The origin of the state system of land surveying in the times of Kievan and Moscow Rus in the X–XV century

T V Ilyushina
Moscow State University of Geodesy and Cartography, 4, Gorokhovsky lane, Moscow, 105064, Russia
E-mail: ilushina@feut.ru

Abstract. As early as during the reign of Yaroslav the Wise (1019-1054), the main legislative source Russkaya Pravda (1054) was compiled, indicating the types of land ownership, borders and areas of land plots for taxation. This was the first step towards creating the simplest system of accounting and evaluation of land and other natural resources in the state on a legislative basis. Methods of land division depended on the structure of ancient Slavic settlements. The first artificial borders appeared for economic needs. Appearance of the first industries-hunting, fishing, cattle breeding, poultry farming and others, was the reason for the appearance of the first signs indicating places of private use. Drawings of land were made based on the results of inspections, inventories and simple measurements, the length of lines was measured with a measuring rope, and the area of agricultural land and forests was determined. By the beginning of the 15th century, there was a need for state land surveying (determining the location, describing borders, calculating areas, issuing legal documents for ownership, resolving disputes over land), as well as collecting information about state borders and natural resources. In X–XV centuries, not only the first important concepts of surveying were developed, but also the beginnings of the cadastre system of land accounting and division of 16–17 centuries were formed.

1. Introduction
The history of the formation of the state is closely connected with the issue of geographical research conducted in parallel with the development, accession and loss of land that is part of Russia. Initially, the Slavic population gradually moved along the Russian Plain, occupying a vast area along the banks of the Dnieper, Volkhov and the western part of the Russian Plain. According to the «Tale of Bygone Years» in 862, the Western Slavic and Finnish tribes called on the Scandinavian Rurik, who became the first prince of Novgorod. After his death, a relative of Rurik, Prince Oleg, conquered and annexed lands along the course of the Dnieper to Kiev, and on campaigns with his squad reached Constantinople. Kiev became the capital of an early state, later named Kievan Rus.

Under Prince Vladimir I (980–1015), the state structure took shape, population density increased, agriculture, forest management, hunting and fishing developed [1]. Kievan Rus reached its peak during the reign of Vladimir’s son, Yaroslav the Wise. The main law of the state was drafted – Russkaya Pravda (dated to various years, starting in 1016 and retaining its significance until the 15–16th centuries), which during the future reigns was supplemented with a number of articles indicating the types of land ownership, borders and land plots for taxation. The law included articles on the protection of all types of property (patrimony), life and property of feudal lords. This was the
first step towards the formation of a simple system of accounting and assessment of land and other natural resources in the state on a legislative basis.

The development of territories had a strong impact on the natural environment and led to a change in landscapes. There was a deforestation at the sites of settlements due to burning forests for plowing agricultural land. This, in turn, caused shallowing of rivers and lakes, and their swamping. Fires contributed to the destruction of animals and plants, the change of primary forests secondary. Changes in the water regime of the rivers led to the violation of habitat conditions or disappearance of fish species. Excessive hunting led to the extinction of some species of animals. Faced with depletion of natural wealth, the population was forced to look for means to replenish them. At first, people, according to custom, observed various restrictions on economic activity aimed at protecting natural resources. Over time, restrictions were enshrined in community rules, religious bans, and then state laws.

2. The first methods of land surveying during the time of Ancient Rus in the 10-15th centuries

The earliest documents relating to the description of Russian lands, including their geography and demarcation of economic land belong to the XI century. The Primary Chronicle describes the geographical settlement of Slavic tribes. It indicates how tribes delimited their lands from neighboring lands. Between the settlements, vast expanses of free land remained, which served as a fund for the expansion of the settlement. Such a division of land did not require complex measurements, nor the intervention of the judiciary, nor the agreement of individuals. It was enough to plot strips of equal width in each land of the earth, and designate them with bordering signs – pits, stakes, stones or furrows. So, the signs on the beekeeping trees (the oldest form of beekeeping) indicated where the bees belonged; spaced snares, clearings for nets – «perevesy», wolf and moose pits – the interests and possessions of the first «borrowers». Zaimka is the name of a one-yard settlement or a land plot occupied by someone by the right of first ownership, far from the developed territories and etymologically is linked to the root meaning to borrow. The first villages appeared between wild forests and fields, had the status and significance of the tract. The hunters and bird catchers, having found favorable living conditions, either remained there forever, or, having depleted the area by predatory hunting, abandoned it and went deeper into the country to establish a new settlement. Therefore, the value of land was determined only by the amount of labor invested. The first artificial boundaries (hedges, strips of uncultivated land, mezhniki, «verges», «limits», etc.) appeared for household needs (protection from wild animals, rapprochement with neighbors in especially valuable lands: arable land, meadows, boards ). Many customs and proverbs arose from the notion of mezha – a boundary: «boundary is a sacred cause», «boundaries create quarrels and abuse», «who has power [strength], will capture another’s land beyond the boundary», «marry to the boundary» with the adjacent land attached and others. The distribution of possessions was determined by the area where land development ended – «where the plow, scythe and ax went» [2]. With the increase in population, the value of land has increased, the right of ownership has strengthened, and signs of the boundaries of possessions protected by law and authorities have been established. The appearance of the first trades – hunting, fishing, cattle breeding, bird catching and others, became the reason for the appearance of the first signs indicating the places of use of individuals. With the increase in population, the value of land has increased, the right of ownership has strengthened, signs of the boundaries of possessions protected by law and power have been strengthened.

As the Slavs settled in river systems and traded with their neighbors, hydrographic knowledge accumulated. In many land surveys, various characteristics of wells, river, lake and groundwater were used [3]. An important river route from the 9th century was a way from the Baltic to the Black Sea. The description of the river network is already in the Primary Chronicle. Through the river Don, trading people from the Sea of Azov or the eastern tributaries of the Dnieper River passed into the Volga system and into the Caspian Sea. Studies of northern rivers since the beginning of the XII century were associated with the development of Veliky Novgorod [4]. The trade routes of Novgorod included many rivers along which the well-known water systems were subsequently built –
Vyshnevolotskaya, Tikhvin and Mariinskaya. The basins of the northern rivers, to the shores of the Arctic Ocean, were mastered.

Figure 1. The first page of the Primary Chronicle – the oldest chronicle of the Slavs.

The Slavs had a special attitude towards the forest, especially sacred groves and worshiped old hollow trees. Cutting trees in such places was strictly prohibited. Article 73 of the Russkaya Pravda stated: «If someone cuts down an oak with a banner or a boundary, he pays a 12 gryvnia fine (from the sale)» [5]. Thus, large oaks were protected, serving as natural landmarks in the lands. Russkaya Pravda considered theft of forests and other people's firewood a crime. Forests were the only beekeepers, and chapter nine talked about protecting onboard property. Hunting locations were also protected by the laws of the Russkaya Pravda from unauthorized violations [5, 6]. Consequently, every rural possession had its limits, approved by the government, and their signs were sacred to the people. However, despite attempts to legally preserve the forest, forest stands were ruined by fires and steppe nomads; riverbanks were cleared for crossing and cut down for arable land.

Monasteries have long been observing lands, healing springs and protected forests; they compiled the first descriptions and maps of the land. The monasteries composed the first descriptions and drawings (Kirillo-Belozersky Monastery (210 manuscripts were already stored here by the end of the 15th century), Trinity-SergiusLavra (one of the largest landowners in Russia), Solovetsky Monastery (was an important colonization center in the north and a strong point Russian possessions on the White Sea coast against the raids of Swedes, Danes and Finns.) [7]. While also protecting nature, the monasteries declared separate sections of forest and other lands protected. A large territory was settled and developed on the Solovetsky Islands off the coast of the White Sea. The population began breeding livestock in the harsh conditions of the North. Breeding livestock in these places allowed reducing the burden on the natural environment. This, in turn, made it possible to protect many species of animals from extermination. On the Solovetsky and Valaam archipelagoes, an exemplary irrigation system was created, which protected the environment from pollution.

The methods for delimiting land depended on the structure of ancient Slavic settlements. All convenient lands were either considered the property of the settlement, or were divided by lot between separate families, the law imposed fines for violating inter-borders. At this time, the first descriptions
of land appear with the purpose of tax distribution. In the annals of the Kiev Pechersk Monastery, the first indication of sazhen as a unit of measurement of land is given (1017). Drawings of individual territories were compiled according to the results of inspections, inventories and simple measurements (the lengths of the boundary lines were measured with a «measured forelock» [rope], and the areas of agricultural land and forests were determined). Unlimited land and slash system of agriculture did not create a need to accurately measure areas and borders. This implied the absence of the need for special geodetic tools, methods and accurate mass land work. Large expanses of land and sporadic population made it possible to do without an accurate measurement of areas and borders. The government did not yet have special land surveying management bodies and land surveying organizations, but in RusskayaPravda instructions were given on boundary signs, which were established by measuring and determining the area of land for taxation [8–10]. The villages were called by natural lands – «falconry», «fishing», «beekeeping», «arable», «saltmining». The better land was described, the bigger penalties for violating land laws were established [11, 12]. The articles of Russkaya Pravda contain information on boundaries, trades, and the resolution of contentious issues about lands and forests [6, 13]. Land was the main revenue source for both private individuals and the state. The princes appropriated the right to trade, to catch birds and animals, but the crafts enriched the common people. All strata of the population, princes, clergy, boyars, combatants, merchants, free peasants could own land and its wealth, and princes bought land property along with people who were obliged to pay rent [14, 15]. The appearance of the first drawings made it possible to study the laws of spatial distribution and development of land and other natural resources, places of settlements, land and water routes, and others.

In 1237–1240 Kievan Rus was conquered by the Mongols. They could not stay for a long time in the southwestern lands, which came under the control of Lithuania and Poland. However, Northeastern Russia, where the Grand Duchy of Moscow was later formed, remained under the control of the Mongols until the end of the 15th century. The Mongols did not intervene in the internal administration of the subservient lands, but they conducted a census of the population, first in Kiev in 1245, then 10 years later on the territory of Vladimir Rus, to determine the size of the tribute. From the time of Ivan Kalita, Moscow princes themselves collected tribute for the Mongols. According to censuses of the 14–15th centuries, the amount of the tribute was calculated according to the wealth of the person, movable property, according to crafts, and according to sokhs – taxable units. Distribution, amendment and addition of local boundary laws led to the creation of special laws in some territories (Novgorod, Pskov and Dvina court letters). The boundary court and land affairs were controlled by the representative of the local authority (the governor), a single tax and a single measure of calculation – sokha, literally a «plow» – were introduced. Along with property, they distinguished between ownership and property rights to other people's things, including easements and lien. For the first time, personal easements (established in favor of a certain person) are mentioned in the Pskov Judicial Charter of 1397 [10, 14].

Among the articles of Russkaya Pravda, there are articles on boundaries, trades, on the resolution of controversial issues about lands and forests. Article 105 introduces the term dacha (the term is only found in the late copies of Russkaya Pravda). According to researchers, a dachais a sum of money, or a type of feudal conditional holding (a loan by bread, seeds, stock, or cattle), which amounted to mercy. The Western Slavs also had special feudal-dependent relations, known under the name of poddas, giving (close to Russian dacha, meaning something given) [8]. Russian truth determined the court fees for resolving land disputes. The course of the judicial boundary trial included the plaintiff’s complaint, judicial evidence (testimonies of witnesses – «clerks and rumors», oath – «company»), payment of a fine («sale») and a fee justified to the judge and the scribe. The first reason for the judicial survey was the inheritance of land. In land and inventory (compiled for a brief inventory of the property; later they began to be attached to the plans of cottages and forest «pegs» (a tree – a small forest in the field or among arable land), books containing a brief description of the land. The word obroktis found in ancient chronicles along with the word «tribute». A lease was understood as a lease, that is, fixed-term or unlimited use of real estate under a lease agreement. The private-law nature of a
lease could be in the case of the first industrial bidding (transportation, forges, mills), and land (beavers rutting, fishing, board places). In the 16th century, whole villages were leased out [for rent]. In the 15th century, rent was also used as a state tax. The rent was a replacement for «tax» (duty system; the main unit – sokha, a plow) in two cases: 1) if the land went out of tax (due to the death of the renter, etc.) or was not yet in the tax, then the government again gave the desolate land for rent; 2) in the case of facilitating the tax duties of renters, taxes were replaced by a tribute. The tax units were divided into ohji (land cultivated by one worker on one horse), chety (plots for sowing a quarter of the grain), and vtyt (households in peasant yards). The first «land-separating» instruments were the arms and legs of a person. But there appeared first artificial measuring instrument: a stick or pole, Novgorod measuring cane (1207, the length of the preserved fragment is 54 cm), measuring cord, tarred hemp ropes. When describing the land, the distance was measured with measuring ropes, indicated the turns of the borders and determined the area of agricultural land, forests and different lands. Mezha was the boundary of land ownership.

As a result of the creation of a single state and the study of state territory, the need arose for more accurate land-measuring work. There was a need for state land surveying (determining location, describing borders, calculating areas, issuing legal documents for ownership, resolving land disputes), as well as collecting information about state borders and natural resources. In this regard, work began on the creation of Scribe Books (1500), including descriptions of the lands during the reign of Prince Ivan III [8, 10–12]. Russian geographical map of a single country dates back to 1497. In 1525, Pavel IoviyNovokomsky, a Bishop and geographer, based on data received from the Russian Ambassador Dmitry Gerasimov, compiled a book for the inhabitants of Western Europe. It contained a map of Muscovy and described the geography, customs and life of the inhabitants of Russia. Almost 30 years later, the Italian cartographer Battista Agnese put a map called in his Atlas, «Moscovia. A drawing made according to the information of Ambassador Demetrios».

![Figure 2. Map of ancient Russia. Moscow lands in 1497](image)

3. **The development of the economy in the 10–11th centuries**

While in the 10–11th centuries, northeastern Russia had a small population, by the end of the XII century, many cities already existed here: Pereslavl-Zalessky, Tver, Zvenigorod, Ustyug, Uglich, Vladimir-on-Klyazma, Yuryev-Polskaya, Dmitrov, Moscow, Suzdal, Rostov, Yaroslavl, etc. Transfer of the «center» inland contributed to preservation and further development of Russian statehood,
spirituality and culture [8]. In the period of XIII-XIV centuries, the population density of northeastern Russia increases markedly, and the area of cultivated lands increases accordingly. Economic ties between villages and cities are expanding through crafts, trade and a developing land tenure system[13].

During this period, various industries were developing, in particular, the most important sectors of the economy were actively developing: logging, construction craft, metal production. Forest beekeeping products were also of great economic importance and were one of the main export items [14, 15]. Honey was the only product for the production of sweets and spirits. Wax was used as fuel for lighting and as a technical oil. The sides were hollowed out in the trees, the deck huts (decks) were installed on the platform (with 5–7 beehives) on two nearby pine trees. A section of the forest with well beehives belonging to the same owner was called bor (in eastern Polesie – votchina), and the beekeeper was called votchinnik. «With the advent of ownership of the sides, the boundaries of the division of possessions were outlined – uhozhie (a plot of forest, land with borts – beecolonies-trees) [15]. Most beekeepers had from 50–80 to 200–500 borts, and industrial beekeepers in the «bortfactories» totaled thousands of borts. Large owners were found along the banks of the Dnieper, Volga and their tributaries, where forests were full of maples, linden and honey bushes, and flood meadows – with legumes and other honey plants [15–17]. They were distributed throughout the territory of Russia, teeming with forests and mowed meadows. The lands occupied significant areas, separated by signs, which were applied to boundary trees – oaks or pines that stood out from other trees. Bort lands occupied large spaces, beaver rutting, fishing, and overgrowth (a net that was placed on a bird) adjoined them. Borders could pass along a stream or a river, a hollow, a forest path or a road. During the time of the Moscow principality, a large number of bort forests belonged to the treasury.

Fisheries were the main occupation of the population and the main source of income on the shores of the White and Barents Seas along with fishing and deer breeding. In the 14-15th centuries hunting areas were strictly defined, hunting grounds could belong to peasants and princes [18, 20]. Land and forest land fenced between natural boundaries (streams, swamps, groves, etc.). This period belongs to the first written mention of the Russian map of Ivan III, compiled during the allotment (surveying) of the lands of the Svyatogorsky monastery (1483) [21]. By the end of the XV century, the first travel guides appear in Russia, including descriptions of the natural resources of different territories.

4. Conclusion
Thus, in the period X–XV century, not only the first important concepts of land surveying were developed, but also the rudiments of the initial state cadastral system of scribal land surveys of the 16th–17th centuries were formed and developed. The state needed land surveying, land accounting and assessment, and the establishment of a procedure for conducting local and patrimonial affairs, in descriptions and measurements of land by land, number of residents, villages, income, land rights of owners. Land plots (pastures, hayfields, and forest lands were fenced between natural boundaries (streams, swamps, etc.), letters of warning prevented disputes. Establishing and consolidating state and private borders of estates, notifying the quantity and quality of the land fund, protecting property rights and the termination of land disputes, land valuation and the establishment of fair taxation – these are the main tasks on the way of development of the state at the end of the 15th century.

References
[1] Pushkarev S G 1993 Review of Russian history (Stavropol: Kavkazskiy Kray)
[2] Russian legislation of the X–XX centuries Vol. 2 Legislation of the period of formation and strengthening of The Russian centralized state 1985 (Moscow: The faculty of law Lit.) pp 181–2
[3] The book of the Big drawing (1627) 1950 (Moscow; Leningrad: Publ. and comments by K N Serbina)
[4] Klyuchevsky V O 1998 Russian history: a Full course of lectures (Rostov-on-don: Phoenix)
[5] Ivanov P I 1846 *Experience of historical research on land surveying in Russia* (Moscow: printing office of Seliverstov S)

[6] Pravda Russkaya 1963 Vol. 3 (Moscow-Leningrad: Publ. house of the Russ. Acad. of Sci.)

[7] Frolov A A 2017 New economic document of the XV century from the archive of the Trinity-Sergius monastery *Dating and attribution* 5(4) 1093–106

[8] *Acts of the Russian state 1505–1526* 1975 (Moscow: Nauka)

[9] Akishin M O 2016 *Legal language of the Russian state of the end of XV–XVII centuries* pp 168–187 Retrieved from: https://nbpublish.com/library_read_article.php?id=19128

[10] *Acts of clerical work (1644–1661)* 1977 (Moscow: Nauka)

[11] *Legislative acts of the Grand Duchy of Lithuania of the XV–XVI centuries. Documents and materials on the history of the peoples of the USSR* 1936 (Leningrad: Sotsekgiz)

[12] Pskov judicial Charter 1914 (St. Petersburg: Publ. of the Imperial archaeol. Commission)

[13] Konovalova I G and Frolov A A 2016 XVI Int. Conf. on historical geography Vol 3 (Moscow: Aquilon) pp 491–501 DOI: 10.21267/AQUILO.2016.3.3956

[14] *Certificates of Veliky Novgorod and Pskov* 1949 (Moscow; Leningrad: GUNP)

[15] Aristov N I 1866 *The industry of ancient Russia* (St. Petersburg: Type QueenandCo)

[16] German I E 1914 *History of Russian land surveying* (Moscow: Typo-lithography by Richter V)

[17] *Novgorod Court Charter: Russian legislation of the X–XX centuries* 1984 Vol 1 (Moscow: Legal liter.)

[18] Rudnev Ya I 1899 *Russianland. The nature of the country, the population and its crafts* Vol 2 (St. Petersburg: printing office of Martynov P)

[19] Budur N and Pankeeva I 1999 *From beekeeping to beekeeping* (Moscow: Terra)

[20] *Grand-Ducal, Royal and Imperial hunting in Russia* 1896 (St. Petersburg: Expedition of preparation of state papers)

[21] Khrenov L. S 1987 *Chronology of Russian geodesy from ancient times to the present day of the USSR* (Leningrad: USSR Acad. of Sci.)