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27

# Nature Based Solutions for urban planning

2



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## Studies

## Problems of preservation of the cultural, historical and natural heritage of the Yenisean Siberia on the example of the City of Krasnoyarsk

di V.A. Bezrukih, L.G. Makarova

### Abstract

The article discusses the objective laws of the development of Siberian cities associated with the historical stages of civilization, the national natural and geographical features of Siberia. The reasons and stages of the active growth of cities in relation to the development of crafts, trades and trade, starting from the Middle Ages to modern times, are analyzed. A brief description of the components of nature, including the features of the relief, affecting the planning and town-planning structural movements of urban development is given. The reasons for the degradation of the urban environment are identified and strategic ways are proposed for the preservation, restoration and development of the natural balance in order to develop the vitality of the city of Krasnoyarsk and its environs.



**KEYWORDS:**

*history, fortress, Karaulnaya (Guardian) Mountain, Yenisei River, Angara River, Kacha River, Torgashinsky Range, urban planning, buildings, architectural ensembles, urban environment, left bank, right bank*

**Problemi di conservazione del patrimonio culturale, storico e naturale della Siberia Ienisseiana sull'esempio della città di Krasnoyarsk**

L'articolo discute le leggi legate allo sviluppo delle città siberiane associate alle fasi storiche della civiltà, alle caratteristiche naturali e geografiche nazionali della Siberia. Vengono analizzate le ragioni e le fasi della crescita attiva delle città in relazione allo sviluppo dell'artigianato, dei mestieri e del commercio, a partire dal Medioevo fino all'età moderna. Viene data una breve descrizione delle componenti della natura, comprese le caratteristiche del rilievo, che influenzano i movimenti strutturali urbanistici e urbanistici dello sviluppo urbano. Vengono identificate le ragioni del degrado dell'ambiente urbano e vengono proposti modi strategici per la conservazione, il ripristino e lo sviluppo dell'equilibrio naturale al fine di sviluppare la vitalità della città di Krasnoyarsk e dei suoi dintorni.

**KEYWORDS:**

*storia, fortezza, montagna Karaulnaya (Guardian), fiume Yenisei, fiume Angara, fiume Kacha, catena montuosa Torgashinsky, pianificazione urbana, edifici, complessi architettonici, ambiente urbano, sponda sinistra, sponda destra*

## **Problems of preservation of the cultural, historical and natural heritage of the Yenisean Siberia on the example of the City of Krasnoyarsk**

*V.A. Bezrukih, L.G. Makarova*

### **Introduction**

Urban planning traces roots back on the cusp of the 4th and 2th ACC. It is emerged within the territory of Far East and Middle East countries along river corridors. Over time sporadic development modified to regular city design, when two basic planning structures - radial and retangular - cross shaped appeared.

Evolverment of crafts, trade and manufacturing led to quantitative and qualitative intensive growth of urban centers. There were changes in social segments of the population, areas of activities were developing. Initial periods of European urban planning cohered with imperial ambitions of Galish, Roman (Byzantine) Empire, Palmyrene Empire and later Ottoman Empire with simultaneously developing monarchial regimens in European countries, including Russia. By the period of Middle Ages (XIII-XIV) cities of Hanseatic league (cities of North-West Europe – German and Livonian with Russian partnership) were founded. Famous Italian urban ensembles such as Pisa and Siena appeared, so as centers of Russian Knyazhestvos (Principalities) including Kiev, Novgorod, Pscov, Vladimir, and others. First theoretical knowledge on urban planning structures formed around predominant centers. Church architecture, residential and public development were also on the way. Further during Renaissance Era the urban planning ideas were articulated in the projects of “ideal cities” with consideration to planning of the development of construction engineering. Overcoming slowly middle age foundations of urban development, cities were rebuilt step by step. In XV-XVI centuries, exceptional urban ensembles were founded including San Marco Square in Venice, the Capitol in Rome, Kremlins in Novgorod, Pscov, Moscow and in other Knyazhestvos (Principalities). But the most magnitude the urban planning attained during XVII-XVIII centuries, when large monarchic states were forming. (Brunov N.I., 2003)

Initially settlements and further – towns, were developed based upon geomorphologic evidence and climate patterns, that have to be favorable for living. The most comfortable and advantageous zones for living considered to be seashores and river valleys thus insuring communications for trade and exchange in kind and creating strategic conditions. Architectural image of cities also depended on climatic conditions of the regions, flora and fauna of the area, and the nature of activities of population.

In its forms and modes of urban planning, objective laws of origin and development of cities manifested. They linked tightly with historical phases of civilization development, national identities and geographic features of countries and regions, with different

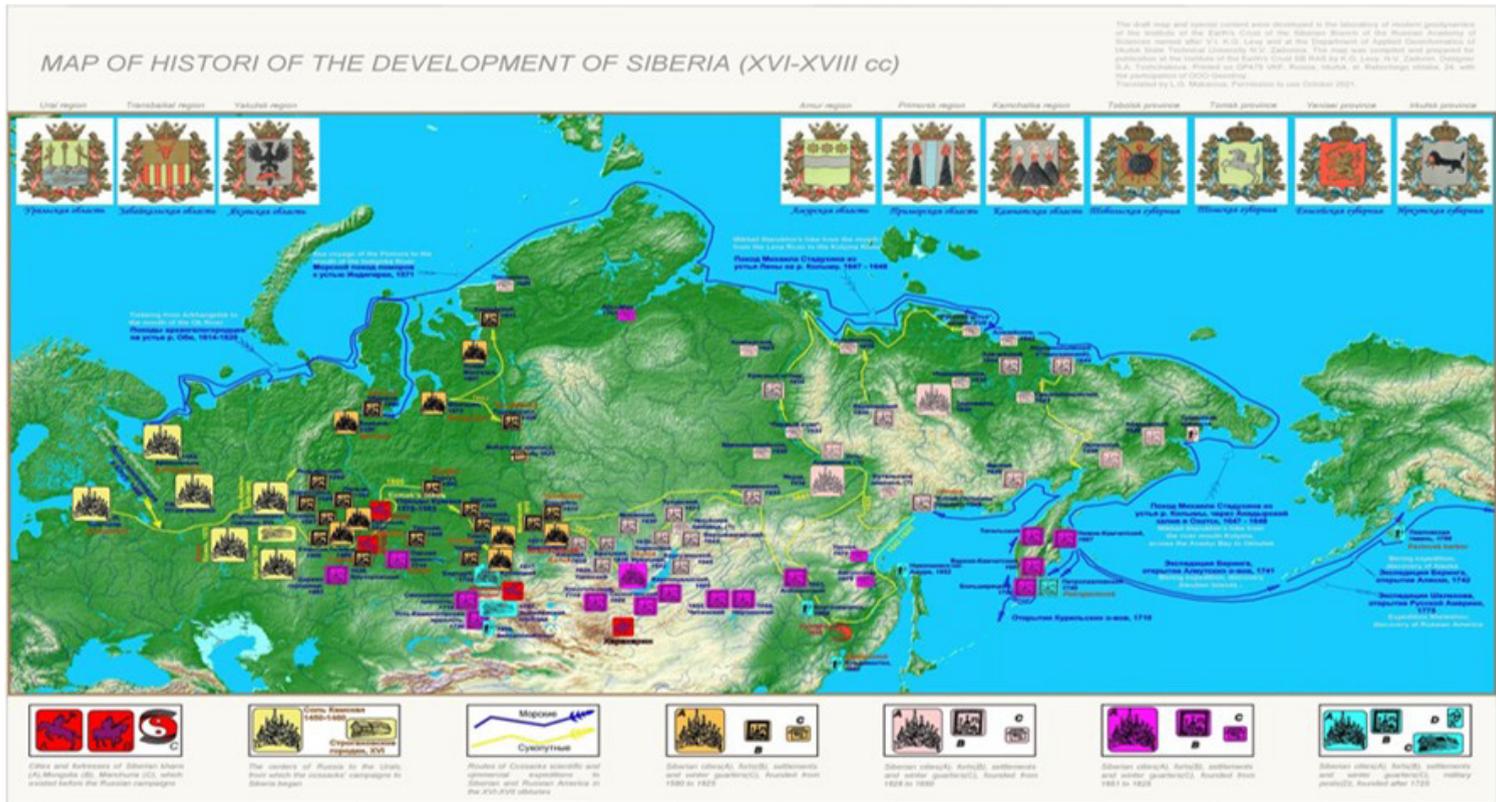


Fig. 1 – Map of the history of the development of Siberia (XVI-XVIII centuries) (16. Levy K.G. 2005).

planning culture and processes of construction technologies. Urban planning has combination of two historical and genetic methods for layout and building: there are “nature’s way (chaotic) development and those created according to the plan. But in “natur’s way” planning one obviously can find explicit features reflecting particular historical conditions that had impact on development. Cities built due to the plan may develop more predictable, but as time goes on, conditions change, and any city irrespectively from genesis would need renovation, including re-layout and reconstruction. Thus, urban planning is a historical process when empiric and scientific knowledge are accumulating. The results of studies on historically created systems of settling are of high importance from historical and urban planning aspects, as it demonstrates not only strength through time and space, but also is the foundation for future planning and forecasting. (Bezrukikh V.A., Kirilov M.A., 1995).

### The conquest of Siberia

New stage of urban planning in Russia closely connected with the extension of Russian State (Russian Tzarstvo from the year of 1547, Russian Imperia from the year of 1721). It started in Asian part of Russia, from Ural up to Pacific Ocean, and dated as of the beginning of XVI century. Expeditions of courageous pathbreakers moved through north seas starting in Arkhangelsk, sailed along rivers - Ob, Irtysh, Enisey, Lena, through mountains and valleys, severe taiga, from Russian North through Siberia to Pacific Ocean, dragging boats over dry land, on the way establishing new settlements



Fig. 2 – V.I.Surikov. *The conquest of Siberia by Yermak* (<http://svistun-sergej.narod.ru/news>).

and towns-landmarks that became basic centers of land reclamation.

There are examples of settlements that later became cities: Beriezovo (1500), Mangazeya (1572), Tobolsk (1578), Surgut (1592), Tomsk (1603), New Mangazeya (1607), Yeniseisk (1610r), Krasnoyarsk (1628r.), etc. Successful Russian expansion to the East based on setting the system of “ostrogs” (some kind of fortress) as key points along Siberian rivers. River factor along with the practice of building fortified fortresses (ostrogs) near rivers, facilitated strategic occupation and development of the

Asian area. First Siberian towns originated in north taiga zone, rich with peltry and valuable fish. Expansion to the south up to rivers Irtysh, Ob, Yenisey was complicated by the resistance of nomadic tribes. (Bykonya G.F., Fedorova V.I., Bezrukikh V.A., 2012) One of the first pioneers were Cossacks from Volga valley headed by ataman Ermak. Cossaks marched forth September 1, the year of 1581 due the Degree of Tsar Ivan the Terrible/ (Ataman – the title of top leaders of various Cossack armies). Ermak’s druzhina (expedition) consisted of 500 warriors. They had to fight for Russian state against invasion of khan Kuchum tribes (the Ruler of Siberian Tzarstvo). Ermak fleet, using excellent navigation skills, made headway through unknown wild places with great care. They moved along Tagil river taking advantage of flow of the river and favourable wind, reached Tura river and came out to Tobol river. This event depicted on V. Surikov (famous artist from Krasnoyarsk) picture “Conquering Siberia”.

Penetration to the very depth of Siberian wild forests (taiga) was followed by foundation of new settlements and fortresses: Beriozovo, Mangazeya -1572 (lost), Pelym



Fig. 3 – Remezov S.U. drawing from the book "Brief Siberian Chronicle (Kungurskaya), fragment (Remezov S.U. 1880) (Remezov S.U. 1880).

and Narym -1593), Surgut – 1592, Obdorsk – 1595, Verkhoturys – 1598. In 1587 Tobolsk was founded and proclaimed as the capital of Siberia.

### **The first settlements (forts, outposts, settlements, cities)**

Mangazeya was one of the first Siberian city founded beyond the Arctic Circle, and was of highly importance as the first prototype of free trade and new free habitudes. It became “a virtual Baghdad of Siberia”, wealthiest city-state, the city – legend. There exchange trade flourished, and gold flow like water facilitating furbearers hunting, rare fish procurement, cattle breeding, shipping development, founding business bone cover and corving handicraft. There ostrog (fortress) was founded with Voeveda at power starting the year of 1600. It made Mangazeya a city-state all but independent of the Russian Empire in its wealth and utter isolation. Due to historic research dated the beginning of XVII century, this territory was in focus not only of Russian merchants, but also merchants from Holland and Britain wishing to colonize that area. In conjunction with Tzar Mikhail Romanov Decree, the Northern Sea Route was forbidden in 1619 under the penalty of death and the city closed to outsiders: navigational markings were torn up, posts established to intercept anyone who might attempt to get through, and maps were falsified. The city was finally abandoned following the catastrophic fire of 1678.

Towards the end of XVII century Yeniseisk with 500 households and later, Krasnoyarsk became the second handicraft and trade centers after Tobolsk. In Krasnoyarsk Ostrog (fortress) were about 300 houses and it functioned as a fortress, enlarging to the steppe zone direction.

Almost simultaneously Russian settlements began developing from Angara mouth to up along Yenisesy thus reclaiming new areas usable for cultivation and stretching to Kazachinsky Porog (the place of Angara and Yenisey junction).

Yeniseisk Voeveda Yakov Ignatijevich Khripunov applied to the government with the demand of ostrog building on Yenisey (Krasnoyarsky ostrog). In 1623 he sent boyar’s son Andrei Anufrievich Dubensky to choose the place for a new fortress. For building a new fortress Dubensky chose a place at the high plane promontory between river Kacha outfall and Yenisey. Dubensky made a layout that was sent to Tobolsk and then, to Moscow. But it was only July of 1628 when the expedition of 303 men led by Andrei Dubensky reached the place identified with great difficulties and began to build the fortress. The first basic settlement was made from disassembled flat-bottom vessels and named as “clapboard village”. It took only 12 days to build it, and later it acquired historic name “Malyi Ostrog” (Small Fortress).



*Fig. 4 – Mangazeya prison with a posad furbearers hunting, rare fish procurement, Reconstruction based on the excavations cattle breeding, shipping development, of M.I.Belov (Bezrukikh V.A., Kirilov M.A., 1995).*



*Fig. 5 – Portrait of encircled by 3,5 meters of high fortification wall (as of described in Dubensky).*



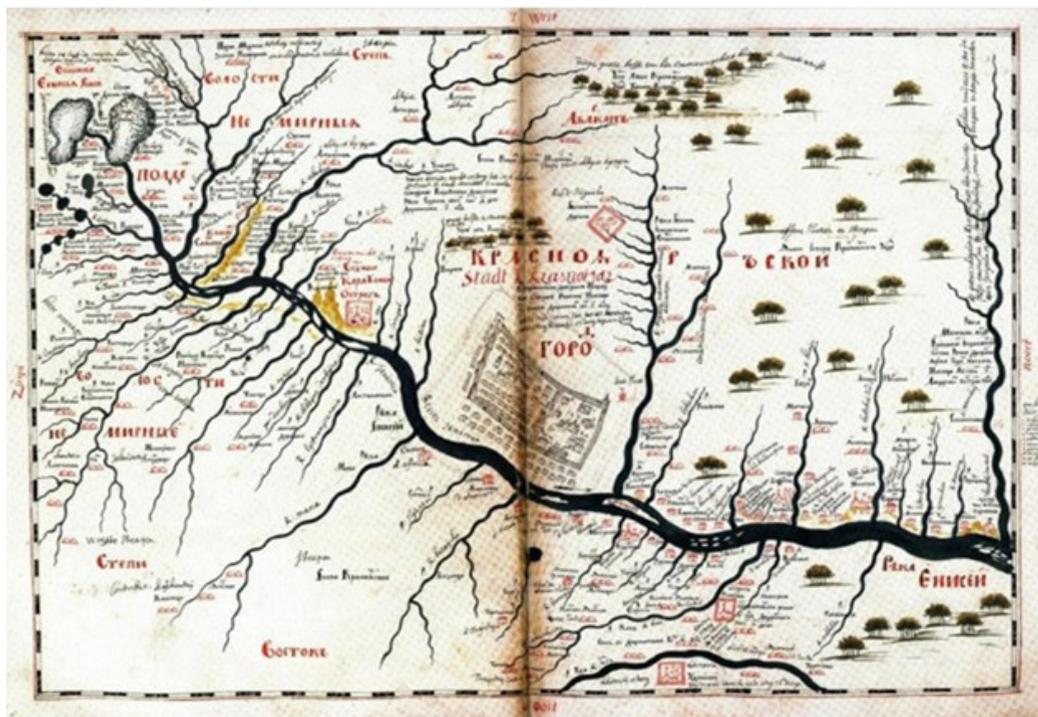
Fig. 6 – The Print of the Krasnoyarsk prison on a letter of 1644.

Dybensky executed honourably his duties as a town governor and first Krasnoyarsk Voevode. Frequent rides of Yeniseysk Kirghiz facilitated the process of building fortress walls from wooden pillars dug into ground and tighten with thick long bodies of trees without branches. It was ‘Ostrog upstanding’, but not made from logs, because local tribes did not have hard armament. Small Ostrog had 4 angular observation towers, one Spassky six-sided gate tower and was encircled by 3,5 meters of high fortification wall (as of described in “Drawing Book of Siberia”, 1699-1701). From the west (steppen) side nearby fortification wall there was a graff of 3 meters depth and 5 meters width. From outside, fortifications of ostrog were successfully completed with watch tower located on the most high point - Kum-Tigey (Pokrovskaya mountain at the present day) on the left bank of Kacha River. Today it is Praskovia Parskava Chapel, the symbol of Krasnoyarsk city. (Remezov S.U. (1697–1711).

Dubensky reported: “inside the small ostrog granary... was built for grain reserves and assembly house (it’s Voevode clerical office in 17th century), and Voevode’s court, public bath house and sable granary for furbearers (furbearers was natural tax in Russia in the period of XV - the beginning of XX centuries and it was collected from people living in Siberia and Northern part of Russia). Also 30 small log cabins were built inside ostrog for Cossacks”. The place, chosen for the fortress, was named Krasny Yar (“red bank”) by Dubensky, quite probably because of red color of marl (agril sand ground) constituting the terrain of high left bank of Kacha River. Ostrog located at the high plane promontory between river Kacha outfall and Yenisey. This location shaped significant identity, peculiarities of layout and city skyline of future Krasnoyarsk.

The net of ostros (Kuznetzky – Novokuznetzk city, Krasnoyarsky – Krasnoyarsk

Fig. 7 – On the left, Remezov S.U. (1701) Fragment of the middle and upper Yenisei "Drawings of the Book of Siberia". On the right, Krasnoyarsk fortress –settlement, Nikolaes Vitsen from the book "Travel to Muscovy".





city, Abakanskyi – Abakan city, and others) defended the main road from South along the rivers Tura-Tobol-Ob-Enisey-Angara from nomad tribes inhabited the basin of the Yenisey between Kazachinskii Rapids and Sayany. The confrontation of Kirghiz knyazhes (rulers) in order to prevent Siberian development lasted almost 100 years.

Settlements foundation paved the way for attraction of Russian inhabitants, arable land development, agriculture upgroth and rural development. Colonization of Siberia and Prieniseisky krai took place from north to south, from Subpolar severe regions to north-taiga with water – land ways. They connected main territories of regional commercial development. Houses were built nearby ostrogs, piece by piece encircling them. Ostrogs became administrative centers. Main centers of settlings was Turukhansko-Taimyrsky commercial region, which territory was included in Mangazeya uezd. Down Yenisey settlements were founded mainly wintering places (temporary housing for furbearry, fishery, hunting and also for winter stay, while rivers are frozen). Later they acquired the status of settlements and towns. The second region was Yeniseisko-Krasnoyarskii that included the areas of two other regions. The first villages and hunter's lodges in Yenisei province appeared, located along main trade and commercial ways going from West Siberia through Macovsky Ostrog to Yenisey and further along Angara to the East or down to Yenisey to the North.

First villages appeared at the beginning of 1630 years near ostrog. They were established by local authorities, Cossacks, building their hunter's lodges with exiled as a workforce.

### **In 1690 Krasnoyarsk received the status of the city**

The city had only wood buildings with architecture appearance in line with the nature of building of north region of Russia. Wood as the major construction material was the most preferential according to quality and quantity. It transported easily by the water and was easy processed. Overwhelming majority of migrants to Prieniseiky Siberia came from North and Central Primorye, where different kind of log-houses widely used. Wooden architecture practices were brought to Siberia by migrants. Pine wood and larch round wood were mainly used for log shell (25-40 sm in diameter and up to 10 meters length).

Afterwards windows with laid on carved dressing appeared. The most extraordinary

*Fig. 8 – On the left, indigenous people of Tartary; drawing from the publication of N. Witsen's book "Northern and Eastern Tartaria". A - Yakut, B - Kalmyk, C - Ostyak, D - Tungus.*

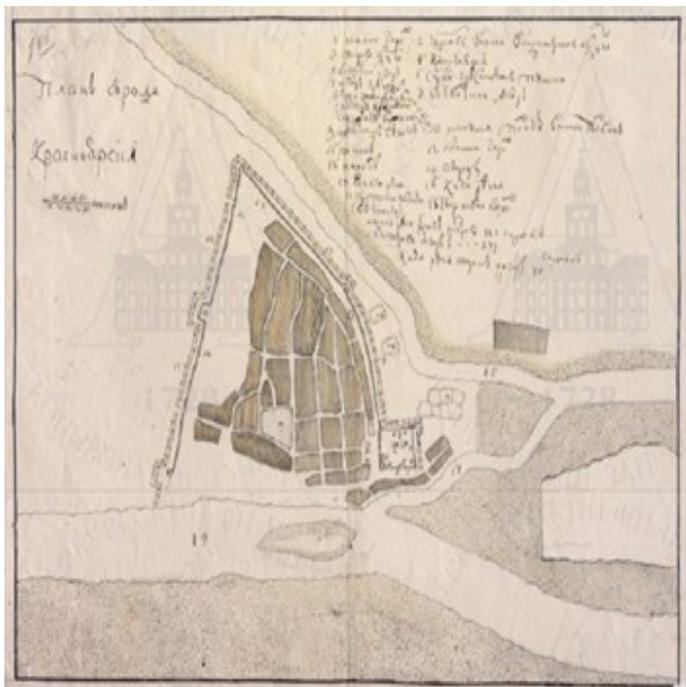


Fig. 9 – Krasnoyarsk plan of the early and late 18th century.

and expressive blockhouses used to build temple complexes. Although developing successfully, wooden architecture had one scarcity – it was nondurable (life cycle of the buildings mainly around 200 years massive fire). (Gevel E.V., Gevel E.V. 2012)

The situation changed radically in the second part of XVIII century. Moscow tract (highroad) hacked through the territory of Krasnoyarsky uezd (krai) in 1762-1776, crossing Achinsk-Krasnoyarsk-Kansk, thus expediting cargo delivery drastically from Russia to the east, and back, in comparison with Ob-Yenisey-Angara water transportation. Krasnoyarsk became top point on the road between Russia and China.

In 1773 an awful fire destroyed Krasnoyarsk and left only 30 houses untouched. After the fire new line layout of Petersburg type was created. Main wide streets were built parallel to Yenisey from west to east, from the place of Yenisey and Kacha junction. Meridionally streets mostly named alleystreet stretched from south to north, from Yenisey to the direction of Pokrovsky hill. The quarters were proportional and had regular geometrical shape. Streets started on the squares and coincided with those squares that had significant public buildings with dominating accent of city space perception. Such a plan became the foundation of urban development of Krasnoyarsk and clearly visible in layouts of modern central part of the city. (Drozdov, N.I.; Artemiev, E.V.; Bezrukikh V.A. 2005)

The transformation of Krasnoyarsk from the big frontier stronghold to a usual small Siberian town had an impact on all spheres of its life. At the last quarter of the century the city appearance had no reminder about its warring past and changed significantly as an impact of the fire and the time. All fortifications disappeared. Isinglass stone and ox bulbs on windows were changed to glass, anywhere the city still continued building wood houses. But use of wood was dangerous, and only stone buildings can change the situation with the fire. (Balandin S.N. (1981)

Tobolsk became the first city in Siberia that started successfully use stone in construction. In that area stock of raw materials were found out. Pits and firing facilities for lime and bricks production were under operation. From 1706 churches, cathedrals and monasteries were built in the style of north-russian cult architectonics. In the middle of XVIII stone houses began to build in Yeniseisk, Irkutsk, within Baikal area. In 1803 there were 230 stone buildings in all Siberia and 115 belonged to cult strata. It is the evidence of week development of engineered brick construction in Siberia up to the beginning of the XIX century.

In Krasnoyarsk the first brick building was Nativity Cathedral (Voskresensky) on Strelka built in 1773. Today the oldest building of krai center is Pokrovskaya Church

founded in 1789. The status of periphery and Russian migrants coming from different part of the country determined baroque and classicism in Siberian variant. Siberian baroque reflected Russian and Ukranian architectonics traditions (Voskresensky Cathedral in Yeniseisk, 1782, Pokrovskaya Krasnoyarsk). Then, Church in towns appearance began to be determined by standardized “pattern projects” used in many Russian cities. They were done in the spirit of provincial classic manner and called for normalizing of the development and suggesting new level of quality.

In December 1822 Yenisei Gubernia was established with Krasnoyarsk as a center, because it had the most favorable economic and geographic location and small area of the town. It resulted by fast growth and foundation of administrative bodies. (10. Lappo G.M. 2008)

The first long-term plan was developed in the middle of 1820 under the guidance of the architecture William Geste. His commitment was in standardization of “red lines” and enlargement of quarters. (Gevel E.V., Gevel E.V. 2012)

The right bank of Yenisey was not developed for a long time. There were old settlements along arm of Torgashinsky Range of mountains - Totgashino village and on the Yenisey river-bank two Cossacks settlements - Verkhnie and Nizhnie Ladeiki of the same age as Krasnoyarsk. [4]. Here there were rare birch forest outliers and shallow lakes overgrown with bulrush and ling, where flock of ducks nested, wide swamps with scourge of mosquitoes existed. This area chilled through by the wind was crossed only by railway (constructed at the end of the 19th century) and tract by what convicts moved to the depth of Siberia. (Bezrukikh V.A., Kirilov M.A. 1995)

In the 40-50th of XIX “the gold rush” flourished. Krasnoyarsk became a managing center of gold industry. 120 gold works were supplied by equipment, food, employees through guberniya center. In winter all owners of gold mines and their managers went to Krasnoyarsk.

At the end of XIX Transsibirian railway crossed the territory of Yeniseiskaya Gubernia.



*Fig. 10 – Cathedral of the city of Krasnoyarsk. Photo of the early XX century. (The building was lost during the Soviet period).*



*Fig. 11 – On the left, view of Krasnoyarsk 1841 Watercolor, author unknown. On the right, view of Krasnoyarsk from Karaulnaya Gora, 1911.*

On the 6th of December of 1895 the first pilot train came to Krasnoyarsk. On the 1st of January, 1897 constant movement of cargo and passenger trains was opened on the Ob-Krasnoyarsk leg.

Starting from this moment former provincial and merchant – clerk image of the city changed, and Krasnoyarsk obtained features of big trade and industrial center.

In Krasnoyarsk first historical monuments and recreational places appeared. For example, in 1855 instead of simple cross on the place of Cossack fortress observation tower of XVII century, Chapple from stone was built as a symbol of the bed of honor of those Krasnoyarsk citizens who died, defending ostrog during the first period of its existence. This memorial was financed by gold mine owner P.I. Kuznetsov. In 1831, the memorial to N.P. Ryazanov was created financed by Russian-American company. Ryazanov was the head of the company from 1799. On his way back to Russia he turned sick and died in Krasnoyarsk on the 1st of March, 1807. Commander was buried on the territory of Voskresenski Cathedral.

In 1828, city park was founded within the old pine forest. In 1845 the foundation stone of Navity of Mary Cathedral Church was laid on Novobazarnaya Square by the project of famous architecture Konstantin Ton. This Cathedral was the largest in Siberia. In the year of 1889, Public museum was founded, and still remaining as one of the largest regional ethnography museum in Siberia.

In 1890 famous Russian writer wrote in his essays “About Siberia”: “On this bank Krasnoyarsk – the most beautiful among all Siberian cities, and on the other – mountains reminding me Caucasus, the same smoke-coloured and dreaming”.

For years urban development on the banks of Yenissey and Katcha were restrained by the lack of bridges. The first bridge through Katcha was built in 1780 and destroyed by high water. The second one -- in 1843, and after 1873 several bridges were build.

For ferriage via Yenissey, boats, ferry lines and also moveable pontoon bridge were used. In 1896 local paper “Yenissey” wrote: “nearby building bridge via Yenissey, the

*Fig. 12 – Bridge over the Yenisei River, designed by engineer L. D. Proskuryakov, built in 1895-1899. (In 1900, at the World Exhibition in Paris, the model of the bridge was awarded the Grand Prix and the gold medal - "For architectural excellence and excellent technical performance")*

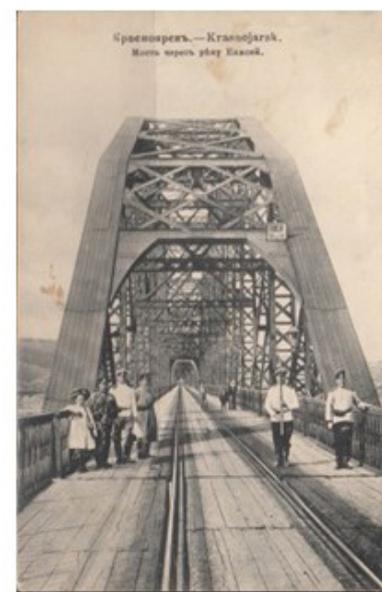
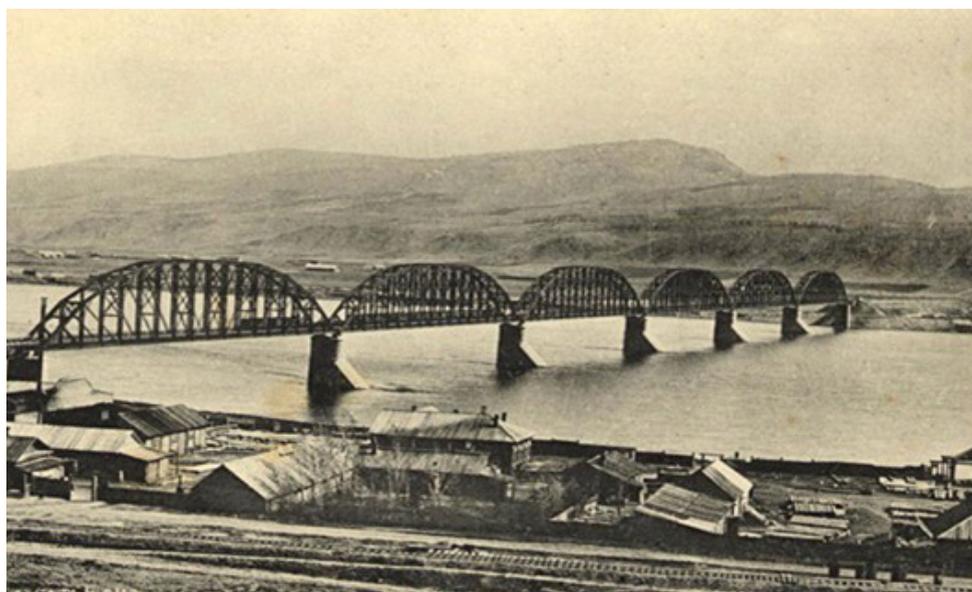




Fig. 13 – General plan of the early 20th century.

whole town emerged: food courts, bakeries, shop keepers and so on... Traffic became so strong, that stagecoach (diligence) had to go there several times a day”. But one of the significant event in the history of the city became the construction of railway bridge via Yenisey in 1899 under the charge of an engineer Evgeniya Karlovitch Knorre by the project of Professor Lavr Proskuryakov. In 1900 this bridge together with Eiffel Tower was awarded Grand Prix and golden medal “for architectural sophistication and bright technical implementation” of World Exhibition in Paris. Later scientists of UNESCO called Krasnoyarsky railway bridge “top of human idea”. Unfortunately, this heritage was demounted for scrap metal in spite of protests of Krasnoyarsk citizens.

Industrial development of the right bank started only at the end of 20th of the XX century, when first five-years plans took place in the Soviet Union. Plants, factories, power stations were built. More intensively the territory of the right bench were developing in the Great Civil war, when industrial factories were evacuated from the European part of Russia. Social infrastructure: cinemas, houses of culture, sports facilities has been developing. In 60-70th housing construction aggressively developed.

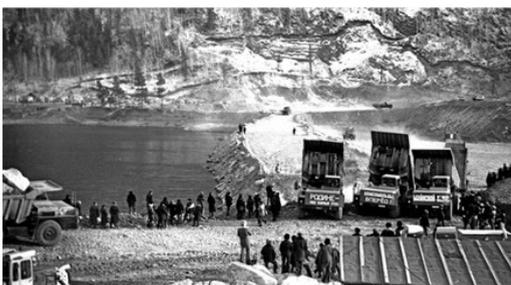


Fig. 14 – On the left, initial stage of construction (photo archive) of the Krasnoyarsk hydroelectric power station. Construction 1955 - 1971. On the right, modern photo of the Krasnoyarsk hydroelectric.

Dilapidated houses and barracks were changed by new block of houses. However, historic approach to urban planning remained in that period; main streets and avenues were developing parallel to Yenisey, including Krasnoyarsky rabochii Avenue located on the right bank. The construction of Kommunalny bridge via Yenisey in 1961 significantly enriched the comfort for citizens. Two of its parts having the length of 940 and 410 meters are divided by special dam through Residential Island.

Urban development was executed according to general layout approved in 1972. Remarkable feature of it is the development of integral architectural ensembles. For example, sports facilities on the Residential Island, left bank Waterfront Square before the bridge with Krasnoyarsk Hotel, Opera & Ballet Theater (named after Dmitry Khvorostovsky), the area of outfall of Katcha with the Concert Hall and the complex of buildings and elements of landscape harmonized in one "Strelka" architectural ensemble. Right bank Waterfront square is organized by ribbon development with modern individual complexes with focus on high rise buildings of the Amaks Hotel, several public project institutions and residential units stretching along Yenisey bank.

During the Soviet period development of large modern complexes constructed with care preserving buildings with historical and architectural values (such as Pokrovsky Church, catholic Church, Surikov Museum, etc.). The companies involved in restoration, engineering and construction companies were engaged.

After USSR fell apart, 90th of XX century, architectural image of the city changed dramatically to worse. Uncontrollable impactation by infill construction with residential and public houses was far away from harmonized architectural ensembles approved previously. The old houses with historical value were neglected, and some of them even were cruelly teared down. Building of primitive and featureless houses with oversimplified modes of façade construction, aggressive advertising led to disproportion in urban planning integrity reached during previous years. Intensive residential development in some neighborhood units located at periphery and "over loading" of central commercial part by shopping & entertainment centers with simultaneous reduce of "green" zones, resulted in deterioration of ecological environment and negative outcomes from transportation infrastructure. (Drozdov N.I. 2006; Drozdov, N.I. ; Artemiev, E.V. ; Bezrukikh V.A. 2008)

In Krasnoyarsk all phases of urban development were specified by nature conditions, by relief in particular. At the beginning (XVII-XVIII centuries) the first and the second terraces above flood-plane of Yenisey were developing, the third terrace also started to develop in 1850th . Today the city is located on 8 terraces and sometimes neighborhood areas are used. If considered that terraces are covered by thick sedimentary cover of quaternary deposits of sedimentary origin, it becomes clear that construction on rising ground facilitates active development of geodynamic processes (erosion, soil slip, etc.).

### **Geomorphology, Climate, Flora and Fauna**

Location of Krasnoyarsk is on junction of three physiographic systems - West Siberia

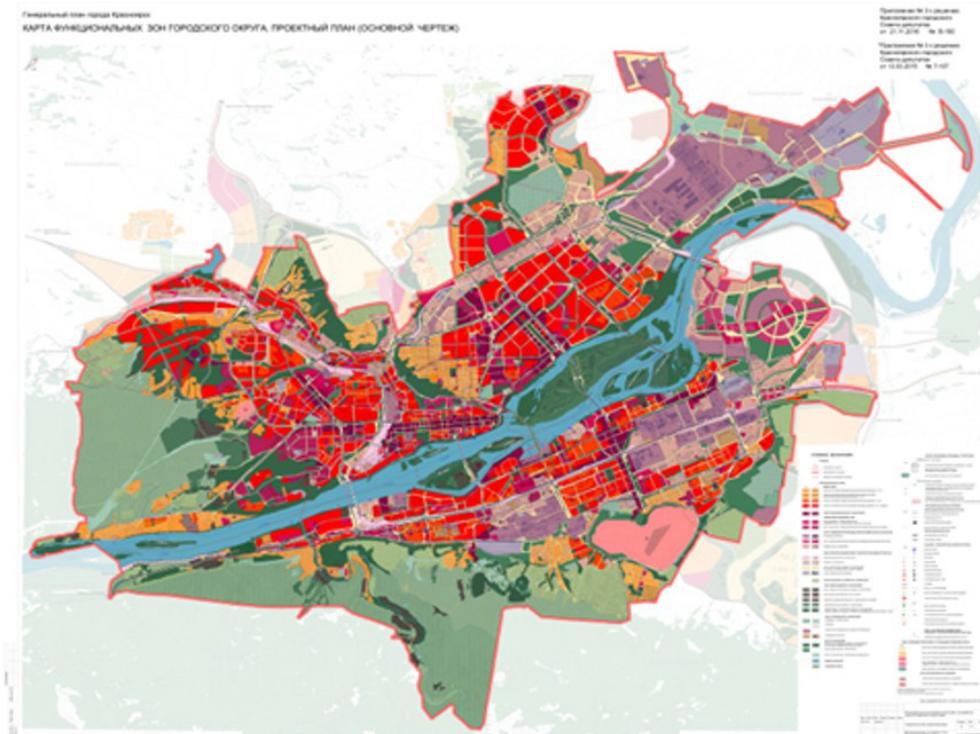


Fig. 15 – Valleys Map of functional areas of Krasnoyarsk (drawing 2016). Administrative public portal.

valley, Siberian Platform, and Altai-Sayansk Upland. Every country has its own history of development. Studying natural conditions of Krasnoyarsk, one becomes acquainted with the history of all vast Siberian territory. Geological and geomorphological structures of Krasnoyarsk and its suburbs is complicated and multidimensional. Initially and as a result of development, the city is located at the interface of multiple phisicographic borders: geologic, landscape, floral and faunistical. On its territory different forms of topography can be defined: macrorelief (uplands, ranges, valleys), mesorelief (hills, valleys, balkas, ravines), microtopography. The major part of the valley consists of the terraces generated as a result of geological activity of Yenisey river and its tributaries . The city mainly located on terraces (8 terraces belonging to different periods of time) and in the valley of the river. Such location makes city-planning works more complicated.

There are several natural landscape zones here: small-leaved and coniferous forests with isolated relict linns preserved from former broad-leaved forests and also spots of forest-steppe.

From December 1934, the territory from the Arctic Ocean to Sayan Mountains was integrated into Krasnoyarsky krai with Krasnoyarsk as a capital. It is the biggest city in the region of around 1 million people. The Krasnoyarsk Region area is about 2339,7 thousand square kilometers or 13.6% of all country's territory with 2,8 mln people of different nationalities. The major part is concentrated in 9 largest towns with the population counting more then 50 000 each. This region according to natural and geographical conditions and Yenisey river was named as "Priyenseyskaya Siberia" (the region around Yenisey river).

Priyenseyskaya Siberia region is stretching 3,000 kilometres (1,900 mi) from the

Sayan Mountains in the south, along the Yenissei River to the Taymyr Peninsula in the north, and 1250 km from west to east. The climate is strongly continental with large temperature variations during the year and with very severe conditions in the north. The average temperature in January is (-)30 - (-)36 °C in the north, and (-)18 °C (-0.4 °F) - (-) 22 in the south and in the middle part. The summer in central regions is warm, with average temperature 16-18°C, up to +20 °C in the south and from +13 °C in the north. The period without frost is between 73 days in the north - to 120 days in the south. The annual precipitation is 200-600 millimeters (12.4 in) in the north and middle part of the territory and up to 1,200 millimeters (47 in) in the southern part. Permafrost is absent at low altitudes south of Lesosibirsk, but as one moves north it grades from sporadic around the 58th parallel to extensive discontinuous around the 60th parallel and continuous north of the 63rd parallel. (Bezrukikh V.A., Kirilov M.A. 1995; Bezrukikh V.A., Ligayeva N.A., Makarova L.G., Khlimanyuk A.A.).

Flora of the krai consists of several natural zones: arctic tundra (marshy plain), taiga, grass forests, forest steppes outlier and island steppes. Taiga zone is the largest part of West-Siberian plain and Middlesiberian upland. In the north it joints with mountain taiga forest of West and East Sayani. By nature of flora it is divided on north, middle and south subzones. In north subzone (north taiga) wet peatland open woodland dominates consisting of Dahurian larch with mix of spruce and birch on taiga gley cryogenic soil. To the south of Polar Circle dumetous and grass- dumetous larchen forest (mid taiga) prevails on podzol and permafrost-taiga soil. To the south and west dark coniferous forest dominates (spruce, fir-tree, Siberian cedar, Siberian larch). In the east (Priangarie) there are sphemlock and pine and pine forests (south taiga). In the south taiga is crossed by mixed small-leaved (forests of deciduous species) forests. They form landscapes changing taiga and island forest steppe (Achinskaya, Krasnoyarskaya, Kanskaya). In the south landscapes turn to steppes of Minusinsk basin. Further in the West and the East Sayany altitudinal zonation is clearly expressed.

Present fauna of the region is very rich, diverse and formed after Ice Age. Such animals as cattles, horses, sheeps of Kirghiz breed, wild animals – bears, wolves, foxes, lynxes, hares, small and medium rodents. In the mountains there are bears, arkhars, saigas, gazelles, wild boars, now leopards appearing.

Wild birds – graylegs, swans and ducks, grouses, blackcocks, great geoses, sandpipers, cranes, hawk eagles, kites, accipiters, black kites etc.; reptiles: snakes, grass snake, lizards, frogs; insects: mosquitos, botflies, mites, etc. The Yenissey and its tributaries are rich in fish: the mountain streams of the headwaters support grayling, trout, lenok, roach, and dace; the middle course has sterlet, trout, goldilocks, several species of whitefish (genus Coregonus), and grayling; the lower course has Siberian lamprey, Siberian sturgeon, sterlet, Alpine char, trout, gold and silver carp, pike, and many others.

### **Geomorphology, Climate, Flora and Fauna**

Thus, the development of the territory Priyeniseiskaya Siberia was staged and took

place from Arctic Circle to the south. Human impact on the morphostructure has changed everywhere quality and quantity of ethnical and social conditions of living for local people as a result of migration and territory development.

These trends especially prevail in the largest residential areas of krai territories and Krasnoyarsk agglomeration at its fines.

However, under the influence of anthropogenous factors (industrial areas, public housing construction, global penetration into geomorphological and hydrological conditions, inconsistent small and medium business activity) ecology is contaminating thus preventing sustainable self-reproducing development.

Exodynamic processes are increasing in prominent structures identified in erosions, suffosions, karst erosions, landslides and soil slips. Detrimental effect on vital functions of forest ecosystems enhances. Air pollution of city areas and its suburbs intensifies, aeration system frustrates, air flow processes cause trouble. High density chaotic commercial development leads to contamination of landscape views, environment grouping, contravention of principles of "scenic frame" (Безрукых В.А., Макарова Л.Г., Онищенко В.С. 2017)

Repetitive standard architecture of large scale development has negative impact on psychoemotional state of people. There are inconsistencies of rate of city industrialization and integrated development of communication frameworks with recreational ecostructures. Many places of historic and culture landscape sights are gone. (Lazarev V.V. 2008)

In recent times great positive efforts has been undertaken in order to control the processes of sustainable regions development. Conceptual programs have been adopted and legal framework is developing.

Scientific and planning approach, rational and creative realization of legislative acts, development of combined solutions and structural approaches – these are essential components for sustainable region development.

Abundant natural resources of Priyenseiskaya Siberia encourage integrated development under condition of ecostructure friendliness of the region which still hiding a lot of enigmas in its subsoil riches.

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