physical geography and the other sciences landscapes (ecosystems) of mountains and plains, which were attributes to special classes, were considered separately, as the result of this a famous lag of science with demands of practices was formed. This is why now identification of dynamics of geo – systems resources and environment of the Central Asia, where recourse productivity decreased due to irrational, for the most part extensive use of natural resources.

The problem is in overcoming of an obvious gap between the mass of accumulated empiric material, evidencing close interrelations and conjugation of mountains and plains of the Central Asia on the one hand and available science means for putting it into order and bringing it together into a single picture on the other hand.

Conjugation of mountainous territories and the adjacent plains started to be studies comparatively recently, with the development of systemic methods of research in geography (Alibekov 1995). The brightest interaction of all processes, which took place in the system of mountains – plains of the arid zone was manifested during the research of anthropogenic impacts on natural systems in deep transformation of natural environment.

The issue is that at the present time economic activity of a human being in the Central Asia touches already on processes, which go on in large natural complexes – ecosystems and shows reality of existence of mountainous – plain systems, i.e. close relations of mountains and plains.

This is identification of dynamics of geo – systems acquires now a particular importance (i.e. ecosystems or landscapes) in connection with general increase of load on natural recourses and environment of the Central Asia, where resource productivity was reduced due to irrational, mostly extensive use

of natural resources. Hence, the necessity of research of mechanisms, providing for combining mountains and plains of the Central Asia arises.

We established theoretical and methodological prerequisites for resolution of the problem of horizontal relations of nature of mountains and plains with the purpose of nature use management on the model of the Aral basin. Mountains and plains are considered as a developing and functioning system, parts of which are linked with material flows (Alibekov 1995).

On the basis of material, collected by ecologists, geographers and specialists of related spheres of knowledge, as well as data of own multi-year research, the author suggested and developed a notion of a geo couple (or a geo dyad) of mountains – plains as a complex whole, a system of neighboring nature – territorial complexes of different rank, connected by commonality of origin and contemporary processes of exchange (sharing) of substance and energy.

A geo dyad is assumed to be territorial conjugation of neighboring mountains and plains, which are functioning and undergo evolution as one whole due to availability of close interconnections and interactions between contrasting nature settings. Large – scale tectonic and atmospheric movements in geographic shell (cover) serve as a common basis of existence of a geo dyad.

Neighboring geological bodies with mountainous and plain relief, which as a rule are in close tectonic connection and develop as one whole, serve the basis for the geo-dyad. Tectonic movements precondition development of mountains and plains, when parts of certain plains with ranges get involved into the process.

Circulation factor in providing for wholeness of geo – dyad is also very significant. Transition of dust, playing a very important role in a geo – dyad of mountains plains takes place due to air currents. Horizontal borders of a geo-dyad tend to zones of divergence, i.e. divergence of currents (watersheds, air current divergence) and to zones of convergence, i.e. of merging of currents (estuaries (mouths) in direct and indirect meaning). Geo-dyads in a plain usually form air current divergence, from which atmospheric currents move towards mountains and border parts of water currents (including underground ones) and water reservoirs, where nature is under direct and indirect impact of flow. In mountains these borders are confined to watersheds.

Functioning of a geo-dyad is done at the expense of stocks of internal and external energy. Energy gets into a geo-dyad through sun radiation and atmospheric circulation. This factor provides for dominating movement of air masses from plains to mountains. However the most energetic source in a geo-dyad serves gravity, making various currents of substance in mountains move. A complicated cascade of transformations of energy starts with rising of water steam evaporation over mountainous ranges and ends with flow and fragmentation of mountainous rocks in river beds. A part of energy of gravitation transforms into surface energy of sedimentations, accumulated in foothills and in plains. A system of a geo-dyad is not balanced,

discharged of energy, accumulated in the mountainous part, goes on continuously and is accumulated in a connected form in the plain part. Introduction of the notion allowed studying the main mechanisms of interaction of members of the couple (mountains – plains), essence of which is brought to movement of masses of mountainous rocks, water, air, dust, alluviums, salts, organic matter and live organisms. The most wide – spread landscape – forming effects of both individual processes and of their spatial combinations were analyzed. The notion of a geo-dyad also allowed for establishment of continuous production – economic connections between mountains and plain (valleys) rayons. The notion of a geo-dyad, in our opinion, specifies a representation about inter – territorial relations, alongside with it, it entails from summarization of materials of various researches on interaction of mountains and plains.

Subject and methods of research of interaction: For more complete identification of specifics, dyads mountains – valleys of different sizes were studied, comprising a row (line) with increasing mass, height and volume of mountains. Dyads were selected in a group lowland – plain, mid – hills – plain and high altitude mountains – plain. In general, the notion of a geographic pair (geo dyad) is a key notion in the paper.

Specifics of the suggested method is presented by conjugated (combined) analysis of various nature components, carried out through selection of indicators or properties, which reflect the process of interaction between mountains and plains.

Research and analysis of mechanisms of interaction of landscapes of mountains and plains is carried out in the following sequence: a factor – a process – a product (result). In our case, mountains and plains serve as a factor (i.e. differences in a relief serve as the guiding factor in a geo dyad), the process is manifested in transferring substance and energy between mountains and plains, while the product in various forms of accumulation (cone of currents offset, formation of alkali soil (saline land) in sites of outlet of underground waters, accumulation of sand in the centre of action of local winds, etc), as the result it is possible to built up chains of causal (and consequence) relationships, extending between mountains and plains.

According to a concept of a geo dyad, mountains and plains are united by oppositely directed currents of matter, energy and information. Circulation of matter (substance) play a key role in supporting direct and reversed contacts of mountains and plains of the Central Asia.

The author undertook an attempt to develop the idea of geographic cycles and uncover patterns of forming one of the largest circulations of matter spatially localized due to specific orographic conditions of the Central Asia.

Collected materials provide a possibility to give the first quantitative assessment of transferring matter, which connects mountains and plains of the Central Asia into one whole (Fig. 1).

Totality of circulations of matter in a geo dyad is an important geographic phenomenon, availability of which brings close the system mountains – plains with the system ocean – continent and all landscape cover.

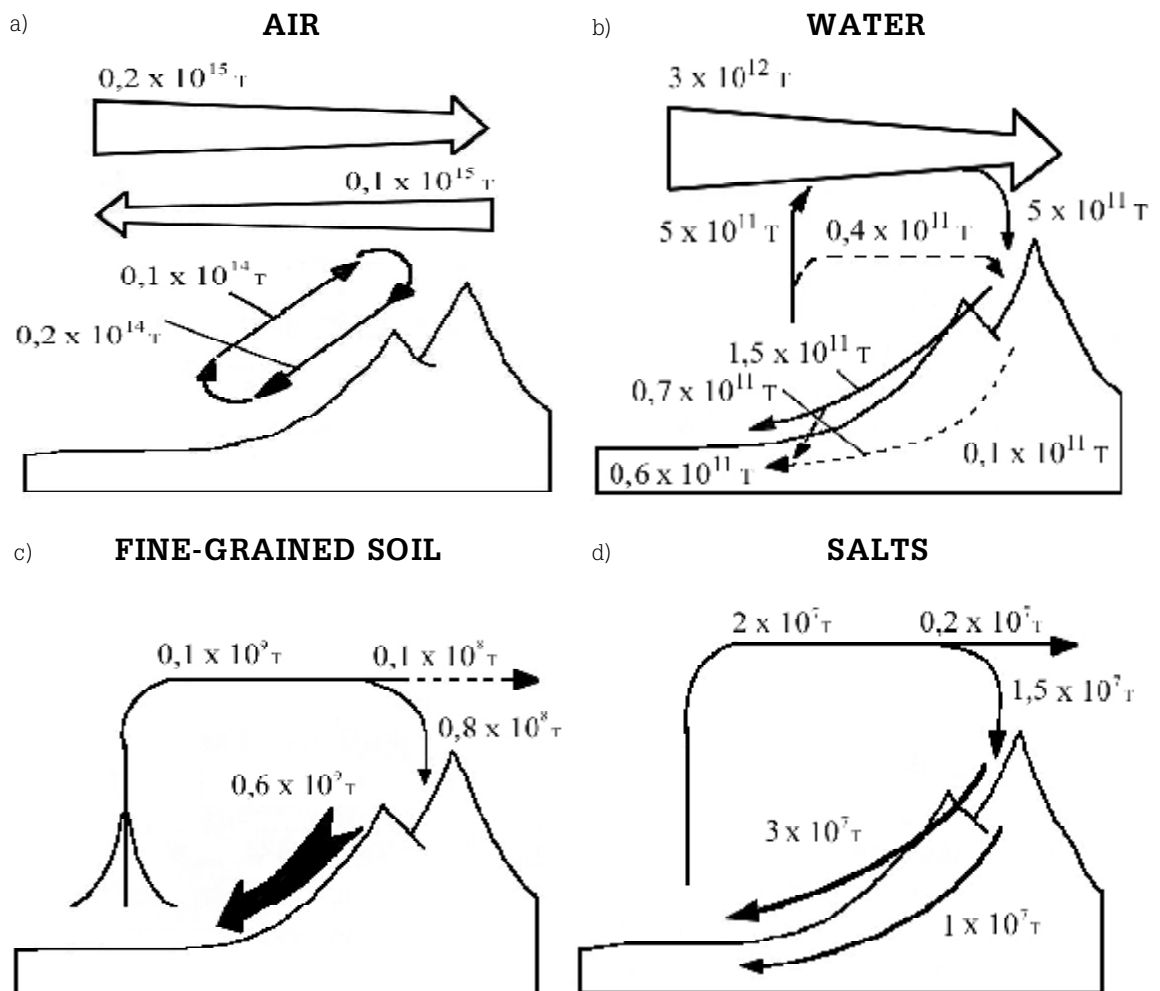


Fig. 1 Scheme of current of matter between mountains and valleys of the Central Asia.

Mountainous and that of the plains circulation represents by itself a complicated totality of processes, each of which allows in its turn a number of other processes based on principle of a chain reaction. Quantitative assessment of individual links of the mountainous and that of the plains circulation (Fig.1) demonstrates a rather complete balance of oppositely directed processes of bringing in and taking out of fine disperse matter into a geo dyad, moving in the form of salts, dredges and aerosols. This balance provides for normal existence of landscapes and maintaining of territorial balance between natural complexes of various types, including particularly dynamic alkaline land hollows and high mountains.

Under the enhanced pressure on nature, which is being observed during recent decades, mechanisms of mountain that of the plain circulation became violated. Deforestation on slopes mountains, degradation of mountainous pastures, plowing (cultivation) of mountain slopes, violation of stability of mountain slopes' masses, change of a regime of down flow of mountainous rivers – all these consequences of developing mountains violate natural mechanisms of functioning of mountain – that of the plain circulation. As the result activation of transfer of combination of matter and energy through communication channels take place, manifested in the form of more frequent mud – slide,

avalanche, land slide and other phenomena, which make serious damage to economy of flat territories. For instance, only mud slides and land slides from mountains to the flat territories of Uzbekistan entail loss in the amount of 300 million USD.

Alongside with it certain transformation of reserved connection (feedback) takes place, i.e. impacts of plains on mountains. Plowing in all places of flat areas and eradication of vegetation cover due to it strengthen transfer of matter (through dust storms) through air (atmospheric) currents to the mountains, increasing melting of glaciers here.

Contemporary tendency in the system mountains – plains of the Central Asia (under impact of economic activity of human being) is characterized by an increasing role of Aeolian transfer of dust, salts and aerosols from plains to mountains due to overload of the valley (plain) landscapes.

In the recent time the new centre of transferring out dust and salts in the plains of the Central Asia are a dry part of the bottom of the Aral Sea.

One of the most dangerous phenomena of crisis ecological situation in the valley (that of the plain) rayons of the Central Asia, which lead to various socio – economic consequences in recent decades are significant increase of dust in the atmosphere and development of powerful sand and salt storms. Annually 30 – 150 million ton of dust and salt mass is brought out from the dry part of the bottom of the

Aral Sea to the adjacent territories or 10 – 50 ton/ha per year. The zone of dust and salt distribution covers vast area around the centre of its origination. This factor leads to strengthening of the process of salination of soil and increase of the level of mineralization of surface and underground waters in irrigated zone, degradation of vegetation, forests and pastures. As the result a continuous decrease of productivity (yields) of agricultural crops is observed. In recent 15 years productivity of pastures decreased on average by 25% across the republic. The carried out researches in the lower course of the river Zarafshan showed that up to 50% of the mass of transferred salt and dust in the territory has the Aral Sea genesis and over 7 million ha of natural pastures are affected by negative impact of salt and dust precipitation (sedimentation) of the Aral Sea. This factor served as one of the main reasons of decrease of productivity of pastures and worsening of the status of biodiversity.

Special attention must be paid at mountainous glaciers of the Central Asia, the surface of which is affected by significant pollution with salt and dusts particles, transferred by winds from flat territories (including from the dry bottom of the Aral Sea). Pollution of snow and glacier cover in the mountains of the Central Asia covers all high altitude zones, including the highest peaks.

Inflow of Aeolian substances to glaciers depends on altitude and varies from 62,3 t/km² (absolute altitude 1500 m) to 148,2 t/km² (absolute altitude 3000 m). In opinion of the majority of scientists areas of glaciers of the Central Asia are reducing. Only because of pollution with Aeolian material intensiveness of melting of glaciers increases by 20%.

In the glacier Jetysuu (Jungarski Alatau) as a whole for 34 years (1956 – 1990), the area of glaciers reduced by 35%, loosing on average 1,03% per year, the volume of a glacier reduced during 34 years by 37%, with the speed of degradation of 1,1% per year. During the period from 1959 to 1980 mountainous glaciers in the Aral Sea basin reduced by 19%. Finally this process will lead to desertification of a large territory.

Based on the above mentioned data it entails that contemporary tendency of development of landscapes in the system mountains – plains of the Central Asia are characterized by the increasing role of Aeolian transfer of dust, salts and aerosols under the impact of economic activities from plains to mountains due to over load in the landscapes of the plains and as the result of mistakes in irrigation development. Thus, due to change of circulation of matter in the system mountains – plains a tight knot of ecological, socio economic and socio – epidemiological problems was formed, resolution of which is possible only on the basis of systemic analysis and comprehensive record of all interacting factors of status of environment.

Thus, economic activity of a human being in the Central Asia already touches on the processes, taking place in large natural complexes and demonstrates a necessity of targeted management of mountain plain systems.

As it was mentioned above economic activities of people in recent time in the Central Asia covers

large natural complexes and shows reality of existence of mountain – plain systems and the necessity of targeted transformation of the system of mountain – plains.

For example, practice shows that increase of volumes of hydro technical construction is often unjustified, useful impact of the planned activities is being increased, while negative consequences are being understated. The increasing permanent withdrawal of waters from rivers of the Central Asia for irrigation and construction needs (there are over 60 water reservoirs in their basin) has lead to the fact that during recent 4 decades it made a significant impact on water yield, which entailed a whole aggregation of negative consequences in the system of mountains – plains.

Construction of a water reservoir in the river bed cardinally changes transportation capacity of flow. As the result its turbidity in the lower pool is decreasing and the prevailing volume of alluvium (80 – 90%) forms sediment in the bed of the water reservoir.

Regulation of channel flow through establishment of water reservoirs produces temporarily quick results, raising water supply to rayons of irrigated agriculture. However the accumulated facts, evidence the origination of secondary consequences of negative nature and about temporary nature of a positive impact. The later circumstance is due to sedimentation of water reservoirs during recent 10 – 15 years (for example on the river Murgab). Negative side effects include, termination of inflow in fertile substances with sediment load into the flood land and into fields are attribute to negative phenomena, the result of the above soil becomes poor.

Water resource management in the perspective must be focused at reduction of negative consequences.

Overcoming of the observed stagnation phenomena in the region is not possible without active transformation of nature, resource productivity of which became low due to irrational, for the most part extensive use of natural resources. For it is necessary preliminary to establish geographic prerequisites for management of natural territorial and territorial – production complexes in the scales of big and complex spatial units, integrated into one whole by movement of matter and energy.

In this respect it is advisable to consider the main lines of transformation of nature management, which seem to be the most perspective ones from the point of view of reliability, feasibility, economy of activities, covering directly or indirectly (through inter – complex, inter – territorial relations) all geographic system of mountains – plains. It is necessary to focus attention at that mostly on its leading link – mountains, in particular, on their watershed parts, playing a role of centers in a landscape. Management over the central part of the system provides for targeted change of properties of dependent nature complexes, located on a plain, adjacent to mountains.

Identification of a pattern of dynamics of the geodyad of mountains – plains in the Central Asian region will allow for giving scientific recommendations on improvement of management of natural resources. At the present time transformation of complexes of small and medium

river basins of mountains and complexes of sand accumulation (which will be dispersed) in the valleys is the most effective way of nature management. At that zoning melioration acquires primary importance (in a broad sense of the world) across all area of the natural complex in combination with activities of change of relief: terracing of slopes, construction of dams, trenches, etc. Agri – silva – melioration turns out to be the most effective measure of management in the interests of further increase of recourse capacity of both mountains and plains. The concept of a geodyad can become a theoretic foundation for drawing of theoretic schemes for development of productive forces, in which it is necessary to stipulate for implementation of ideas of conjugated (combined) improvement of situation on neighboring plains and mountains.

I mean implementation of the so called ecological development, in the process of which not only status of environment will improve, but

also conditions of life and labor of people. Such approach corresponds to the existing traditions of the Central Asian people, who developed many rational ways of organization of their activity at relatively complete use of what nature of mountains and plains can give.

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