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DEMOGRAPHIC AND SETTLEMENT HISTORY OF WESTERN SIBERIA.

A Regional Literature Review of the Ob-Irtysh Basin, Southern Steppe, and Yugra (10000BC - 1900AD).

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Figure 1. Geographical Subdivisions of the Ob-Irtysh Basin (I-1 Altai, I-2 South-West Siberian Steppe and Forest-Steppe, I-3 North-West Siberian Taiga, Tundra, and Yugra), River Basins, Oblast Boundaries, and Principal Archaeological Sites of Western Siberia.

Abstract

This review synthesises archaeological, palaeoecological, bioarchaeological, and historical census literature to reconstruct the population and settlement history of Western Siberia (the Ob-Irtysh river basin, ~2,40M km^2) from 10000BC to 1900AD. Following the regional framework established for Northern Eurasia [1], the basin is examined across three geographical provinces: the Altai region (I-1, 265k km^2), the South-West Siberian Steppe and Forest-Steppe (I-2, 680k km^2), and the North-West Siberian Taiga, Tundra, and Yugra (I-3, 1,45M km^2). Rather than relying on global historical interpolation schemes or raw radiocarbon date counts, population estimates are derived from excavated house counts and floor areas (Amnya I, Kayukovo 2, Botai, Arkaim, Kamennyi Ambar, Chicha-1, Rafailovskoye, Sherkaly-1, and Nadym Gorodok), cemetery mortality profiles (Sopka-2, Tartas-1, Choburak-I, and 43 Sargat burial grounds), 17th-century Russian fur-tribute (*yasak*) registers [2][3], the ten Imperial Poll-Tax Revisions (*revizii*, 1719-1858) [4][5], and the First All-Russian Imperial Census of 1897 [6][7]. Total population across the Ob-Irtysh basin grew from ~7,3k hunter-fishers at 10000BC to ~20,8k in the Early Neolithic (6000BC), ~97,8k in the Middle Bronze Age (2000BC), ~221,2k during the Scythian and Sargat Iron Age (400BC), and ~224,8k in the High Middle Ages (1000AD). Following late medieval political reorganisation (~163,5k on the eve of Yermak's 1582 campaign, including ~21,5k inhabitants across the ten Ob-Ugrian Yugra principalities and ~39,3k in the core of the Siberian Khanate), Russian agricultural settlement lifted the basin's population to ~269,0k by 1700AD, ~855,0k by 1800AD, and ~3,56M by 1900AD.

Background

Stretching from the Ural watershed (58°E-60°E) to the Yenisei-Chulym divide (86°E-90°E) and from the intermontane valleys of the Russian Altai (49°N) to the Kara Sea coast (73°N), the Ob-Irtysh drainage basin forms the westernmost third of Siberia [1]. As shown in Figure 1, latitudinal climate belts and elevation gradients divide Western Siberia into three distinct environmental zones:

1. Altai Region (I-1, ~265k km^2; 49,0°N-54,0°N, 80,0°E-90,0°E): Covering the high intermontane valleys of the Mountain Altai (*Gorny Altai* - the Katun, Biya, Chuya, Argut, Ursul, Chulyshman, Bukhtarma, Ukok, and Anui/Denisova valleys) and the northern forest-steppe foothills (*Altaiskoye Priobye* - the Charysh, Alei, Inya, and Chumysh valleys). Rich in sheltered winter pastures and polymetallic copper-tin ores, the Altai supported early pastoralist settlement during the Eneolithic (Afanasievo culture), horse-riding polities during the Scythian (Pazyryk), Hunno-Sarmatian (Bulan-Koba), and Turkic (Srostki) periods, and rapid mining and agricultural expansion under the Kolyvano-Voskresensk (Altai) Mining District in the 18th and 19th centuries [8][9][10][11].
2. South-West Siberian Steppe and Forest-Steppe (I-2, ~680k km^2; 52,0°N-57,5°N, 61,0°E-86,0°E): Spanning the Southern Trans-Urals and Tobol-Ishim interfluve (the Tura, Pyshma, Iset, Miass, Tobol, Ubagan, and Ishim rivers), the Middle Irtysh (Tara, Om, and Osha rivers), the Baraba forest-steppe (Tartas and Kargat rivers, Lakes Chany and Sartlan), and the Kulunda steppe [12][13][14]. This chernozem and meadow-steppe belt supported Eneolithic horse-hunters (Botai-Tersek), Middle Bronze Age fortified settlements (Sintashta-Petrovka), Late Bronze Age fortified towns (Chicha-1), Early Iron Age chiefdoms (Sargat culture), the Late Medieval Tyumen and Siberian Khanates, and the primary corridor of Russian peasant colonisation along the Siberian Tract and Trans-Siberian Railway [5][15][16][17][18][19].
3. North-West Siberian Taiga, Tundra, and Yugra (I-3, ~1,45M km^2; 57,5°N-73,0°N, 58,0°E-86,0°E): Encompassing the boreal forest, wetlands, and Arctic tundra of the Lower and Middle Ob (Surgut, Berezov, and Obdorsk reaches), the Lower Irtysh (Demyanka and Konda basins), the eastern Ural tributaries (Tavda, Pelym, Lozva, Northern Sosva, Lyapin, and Voikar), and the right-bank Arctic

rivers (Vakh, Trom-Yugan, Pim, Kazym, Polui, Nadym, Pur, Taz, and Yamal) [20][21]. Abundant seasonal runs of whitefish and sturgeon alongside migrating elk and reindeer herds sustained early fortified fishing settlements in the Neolithic (Amnya I and Kayukovo 2, c. 6000 cal BC), Iron Age metalworking centres (Barsova Gora, Ust-Polui, and the Kulai culture), and ten hereditary Ob-Ugrian (Khanty and Mansi) principalities (*knyazhestva*) documented in 16th- and 17th-century Russian records [2][3][22][23].

Methodology

Regional population estimates in this paper are built from three primary lines of evidence: excavated dwelling floor areas, skeletal mortality profiles from cemeteries, and historical tax and census records[1].

House Counts and Settlement Area

1. Boreal Taiga Pit-Houses (*Poluzemlyanki*, I-3): Excavations of Early Neolithic (Amnya I, Kayukovo 2), Bronze Age (Barsova Gora), and Iron Age (Beloyarskaya, Kulai, Karym) settlements by V. A. Borzunov [20][24][25], E. N. Dubovtseva [26][27], O. V. Kardash [23], and H. Piezonka [22][28] identify two main house types:

- *Single-Chamber Pit-Houses (15-45 m^2)*: Occupied by nuclear or small extended families of 5-8 individuals (~4,5-5,5 m^2 of heated winter floor space per person).
- *Multi-Hearth Communal Pit-Houses (60-160 m^2, e.g. Kayukovo 2, Barsov Gorodok)*: Occupied by kin groups of 12-25 individuals (2-4 hearth families).
- *Medieval Ob-Ugrian Fortified Towns (Gorodishcha / Gorodki, 12th-17th c. AD)*: Excavations in permafrost at Nadym Gorodok [29], Ust-Voikary [30], Berezov / Sugmut-Vash [31], and Emder [32] reveal dense rows of surface log cabins (16-36 m^2, housing 5-7 persons each) inside timber ramparts (700-3 500 m^2), surrounded by outer seasonal quarters (*posad*). Assuming an occupancy rate $c_{\text{occ}} = 0{,}70$ across multi-phase house depressions and a mean household size $H_{\text{size}} = 6{,}5$ persons, settlement population is calculated as:

$$P_{\text{site}} = N_{\text{dwellings}} \times c_{\text{occ}} \times H_{\text{size}}$$

2. Steppe and Forest-Steppe Longhouses (I-2):

- *Middle Bronze Age Sintashta-Petrovka Fortified Settlements (2100-1750 cal BC)*: Magnetometry surveys and excavations at Arkaim (60-67 houses), Kamennyi Ambar (46 houses), and Sintashta (35-42 houses) document radial or linear blocks of timber-and-turf row-houses measuring 110-220 m^2 each [16][33]. While early studies suggested 25-30 occupants per house, demographic and cemetery analyses by A. V. Epimakhov [34][35] and B. Hanks [36] show that roughly one-third of indoor floor area was used for winter stalling of young livestock, wells, and copper-smelting furnaces, indicating 10-15 persons per house and 450-950 permanent residents per fortified settlement.
- *Early Iron Age Sargat Settlements (500BC - 400AD)*: N. P. Matveeva's [17][37] study of Middle Tobol and Iset settlements (Rafailovskoye, Pavlinovo, Bayevo) combines multi-room house floor areas (70-180 m^2) with contemporary burial grounds (705 individuals across 43 cemeteries) to estimate an average household of 10,0-11,0 persons, with ordinary villages (*selishcha*) housing 250-360 residents and major fortified centres such as Rafailovskoye supporting 1 200-1 650 inhabitants.

Cemetery Mortality Estimates

In the mountain valleys of the Altai (I-1) and the open steppes of I-2, mobile pastoralist winter camps leave thin cultural layers, whereas burial mounds (*kurgans*) and flat cemeteries are well preserved. Following the standard Acsádi-Nemeskéri life-table formula as applied to Siberian skeletal series by N. P. Matveeva [37], A. V. Epimakhov [34], and N. N. Seregin [10]:

$$P_{\text{living}} = \frac{N_{\text{burials}} \times e_0}{T_{\text{duration}} \times f_{\text{preserved}}}$$

where life expectancy at birth $e_0 \approx 24{,}5$-$27{,}5$ years (derived from osteological series at Sopka-2, Tartas-1, and 43 Sargat cemeteries where adult life expectancy at age 20 is $e_{20} = 16{,}5$ years and sub-adult mortality d_{0-14} is 38-45%), T_{duration} is the radiocarbon phase duration in years, and $f_{\text{preserved}}$ is the estimated burial recovery fraction (0,60-0,80 in large communal flat cemeteries such as Tartas-1, compared with 0,08-0,15 for monumental stone kurgans of the Pazyryk and Sargat elites).

Tax Registers and Census Records

1. 17th-Century *Yasak* Tribute Books (*Yasachnye Knigi*): Early Russian fiscal registers preserved in the Russian State Archive of Ancient Acts (RGADA, Fund 214, *Sibirsky Prikaz*) record headcounts of adult able-bodied indigenous male tribute payers (*yasachnye lyudi*, aged 18-50). Following B. O. Dolgikh [2], S. V. Bakhrushin [3], E. V. Perevalova [38], and Ya. G. Solodkin [39], total indigenous population is estimated using:

   - *Ob-Ugrian (Khanty and Mansi) Principalities (I-3)*: A multiplier of $k = 4{,}1$-$4{,}5$ per registered *yasak* payer (combining Dolgikh's base ratio of 4,0 with a 5-12% allowance for unregistered dependents and remote forest or tundra camps).
   - *Siberian Tatars (Tobolsk, Tyumen, Turinsk, Tara, and Baraba Volosts, I-2)*: A multiplier of $k = 4{,}0$-$4{,}3$ applied to registered tribute-paying (*yasachnye*), military-service (*sluzhilye*), and Bukharan merchant (*bukhartsy*) men [2][18].
   - *Altai Teleuts, Telengits, and Northern Altaian Tributaries (I-1)*: A multiplier of $k = 4{,}0$ per tribute payer or armed horseman listed in Russian diplomatic reports (*stateynye spiski*) [2][40].

2. 18th- and 19th-Century Poll-Tax Revisions (*Revizii*) and the 1897 Imperial Census: Between 1719 and 1858, the Russian state conducted ten Poll-Tax Revisions (*revizskie skazki*) enumerating taxable male "souls" (*revizskie dushi*) among Russian state peasants (*gosudarstvennye krestyane*), Cabinet mining peasants (*pripisnye krestyane*), townspeople, and Siberian *yasak* payers (re-registered under Major Ya. Shcherbachev's 1763 *yasak* commission) [4][5][11]. Total population from revision male counts is obtained by doubling male soul totals (incorporating female family members recorded from the 3rd Revision of 1762-1764 onwards) and adding non-taxable categories (Cossacks of the Siberian Host, regular troops, clergy, and exiled settlers) [4]. Finally, the First All-Russian Imperial Census of 28 January 1897 (*Pervaya vseobshchaya perepis' naseleniya Rossiyskoy Imperii 1897 g.*), analysed at the *uezd* and *volost* level by S. K. Patkanov [6], Z. A. Tychinskikh [7], E. A. Bryukhanova [41], and Yu. V. Semenov [42], provides direct household-level enumerations across Tobolsk Governorate, Tomsk Governorate (including the Altai Mining District), and Akmolinsk Oblast.

Altai Region

Final Palaeolithic, Mesolithic, and Afanasievo Settlement (10000 - 2500BC)

During the Younger Dryas and Early Holocene warming (10000-6000BC), the sheltered lower valleys of the Anui, Katun, Biya, and Charysh rivers served as refugia for hunting and fishing groups. Stratified cave and open-air sites at Denisova Cave (Holocene layers 0-8), Kaminnaya Cave, Ust-Karakol-1, Kara-Bom, and Tytkesken-2 (along the Middle Katun, where nine cultural layers span the Mesolithic to the Eneolithic) document a gradual shift from Final Palaeolithic blade hunters to semi-sedentary Mesolithic and Kuznetsk-Altai Neolithic riverine fisher-hunters living in pit-houses (16-28 m^2) and using collective cemeteries (Ust-Isha, Solontsy-5, Itkul). Across the Altai region (I-1), population grew gradually from ~1,5k (1,2k-1,9k; 0,006 persons/km^2) at 10000BC to ~4,0k at 6000BC and ~7,5k by 4000BC.

Around 3100-3050 cal BC, the Mountain Altai experienced a major economic and demographic shift with the arrival of the Afanasievo culture (*Afanasievskaya kultura*), established by Western Steppe (Yamnaya-related) pastoralists who introduced domesticated cattle, sheep, goats, and horses [8][43]. A series of more than 150 AMS radiocarbon dates compiled by A. V. Poliakov, S. V. Svyatko, and N. F. Stepanova [8] shows that Mountain Altai Afanasievo sites cluster between 3100 and 2800 cal BC, slightly earlier than the Minusinsk Basin sites (2900-2500 cal BC). Over 60 kurgan cemeteries (Elo-1/2, Balyktyul, Kurta-2, Nizhnyaya Sooru, Bike-1/3, Kuyum, Aragol, Karasu) containing more than 450 stone-ringed enclosures and 15+ seasonal settlements (Elo-Bashichi, Kara-Tenesh, Malyi Dugan; [43]) indicate ~6,0k-8,0k pastoralists in the mountain valleys alongside ~6,5k-8,8k Eneolithic Bolshoy Mys inhabitants in the northern foothills, bringing the total Altai population to ~13,5k (10,8k-16,8k; 0,051 persons/km^2) at 3000BC.

Bronze Age Metallurgy and Farming Villages (2500 - 800BC)

During the Early and Middle Bronze Age (2200-1700 cal BC), settlement patterns differed between the high mountain valleys and the northern forest-steppe plains [44]:

- Karakol Culture (2200-1700 cal BC): Concentrated in the Ursul and Middle Katun valleys (Karakol, Besh-Ozek, Ozernoye) and known for stone-cist graves decorated with polychrome mineral paintings (~5,0k-7,5k mountain inhabitants).
- Elunino Culture (2200-1700 cal BC): Occupying the Upper Ob forest-steppe and the copper-tin mining foothills of the Rudny Altai [44][45]. At the settlement of Berezovaya Luka on the Alei River (excavated over >2 200 m^2), S. P. Grushin documented permanent timber-frame dwellings (17-20 m^2), bronze-casting workshops, and large herds of horses (36%), sheep and goats (37%), and cattle (27%). More than 80 Elunino settlements and cemeteries (Elunino-1, Teleutsky Vzvoz-1, Starodubtsevo) supported ~15,0k-21,0k agro-pastoralists, raising total I-1 population to ~23,0k (18,5k-28,5k) by 2000BC.

Between 1800 and 800 cal BC, Andronovo (Fedorovo) communities (Firsovo-XIV, Kytmanovo, Rubtsovsk) and Late Bronze Age Irmen (*Irmenskaya kultura*) villages (Blizhniye Elbany, Krasnaya Gorka, Kalistratiha, Plotinnaya) established dense chains of river-terrace settlements containing 8-15 large multi-hearth pit-houses (80-150 m^2 each, housing 100-200 residents per village). Regional population increased from ~34,0k at 1500BC to ~48,0k at 1000BC and ~55,0k (45,0k-66,0k; 0,208 persons/km^2) by 800BC.

Scythian, Hunno-Sarmatian, and Medieval Periods (800BC - 1700AD)

1. Scythian-Saka Period (550-200BC) - Pazyryk, Kara-Koba, and Bystryanka Cultures:

- Following the early Scythian Arzhan-Maiemir phase (850-550BC), nomadic pastoralism expanded across all elevation zones of the Altai. Between 1995 and 2014, joint surveys by Ghent University and Gorno-Altaisk State University led by J. Bourgeois and W. Gheyle [9] mapped ~1 250 km^2 of high mountain valleys (Chuya, Kuray, Yustyd, Sebÿstei, Kalanegir, Dzhazator) using satellite imagery and GPS ground checks, recording more than 4 800 surface monuments (3,8-6,5 monuments/km^2 in Yustyd and Sebÿstei), of which 45-55% (>2 200 kurgans) date to the Pazyryk and Kara-Koba phases.
- Across all habitable valleys of the Russian Altai (an estimated 18 000-25 000 Scythian kurgans built over 350 years, with $e_0 = 26$ years and elite kurgan representation $f_{\text{preserved}} \approx 0{,}08\text{-}0{,}12$), the Mountain Altai Pazyryk population numbered ~22,0k-30,0k pastoralists, while the northern foothill Bystryanka, Kamen, and Staroaleika farming and herding groups supported ~42,0k-52,0k inhabitants, giving a combined Altai population of ~68,0k (56,0k-82,0k; 0,257 persons/km^2) at 400BC.

2. Hunno-Sarmatian and Migration Period (200BC - 500AD) - Bulan-Koba Culture:

- Synthesised by N. N. Seregin and S. S. Matrenin [10] from more than 750 excavated graves across 45+ cemeteries (Bulan-Koba IV, Yaloman II, Ust-Edigan, Belyi Bom II, Choburak-I, Dyalyan, Stepushka), the Bulan-Koba culture (200BC - 450AD) and northern foothill Maima communities maintained a regional population of ~64,0k at 1AD and ~62,0k at 400AD, marked by frequent weapon burials (~75% of adult males buried with composite bows, iron armour plates, and horses).

3. Turkic Khaganates, Medieval Srostki Culture, and Teleut/Telengit Uluses (500 - 1700AD):

- As the core metalworking region of the First and Second Turkic Khaganates (Kudyrge, Katanda, and Kuray phases; ~70,0k by 800AD), the Altai reached its highest pre-modern population during the Srostki culture (*Srostkinskaya kultura*, 850-1050AD), linked to the eastern wing of the Kimak-Kipchak confederation [46]. Across more than 160 kurgan cemeteries (Srostki-1, Biyke, Filimonovo, Kamen-2, Shadrino) and 40+ foothill settlements combining horse herding with millet and barley cultivation, the regional population reached ~78,0k (64,0k-93,0k; 0,294 persons/km^2) at 1000AD.
- After 13th- and 14th-century Mongol-era warfare and pasture shifts reduced regional numbers to ~56,0k by 1400AD, 17th-century Russian tribute records from Kuznetsk (founded 1618) and Tomsk (founded 1604) analysed by B. O. Dolgikh [2] and O. A. Mitko [40] document ~14,0k-18,0k Teleuts ("White Kalmyks" of Prince Abak) and Northern Altaian/Shor tributaries (Kumandins, Tubalars, Chelkans, Abintsy) in the Upper Ob and Biya basins alongside ~28,0k-36,0k Southern Altai Telengits and Uriankhai (*dvoedantsy* paying dual tribute across 24 Dzungar *zaisanstvos*), giving ~54,0k (45,0k-64,0k) in 1580AD and ~55,0k (including early Russian settlers around Kuznetsk) by 1700AD.

Imperial Mining District and Peasant Colonisation (1700 - 1900AD)

The demographic profile of the Altai changed dramatically after the founding of Biysk Fortress (1709), the construction of Akinfiy Demidov's Kolyvan (1727) and Barnaul (1739-1744) copper and silver smelters, and Empress Elizaveta Petrovna's 1747 decree transferring the Kolyvano-Voskresensk Mining District (*Kolyvano-Voskresenskiy gorniy okrug*) to the Imperial Cabinet [4][5][11]:

1. 18th-Century Fortification Lines, Ascribed Peasants, and the 1756 Entry of Southern Altai Nomads:

- Protected by the Kolyvano-Kuznetsk Fortified Line along the Biya, Katun, and Charysh foothills, the Imperial Cabinet assigned tens of thousands of state peasants as ascribed mining peasants (*pripisnye*

krestyane) who supplied charcoal, timber, and grain to the Barnaul, Pavlovsk, and Zmeinogorsk silver works, supplemented by exiled Old Believers ("*Polyaki*") settled in the Uba and Bukhtarma valleys [5].

- Following the Qing destruction of the Dzungar Khanate in 1755-1756, twelve Southern Altai *zaisans* petitioned for Russian protection under Empress Elizabeth's decree of 2 May 1756 [11]. Regulated by Major Ya. Shcherbachev's 1763 *yasak* commission and later codified into seven Altaian *dyuchinas* and twenty-four Kalmyk and Teleut *volosts* under M. M. Speransky's 1822 Statute on Indigenous Administration (*Ustav ob upravlenii inorodtsev*), the indigenous Altaian, Teleut, and Kumandin population stabilised at ~42,0k-48,0k [6][11]. Combined with rapidly growing Russian villages, total Altai population rose from ~95,0k (82,0k-108,0k) in 1750AD (2nd Revision) to ~185,0k (165,0k-205,0k; ~140k Russians and ~45k indigenous Altaians) by 1800AD (5th Revision, 1795) and ~340,0k (310,0k-370,0k) by 1850AD (9th Revision) [4].

2. Post-1865 Cabinet Land Opening and the 1897 Imperial Census:

- Following the emancipation of Cabinet mining peasants in 1861 and the Imperial decree of 30 July 1865 opening the Altai Cabinet lands to peasant migration from European Russia [19], the fertile black-earth piedmont of the Upper Ob became the primary agricultural destination in Siberia.
- In the First All-Russian Imperial Census of 1897 [6][41][42], Biysk *uezd* recorded 337 007 inhabitants, Zmeinogorsk *uezd* 242 718, and the Upper Ob and foothill *volosts* of Barnaul *uezd* (584 100 across the entire *uezd*, with Barnaul city at 21 073 and Biysk city at 17 213) contributed ~240,0k-260,0k within the I-1 boundary, including 49 528 indigenous Turkic inhabitants enumerated by S. K. Patkanov (42 223 Altaians, Telengits, Kumandins, Tubalars, and Chelkans, plus 7 305 Teleuts) [6]. Including peasant arrivals between 1897 and 1900, the population of the Altai region (I-1) reached ~875,0k (820,0k-930,0k; 3,302 persons/km^2) in 1900AD.

South-West Siberian Steppe and Forest-Steppe

Mesolithic, Neolithic, and Botai Horse-Hunters (10000 - 2500BC)

Pollen cores and radiocarbon series from the Tobol-Ishim interfluve (Oshukovskoye peatland, Lake Kyrtyma, Lake Mergen) studied by N. E. Ryabogina and V. A. Zakh [12][13] and from the Baraba forest-steppe studied by V. I. Molodin [14][47] show that Boreal and Atlantic warming (8500-5000BC) established birch-pine parklands and shallow fish-rich lakes across the 680k km^2 of I-2. From sparse Mesolithic hunting and fishing camps (Chernoozerye VIa, Kamyshnoye-1, Vengerovo-5, Tartas-3; ~3,8k at 10000BC), population grew during the Early and Late Neolithic (Koshkino, Boborykino, Koksharovsko-Yuryinskaya, and Ust-Tartas cultures; Mergen 6 with 20+ pit-houses of 20-50 m^2 and Vengerovo-2A) from ~11,0k (8,8k-13,8k) at 6000BC to ~21,0k (16,8k-26,0k) at 4000BC.

Between 3700 and 3100 cal BC, the southern Ishim-Tobol forest-steppe margin witnessed the growth of the Botai-Tersek culture, whose economy relied heavily (90-99% of animal bones) on horse hunting, taming, and mare's milk (*koumiss*) processing [15][48]. Fluxgate magnetometry surveys led by A. K. Outram and V. F. Zaibert [48] mapped 158-250+ polygonal pit-houses (20-70 m^2) across 15 ha at the Botai type-site (~160 contemporaneous dwellings housing ~450-800 residents), 54 houses at Krasnyi Yar, and 44 houses at Vasilkovka IV, raising total I-2 population to ~35,0k (28,0k-43,5k; 0,051 persons/km^2) by 3000BC.

Bronze Age Fortified Towns and Forest-Steppe Villages (2500 - 800BC)

1. Early and Middle Bronze Age (2300-1750 cal BC) - Tashkovo, Odinovo-Krotovo, and Sintashta-Petrovka Settlements:

- In the Lower Tobol and Tura basin, circular Tashkovo-2 villages (11-13 timber houses of 35-48 m^2 arranged around a central open space, housing 70-100 residents) developed alongside the Odinovo and Krotovo cultures of the Middle Irtysh and Baraba (Sopka-2, Tartas-1 with >800 excavated graves, Vengerovo-2 with 60-110 m^2 houses containing indoor tin-bronze furnaces, and the Rostovka and Chernoozerye Seima-Turbino cemeteries; [14][47]).
- In the Southern Trans-Urals and Upper Tobol-Ui-Miass watershed, Sintashta-Petrovka (2100-1750 cal BC) pastoralists and copper smelters built more than 24 fortified circular and rectangular towns, including Arkaim (2,0 ha, 60-67 longhouses housing 600-1 000 residents), Kamennyi Ambar (1,8 ha, 46 longhouses of 150-220 m^2 housing 460-700 residents), Sintashta, Ustye, Stepnoye, Kuysak, Alabuga, and Petrovka-2 [16][33][34][35][36]. Combining the 24 fortified towns and surrounding hamlets (~15,0k-24,0k inhabitants) with Tashkovo and Odinovo-Krotovo communities across the Irtysh and Baraba plains gives a total I-2 population of ~62,0k (50,0k-76,0k; 0,091 persons/km^2) at 2000BC.

2. Late Bronze Age Expansion (1750-900BC) and the Fortified Town of Chicha-1 (900-700 cal BC):

- During the Andronovo (Alakul and Fedorovo) period (1750-1400BC) and the subsequent Cherkaskul, Pakhomovo, Suzgun, Barkhatovo, and Irmen cultures (1400-900BC), hundreds of unfortified river-terrace villages (5-20 large timber houses of 100-250 m^2 per village) spread across the Tobol, Ishim, Irtysh, and Baraba valleys, lifting I-2 population to ~86,0k at 1500BC and ~108,0k at 1000BC.
- Around 900-700 cal BC (Late Irmen transition), cooler, wetter conditions and contact with northern forest groups (Atlym and Suzgun) led to the construction of large fortified settlements in Baraba [49]. At Chicha-1 on Lake Malaya Chicha, Russian-German magnetometry and excavations directed by V. I. Molodin, H. Parzinger, and J. Schneeweiss [49] uncovered a 5,2 ha fortified town divided by concentric ditches and ramparts into an inner citadel (Zone I) and three outer residential quarters (Zones II-IV) containing 100-110+ contemporaneous pit and timber-frame houses (40-120 m^2 each), supporting ~800-1 250 inhabitants (mean ~1 050). Regional population in I-2 reached ~118,0k (96,0k-142,0k) at 800BC.

Early Iron Age Sargat Confederacy and Siberian Khanate (800BC - 1700AD)

1. The Sargat Culture (*Sargatskaya kultura*, 500BC - 400AD):

- Covering more than 400k km^2 across the Tobol, Iset, Pyshma, Ishim, Middle Irtysh, and Baraba forest-steppe, the Sargat culture formed the largest pre-modern population in Western Siberia, widely associated with Ugrian and Iranian mounted pastoralists and forest-steppe farmers [17][37][50].
- More than 500 known Sargat sites (~80 fortified *gorodishcha*, ~300 unfortified villages, and ~150 kurgan cemeteries) form a three-level settlement hierarchy reconstructed by N. P. Matveeva [17][37]:
- *Major Fortified Centres*: Rafailovskoye on the Iset (a 1,8 ha multi-rampart citadel plus a 12,0 ha outer settlement containing ~155 contemporaneous multi-room houses and supporting 1 200-1 650 residents; [50]), Pavlinovo, Aktau, Inbereny-IV, Sargatskoye, Bayevo, and Abramovo-4.
- *Ordinary Fortified Refuges and Villages*: 25-35 active households of 10,0-11,0 persons each, or 250-360 residents per settlement cluster.

- *Seasonal Herding Camps*: 5-10 households (50-100 persons).
- Combining mortality data from 43 Sargat cemeteries (705 individuals; adult life expectancy $e_{20} = 16{,}5$ years, mean adult age at death 36,5 years; [37]) with settlement counts across the Tobol-Irtysh river valleys yields an estimated I-2 population of ~136,0k (112,0k-162,0k; 0,200 persons/km^2) at 400BC and ~138,0k (114,0k-165,0k) at 1AD, declining to ~112,0k by 400AD during the Migration Period.

2. Medieval Forest-Steppe Polities and the Siberian Khanate (600 - 1700AD):

- Between 600 and 1240AD, Bakalskaya (Tobol-Iset), Yudino (Tura-Tavda), and Ust-Ishim (Middle Irtysh) communities interacted with the Kimak-Kipchak Khaganate (whose main seat on the Middle Irtysh is mentioned by medieval Islamic geographers) and Cuman-Kipchak tribes, sustaining ~118,0k inhabitants at 800AD, ~126,0k at 1000AD, and ~120,0k at 1200AD.
- Under the Ulus of Jochi (the Shibanid appanage and the local Taibugid rulers), 14th-century political fragmentation and plague reduced the I-2 population to ~92,0k by 1400AD. In the 15th and 16th centuries, the region reorganised under the Tyumen Khanate (centred at Chimgi-Tura, modern Tyumen) and the Siberian Khanate (c. 1495-1598AD) ruled by the Taibugids and the Shibanid Khan Kuchum (r. 1563-1598) [18][51][52].
- Excavations of the Khanate's 65+ fortified settlements (*gorodishcha*) synthesised by A. P. Zykov, S. F. Tataurov, and D. N. Maslyuzhenko [18][52] show that the capital Isker (Qashliq / Gorod Sibir) occupied a 2,0-2,6 ha triple-rampart promontory citadel with an outer settlement (~95 structures) housing 450-850 permanent residents (rising to 2 000-3 500 during military musters), flanked by regional administrative forts at Chimgi-Tura (500-1 000 residents), Suzgun, Chuvashsky Mys, Karachin Gorodok, Kullara, Kyzyl-Tura, and Ton-Tura (Voznesenskoye on the Om River in Baraba, 300-600 residents).
- Based on the earliest Russian *yasak* and service-Tatar registers (1590s-1630s) compiled by B. O. Dolgikh [2], the indigenous population of the Siberian Khanate's core territory in c. 1580AD numbered ~34,3k-44,3k (mean ~39,3k: ~9,5k-11,0k Tobolsk and Vagay Tatars, ~5,8k-6,8k Tyumen and Tura Tatars and Southern Mansi, ~3,2k-4,0k Tara and Middle Irtysh Tatars, ~3,8k-4,5k Baraba Tatars, and ~12,0k-18,0k Ishim-Kulunda nomadic subjects), within a total I-2 population of ~88,0k (72,0k-105,0k) including southern Kazakh and Kalmyk steppe camps.
- Following the founding of Tyumen (1586), Tobolsk (1587), Tara (1594), Turinsk (1600), Yalutorovsk (1659), and Shadrinsk (1662), Russian peasant (*pashennye krestyane*) and Cossack settlement across the Tura, Pyshma, Iset, and Tobol valleys added ~145,0k Russian inhabitants by the 1701 Tobolsk census alongside ~43,0k Siberian Tatars, Bukharans, and southern pastoralists, bringing I-2 population to ~134,0k in 1650AD and ~188,0k (172,0k-204,0k; 0,276 persons/km^2) by 1700AD.

Fortified Lines, Poll-Tax Revisions, and the Trans-Siberian Railway (1700 - 1900AD)

Throughout the 18th and 19th centuries, the South-West Siberian forest-steppe served as the main gateway for Russian agricultural settlement in Asia [4][5][19]:

1. The 18th-Century Fortified Lines and Poll-Tax Revisions (1700 - 1850AD):

- Following I. D. Bukhgolts's founding of Omsk Fortress (1716) and the construction of the Irtysh and Novo-Ishimskaya fortification lines (Presnogorkovskaya - Petropavlovskaya - Omskaya, 1730s-1752), Russian military and peasant settlement pushed southward from the Tobol-Tura river valleys onto the open chernozem plains of Kurgan, Ishim, Omsk, and the Baraba Siberian Tract (*Sibirskiy trakt*) [5].

- According to V. M. Kabuzan's [4] and A. D. Kolesnikov's [5] analyses of the 1st through 10th Poll-Tax Revisions, the population of I-2 nearly doubled every half-century: rising from ~188,0k in 1700AD to ~340,0k (305,0k-375,0k) in 1750AD (2nd Revision, 1744-1747), ~640,0k (585,0k-695,0k) in 1800AD (5th Revision, 1795), and ~1 180,0k (1,09M-1,27M; 1,735 persons/km^2) in 1850AD (9th Revision). Alongside Russian state peasants and Cossacks of the Siberian Line Host, the indigenous and resettled Turkic population (Tobolsk, Tyumen, Tara, and Baraba Tatars, Central Asian *Bukhartsy*, and Volga-Ural Tatar settlers) expanded from ~43,0k in 1700AD to ~52,0k in 1795 and ~64,0k by the 10th Revision of 1858 [7][53].

2. Post-Emancipation Peasant Resettlement, the Trans-Siberian Railway, and the 1897 Census (1850 - 1900AD):

- After the 1861 peasant emancipation, the 1889 Resettlement Law, and the construction of the West Siberian section of the Trans-Siberian Railway (Chelyabinsk - Kurgan - Petropavlovsk - Omsk - Kainsk - Ob, 1892-1896), state-assisted peasant migration into the Tobol, Ishim, and Baraba steppes accelerated sharply [19][54].
- In the 1897 Imperial Census [6][7][41][42], the eight southern forest-steppe *uezds* of Tobolsk Governorate recorded 1 403 837 inhabitants (Ishim *uezd* 269 031, Kurgan 260 095, Tyukalinsk 208 718, Yalutorovsk 188 550, Tara 159 655, Tobolsk 127 860, Tyumen 121 357, and Turinsk 68 571, including 56 957 Tatars and Bukharans in Tobolsk Governorate [7][53]), while Kainsk *uezd* (187 147) and the northern Baraba-Kulunda *volosts* of Tomsk Governorate added ~512,0k, and the northern forest-steppe districts of Akmolinsk Oblast (Petropavlovsk *uezd* 227 539, Omsk *uezd* 100 539 with Omsk city at 37 376, and adjoining Ishim-Irtysh *volosts*) accounted for ~580,0k-620,0k residents. Including railway-corridor arrivals between 1897 and 1900, the total population of I-2 reached ~2 650,0k (2,50M-2,80M; 3,897 persons/km^2) in 1900AD.

North-West Siberian Taiga, Tundra, and Yugra

Early Neolithic Fortified Settlements: Amnya I and Kayukovo 2 (10000 - 4000BC)

As post-glacial forests established across the Lower Ob and Konda-Sosva basins, Mesolithic hunter-fishers occupied elevated pine-covered river terraces (Lugovskoye, Sumpanya-IV/VI, Korstovo, Komudvany; ~2,0k across 1,45M km^2 at 10000BC, rising to ~3,2k at 8000BC). Around 6100-5500 cal BC, Early Neolithic communities in the West Siberian taiga began building fortified promontory settlements (260-1 900 m^2) enclosed by timber palisades, earthen banks, and ditches, as documented by V. A. Borzunov [20][25], E. N. Dubovtseva [26][27], O. V. Kardash [23], and H. Piezonka [22][28]:

- Amnya I and Amnya II (Kazym River Basin, 63,5°N): AMS radiocarbon dating published by H. Piezonka, N. M. Chairkina, E. N. Dubovtseva, and L. L. Kosinskaya [22][26] dates the inner defensive ditch, rampart, palisade, and House 1 to 6100-5900 cal BC, making Amnya I the oldest dated fortified settlement in northern Eurasia. The site consists of 10 semi-subterranean pit-houses (15-40 m^2, 0,6-1,8 m deep) behind three defensive ditch-and-bank lines (Amnya I), together with 10 unfortified outer pit-houses (Amnya II) 50 m to the east, housing ~40-75 residents (mean ~60) who controlled seasonal fish-weir (*zapor*) and elk-crossing sites.
- Kayukovo 2 (Bolshoy Salym - Bolshoy Yugan Watershed): Excavated by O. V. Kardash, N. M. Chairkina, E. N. Dubovtseva, and H. Piezonka [23] and AMS-dated to 6000-5500 cal BC. This circular fortified settlement (35 x 35 m, ~1 150 m^2 inner enclosure within a 0,25 ha site) was surrounded by a timber wall and ring ditch and contained 5 outer pit-houses (16-32 m^2) linked by sunken passages to a central communal building (House 6), housing ~30-55 residents (mean ~42).

- Together with Imnegan, Sumpanya IV/VI, and Et-to I/II (on the Nadym-Pur watershed at 63,2°N), more than 300 Neolithic pit-house sites across I-3 supported ~5,8k (4,6k-7,2k) inhabitants at 6000BC and ~8,8k (7,0k-11,0k) by 4000BC.

Eneolithic, Bronze Age, and Iron Age Centres (4000BC - 600AD)

1. Eneolithic and Bronze Age (4000-800BC) - Sartyn'ya, Seima-Turbino, Atlym, and Barsova Gora:

- Eneolithic comb-pit pottery groups (Sartyn'ya, Shapkul, Chuovsky) living in multi-hearth winter pit-houses (40-90 m^2) supported ~10,8k inhabitants at 3000BC. During the Seima-Turbino period (2150-1900 cal BC; Satyga XVI sanctuary) and the Late Bronze Age Atlym culture (1200-800BC), large semi-subterranean houses (50-120 m^2) spread north to the Arctic Circle, raising I-3 population from ~12,8k at 2000BC to ~15,5k at 1000BC.
- Along an 8 km bluff on the right bank of the Middle Ob near Surgut, the Barsova Gora complex studied by Yu. P. Chemyakin and A. P. Zykov [55][56] preserves 66 fortified settlements (*gorodishcha*), ~300 unfortified villages (*selishcha*), 8 ritual sites, and ~3 000 house depressions spanning 7 000 years from the Neolithic to the 17th century AD.

2. Early Iron Age and Migration Period (800BC - 600AD) - Beloyarskaya, Kulai, Ust-Polui, and Karym Cultures:

- Between 500BC and 450AD, the Kulai culture (*Kulaiskaya kultura*) spread across the Middle and Lower Ob (Sarovskoye, Barsov Gorodok I/32; [56]).
- At Ust-Polui (260BC - 140AD, on the Polui River cape in modern Salekhard at 66,5°N), excavations by N. V. Fedorova, A. V. Gusev, R. J. Losey, and E. V. Vodyasov [57][58][59][60] uncovered a ditch-and-palisade sanctuary and metalworking site (~4 200 m^2) containing the earliest evidence of iron smelting and forging in the Arctic [57][58], carved bone harness toggles for reindeer sleds [60], and the remains of more than 115 domesticated sledging and sacrificial dogs [59]. During the subsequent Karym phase (350-550AD) studied by V. A. Borzunov and Yu. P. Chemyakin [24], fortified taiga settlements multiplied along the Surgut and Lower Ob rivers, with regional population growing from ~17,2k at 400BC to ~18,0k at 1AD and ~18,6k at 400AD.

Medieval Yugra and the Ten Ob-Ugrian Principalities (600 - 1700AD)

Between the 8th and 16th centuries AD (Lower Ob culture: Kintusovskiy, Oronturskiy, Emder, and Saygatinskiy stages; [32][55]), trade in northern furs with Volga Bulgaria, Great Novgorod (recorded in Gyuryata Rogovich's 1096AD account and the Novgorodian expeditions of 1187 and 1193), and the Golden Horde supported the rise of ten hereditary Ob-Ugrian (Mansi/*Vogul* and Khanty/*Ostyak*) principalities (*knyazhestva*) [2][3][38][39][61]. Analysis of 25 871 fish bones from 17 Late Holocene sites (Nadym Gorodok, Ust-Voikary, Sherkaly-1, Bukhta Nakhodka, Berezov) by T. V. Lobanova and D. O. Gimranov [21] confirms that large-scale seasonal catching and drying (*yukola*) of pike, ide, sturgeon, nelma, and muksun supplied the food stores needed for permanent fortified timber towns (*gorodki*):

- Sherkaly-1 (*Shorkarskiy Gorodok*, Koda Principality): Three fortified hill enclosures (~1,2 ha) with 40+ surface log cabins fitted with stone ovens (*pechi-kamenki*) and smithies (~200-350 residents; [55]).
- Emder (Endyrskoye-1): Nine successive building layers (11th-16th c. AD, ~2 400 m^2 citadel and outer settlement, ~120-220 residents; [32]).
- Ust-Voikary (*Voikarsky Gorodok*) and Berezov (*Sugmut-Vash*): Permafrost-preserved log towns containing ~30 residential and storage buildings (~100-165 residents; [30][31]).

- Nadym Gorodok (1200-1730AD, a 700 m^2 timber fort of the *Bolshaya Karacheya* clan with 6 log apartment blocks housing 40-75 winter residents; [29]) and Bukhta Nakhodka (1213-1332AD tree-ring dated Arctic *Sikhirtya* coastal fort on the Yamal Peninsula, 25-45 residents).

No.	Principality	Ethnic Group	Ruling Dynasty	Main Fortified Towns (N)	Adult Male Yasak Payers	Armed Warriors	Estimated Pop. (k = 4,1-4,5)
1	Pelym (Pelymskoe)	Western Mansi (Voguls)	Asyka, Yumshan, Ablegirim	Pelym, Ust-Lozva, Vagil (7)	365-410	400-500	1 800-2 200
2	Tabary & Koshuki	Southern Plough Mansi	Prince Bochay (Tabary)	Tabary, Koshuki, Chubarov (4)	177-215	150-200	750-950
3	Kondia (Kondin-skoe)	Konda Mansi & Khanty	Prince Agai / Kondinsky	Kartauzh, Levushi, Satyga (7)	235-340	250-350	1 100-1 500
4	Kod (Koda & Emder)	Middle-Lower Ob Khanty	House of Alachev (Moldan, Igichey)	Koda, Shorkar, Vezhakar, Emder (14)	620-730	350-450	3 000-4 500
5	Belogorye (Ob-Irtysh)	Confluence Khanty	Prince Samar (d. 1582)	Samarovo, Belogorye, Tsingaly (7)	340-410	250-320	1 500-1 850
6	Kazym (Kazymskoe)	Northern Khanty & Nenets	Kazym / Moldanov Princes	Yuilsk, Polnovat, Amnya (4)	185-220	120-160	800-980
7	Sosva (Sugmut-Vash)	Northern Mansi & Khanty	Sosva Princes (Berezov)	Sugmut-Vash, Iskar, Sartyn'ya (6)	320-370	200-260	1 350-1 600
8	Lyapin & Kunovat	Sygva Mansi & Khanty	Luguyev Dynasty (Luguy, Shatrov)	Lombovozh, Lopmus, Ust-Voikary (6)	430-490	250-320	1 800-2 150
9	Obdorsk (Pulnovat-Vash)	Arctic Khanty & Nenets	House of Taishin (Vasily, Mamruk)	Pulnovat-Vash, Sobsky, Muzhi (5)	380-450 (760 w/ Nenets)	300-400	1 775 (3 200 w/ Nenets)
10	Bardakovo & Surgut Ob	Eastern (Surgut) Khanty	Prince Bardak & Prince Tonya	Bardakov, Monkys-Uriy, Pim (10)	390 Core (850 All Surgut)	250-350	1 650 (3 550 All Surgut)
-	Unattached Tura/ Nadym/Taz	Tura Mansi & Taz Nenets	Bolshaya Karacheya & Tura Murzy	Nadym Gorodok, Tura Yurts (5)	550-680	200-300	2 300-2 900

(Continued from previous page)

No.	Principality	Ethnic Group	Ruling Dynasty	Main Fortified Towns (N)	Adult Male Yasak Payers	Armed Warriors	Estimated Pop. (k = 4,1-4,5)
Total	All Yugra & NW Taiga (I-3)	Khanty, Mansi & Nenets	10 Hereditary Princely Houses	65-75 Active Fortified Gorodki	4 680-5 410	2 720-3 610	19 350-23 880 (Mean 21,5k)

Table 1. Political, Military, and Demographic Overview of the Ten Yugra Principalities (c. 1580-1630AD), Reconstructed from 17th-Century Russian Yasak Registers (Dolgikh 1960; Bakhrushin 1935; Perevalova 2004; Solodkin 2015).

As shown in Table 1 and Figure 2, summing across all ten principalities and neighbouring Tura Mansi and Nadym/Taz Nenets districts gives 16 050-19 800 Ob-Ugrians (~9,8k Khanty and ~6,4k Mansi) plus ~2 800-3 800 North-West Siberian Tundra and Forest Nenets (*Samoyeds*) in 1580-1625AD, matching B. O. Dolgikh's [2] estimate of ~21,5k (19,35k-23,88k) indigenous inhabitants across I-3 (rising to ~26,0k by 1700AD when ~4,5k Russian Cossacks and townsmen in Berezov, Surgut, Pelym, Obdorsk, and Mangazeya are included).

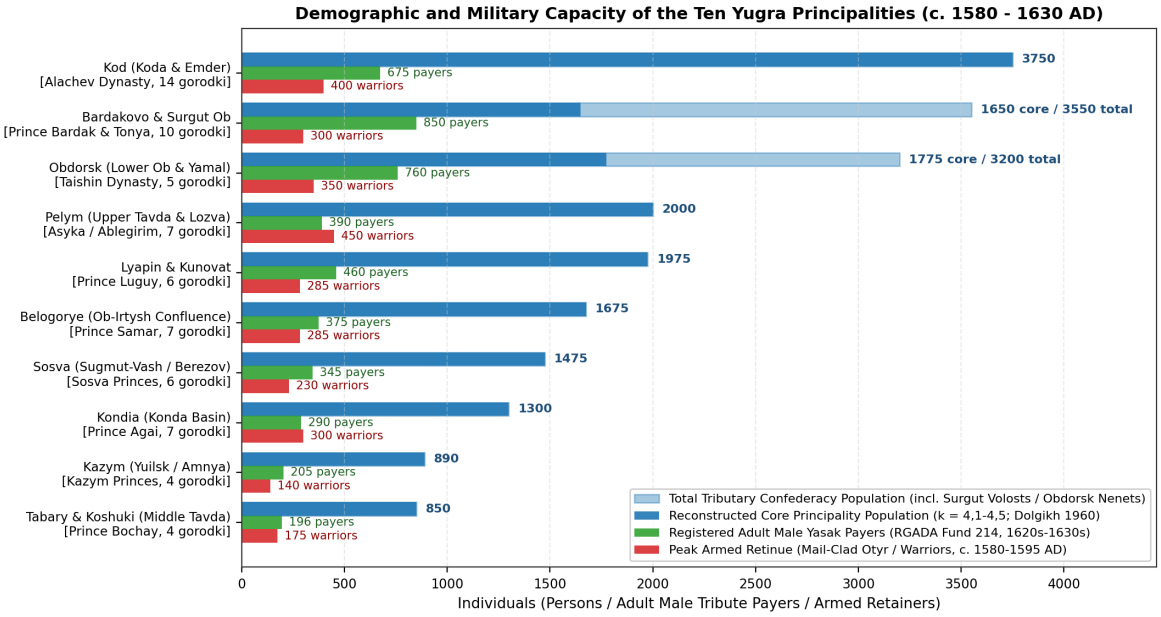


Figure 2. Population, Registered Adult Male Yasak Payers (RGADA Fund 214), and Armed Retinues of the Ten Yugra Principalities (c. 1580-1630AD).

Berezov and Surgut Districts in the 18th and 19th Centuries (1700 - 1900AD)

During the 18th and 19th centuries, the northern forest and tundra basins of the Lower and Middle Ob were administered primarily through Berezov and Surgut *okrugs* (*uezds*) of Tobolsk Governorate, alongside the northern *volosts* of Turinsk (Pelym) and Verkhoturye [4][6][62]:

1. Orthodox Christianisation, Abandonment of Fortified *Gorodki*, and Poll-Tax Revisions (1700 -

1850AD):

- Following Peter I's decrees of 1706-1714 and the missionary expeditions of Metropolitan Filofey (Leshchinsky) between 1712 and 1727 [62], most Khanty and Mansi river communities were formally baptised, and the old fortified princely *gorodki* (such as Nadym Gorodok, abandoned c. 1730; [29]) gave way to open winter log-cabin villages (*zimovya*) and seasonal birch-bark fishing camps (*yurts*). In Obdorsk, however, the hereditary Taishin princes retained formal administrative authority over Lower Ob Khanty and Yamal Nenets *yasak* collection until 1886 [38][61].
- Across the 2nd (1744-1747), 5th (1795), and 9th (1850) Revisions [4][62], slow growth among northern Khanty and Tundra Nenets reindeer herders offset gradual linguistic assimilation of southern Mansi and Konda villages into surrounding Russian peasant parishes, lifting total I-3 population from ~26,0k in 1700AD to ~28,0k in 1750AD, ~30,0k in 1800AD, and ~32,0k in 1850AD.

2. The 1897 Imperial Census Across Berezov, Surgut, and Pelym (1900AD):

- In the First All-Russian Imperial Census of 1897, analysed in detail at the *volost* and clan level by S. K. Patkanov [6], the complete *okrug* tally for Berezov *Okrug* (including nomadic Yamal and Kazym tundra *volosts* beyond the 11 406 stationary residents) recorded 21 411 inhabitants (72,9% indigenous Khanty, Mansi, and Nenets, alongside Russian townsmen in Berezov [1 070] and Obdorsk and migrant Izhma Komi-Zyrian reindeer herders), while Surgut *Okrug* recorded 7 747 inhabitants (72,1% indigenous Khanty and Forest Nenets, with 1 120 residents in Surgut town).
- Including the Ob-Ugrian and Selkup *volosts* of northern Tobolsk (Samarovo), Turinsk (Pelym and Konda), and the Upper Taz [6][63], the 1897 Census enumerated 19 663 Khanty (*Ostyaks*), 7 651 Mansi (*Voguls*), and ~4 450 West Siberian Tundra and Forest Nenets (*Samoyeds*) (~31 764 indigenous inhabitants across I-3), together with ~3 200 Russians and Komi-Zyrians, giving a total I-3 population of ~35,0k (32,0k-38,0k; 0,024 persons/km^2) in 1900AD.

Population Estimates

Combining the excavated settlement data (Figure 3 and Table 3), cemetery mortality profiles, 17th-century *yasak* registers, 18th- and 19th-century Poll-Tax Revisions, and the 1897 Imperial Census across I-1, I-2, and I-3 produces the regional population and density estimates from 10000BC to 1900AD shown in Figure 4 and Table 2.

Date	I-1 Altai Pop. (265k km²)	I-1 Dens.	I-2 Steppe Pop. (680k km²)	I-2 Dens.	I-3 Taiga/ Yugra Pop. (1,45M km²)	I-3 Dens.	Western Siberia Total (2,40M km²)	Main Cultural or Historical Period
10000BC	1 500 (1,2k-1,9k)	0,006	3 800 (3,0k-4,8k)	0,006	2 000 (1,5k-2,6k)	0,001	7 300 (5,7k-9,3k)	Final Palaeolithic / Early Mesolithic (Denisova, Chernooz-erye)

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Date	I-1 Altai Pop. (265k km²)	I-1 Dens.	I-2 Steppe Pop. (680k km²)	I-2 Dens.	I-3 Taiga/ Yugra Pop. (1,45M km²)	I-3 Dens.	Western Siberia Total (2,40M km²)	Main Cultural or Historical Period
8000BC	2 400 (1,9k-3,0k)	0,009	6 200 (4,9k-7,8k)	0,009	3 200 (2,5k-4,1k)	0,002	11 800 (9,3k-14,9k)	Boreal Mesolithic Hunter-Fishers (Kaminnaya, Sumpanya, Vengerovo-5)
6000BC	4 000 (3,2k-5,0k)	0,015	11 000 (8,8k-13,8k)	0,016	5 800 (4,6k-7,2k)	0,004	20 800 (16,6k-26,0k)	Early Neolithic Fortified Sites (Amnya I, Kayukovo 2, Koshkino)
4000BC	7 500 (6,0k-9,4k)	0,028	21 000 (16,8k-26,0k)	0,031	8 800 (7,0k-11,0k)	0,006	37 300 (29,8k-46,4k)	Late Neolithic / Early Eneolithic (Boborykino, Ust-Tartas)
3000BC	13 500 (10,8k-16,8k)	0,051	35 000 (28,0k-43,5k)	0,051	10 800 (8,6k-13,5k)	0,007	59 300 (47,4k-73,8k)	Afanasievo Pastoralists (I-1) & Botai Horse Villages (I-2)
2000BC	23 000 (18,5k-28,5k)	0,087	62 000 (50,0k-76,0k)	0,091	12 800 (10,2k-15,8k)	0,009	97 800 (78,7k-120,3k)	Sintashta-Arkaim Forts, Elunino, Krotovo & Seima-Turbino
1500BC	34 000 (27,5k-41,5k)	0,128	86 000 (70,0k-105,0k)	0,126	14 200 (11,5k-17,5k)	0,010	134 200 (109,0k-164,0k)	Andronovo (Alakul & Fedorovo) Farming & Herding Expansion

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Date	I-1 Altai Pop. (265k km²)	I-1 Dens.	I-2 Steppe Pop. (680k km²)	I-2 Dens.	I-3 Taiga/ Yugra Pop. (1,45M km²)	I-3 Dens.	Western Siberia Total (2,40M km²)	Main Cultural or Historical Period
1000BC	48 000 (39,0k-58,0k)	0,181	108 000 (88,0k-130,0k)	0,159	15 500 (12,6k-19,0k)	0,011	171 500 (139,6k-207,0k)	Late Bronze Irmen, Suzgun, Barkhatovo, Atlym & Barsova Gora
800BC	55 000 (45,0k-66,0k)	0,208	118 000 (96,0k-142,0k)	0,174	16 200 (13,2k-19,8k)	0,011	189 200 (154,2k-227,8k)	Chicha-1 Fortified Town (108 Houses) & Early Scythian Period
400BC	68 000 (56,0k-82,0k)	0,257	136 000 (112,0k-162,0k)	0,200	17 200 (14,0k-21,0k)	0,012	221 200 (182,0k-265,0k)	Pazyryk Culture (I-1), Sargat Confederacy (I-2), Kulai (I-3)
1AD	64 000 (52,0k-77,0k)	0,242	138 000 (114,0k-165,0k)	0,203	18 000 (14,8k-21,8k)	0,012	220 000 (180,8k-263,8k)	Bulan-Koba (I-1), Late Sargat (Rafailovskoye), Ust-Polui (I-3)
400AD	62 000 (50,0k-75,0k)	0,234	112 000 (92,0k-134,0k)	0,165	18 600 (15,2k-22,5k)	0,013	192 600 (157,2k-231,5k)	Migration Period (Choburak-I / Dyalyan, Potchevash, Karym)
800AD	70 000 (58,0k-84,0k)	0,264	118 000 (96,0k-142,0k)	0,174	19 600 (16,0k-23,5k)	0,014	207 600 (170,0k-249,5k)	First & Second Turkic Khaganates, Early Kimak & Kintusovskiy

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Date	I-1 Altai Pop. (265k km²)	I-1 Dens.	I-2 Steppe Pop. (680k km²)	I-2 Dens.	I-3 Taiga/ Yugra Pop. (1,45M km²)	I-3 Dens.	Western Siberia Total (2,40M km²)	Main Cultural or Historical Period
1000AD	78 000 (64,0k-93,0k)	0,294	126 000 (104,0k-150,0k)	0,185	20 800 (17,0k-25,0k)	0,014	224 800 (185,0k-268,0k)	Srostki Culture & Kimak-Kipchak Peak; Early Yugra Gorodki
1200AD	72 000 (59,0k-86,0k)	0,272	120 000 (98,0k-144,0k)	0,176	21 500 (17,8k-25,6k)	0,015	213 500 (174,8k-255,6k)	Cuman-Kipchak, Bakalskaya, Ust-Ishim, Sherkaly-1 & Emder
1400AD	56 000 (46,0k-67,0k)	0,211	92 000 (75,0k-110,0k)	0,135	21 200 (17,5k-25,2k)	0,015	169 200 (138,5k-202,2k)	Ulus of Jochi/Shiban Steppe Contraction; Bukhta Nakhodka
1500AD	55 000 (45,0k-66,0k)	0,208	90 000 (74,0k-108,0k)	0,132	21 600 (18,0k-25,5k)	0,015	166 600 (137,0k-199,5k)	Tyumen & Siberian Khanates; Four Oirats; 10 Yugra Polities
1580AD	54 000 (45,0k-64,0k)	0,204	88 000 (72,0k-105,0k)	0,129	21 500 (19,3k-23,9k)	0,015	163 500 (136,3k-192,9k)	Eve of Yermak (Isker, 10 Yugra Princi-palities, Teleut Uluses)
1650AD	53 000 (44,0k-62,0k)	0,200	134 000 (115,0k-154,0k)	0,197	23 500 (20,5k-26,8k)	0,016	210 500 (179,5k-242,8k)	Russian Agricultural Settlement (Tobolsk, Tyumen, Tara, Surgut)
1700AD	55 000 (48,0k-62,0k)	0,208	188 000 (172,0k-204,0k)	0,276	26 000 (22,5k-29,5k)	0,018	269 000 (242,5k-295,5k)	1701 Tobolsk Census (151k Russians + 118k Indigenous)

(Continued from previous page)

Date	I-1 Altai Pop. (265k km²)	I-1 Dens.	I-2 Steppe Pop. (680k km²)	I-2 Dens.	I-3 Taiga/ Yugra Pop. (1,45M km²)	I-3 Dens.	Western Siberia Total (2,40M km²)	Main Cultural or Historical Period
1750AD	95 000 (82,0k-108,0k)	0,358	340 000 (305,0k-375,0k)	0,500	28 000 (24,5k-31,5k)	0,019	463 000 (411,5k-514,5k)	2nd Revision (1744-1747); Irtysh/Ishim Lines & Demidov Works
1800AD	185 000 (165,0k-205,0k)	0,698	640 000 (585,0k-695,0k)	0,941	30 000 (26,5k-33,5k)	0,021	855 000 (776,5k-933,5k)	5th Revision (1795); Kolyvano-Voskresensk District & Siberian Tract
1850AD	340 000 (310,0k-370,0k)	1,283	1 180 000 (1,09M-1,27M)	1,735	32 000 (28,5k-35,5k)	0,022	1 552 000 (1,43M-1,68M)	9th Revision (1850); State Peasant Resettle-ment into Tobolsk/ Tomsk
1900AD	875 000 (820,0k-930,0k)	3,302	2 650 000 (2,50M-2,80M)	3,897	35 000 (32,0k-38,0k)	0,024	3 560 000 (3,35M-3,77M)	1897 First All-Russian Census & Trans-Siberian Railway Boom

Table 2. Estimated Population and Population Density of Western Siberia (Ob-Irtysh Basin: I-1 Altai, I-2 South-West Siberian Steppe and Forest-Steppe, I-3 North-West Siberian Taiga, Tundra, and Yugra, 10000BC - 1900AD). Densities in persons/km^2.

Limitations

Three main sources of uncertainty affect the population ranges reported in Table 2:

1. Pit-House Contemporaneity and Seasonal Mobility in the Northern Taiga (I-3): Because boreal hunter-fisher groups periodically moved their winter pit-house villages (*poluzemlyanki*) and summer birch-bark fishing camps (*yurts*) along shifting river channels, surface counts of house depressions (~3 000 at Barsova Gora) accumulate over several centuries [20][28]. Applying a 70% occupancy factor ($c_{\text{occ}} = 0{,}70$) within single-phase fortified enclosures avoids overstating winter settlement populations.

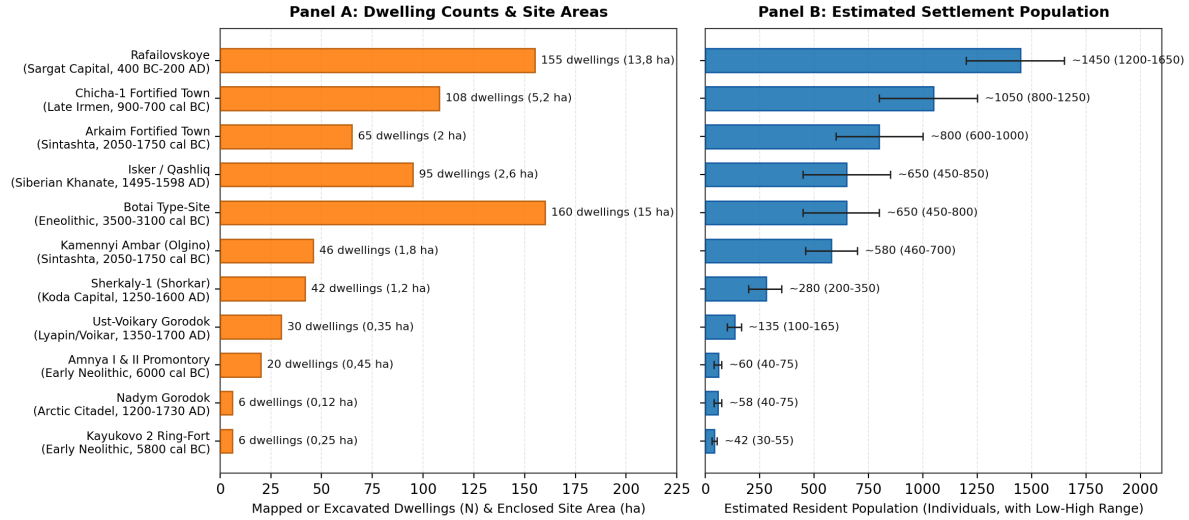


Figure 3. Mapped or Excavated Dwelling Counts, Enclosed Site Areas (ha), and Estimated Resident Populations Across Key Prehistoric and Medieval Settlements of Western Siberia (6000 cal BC - 1598AD).

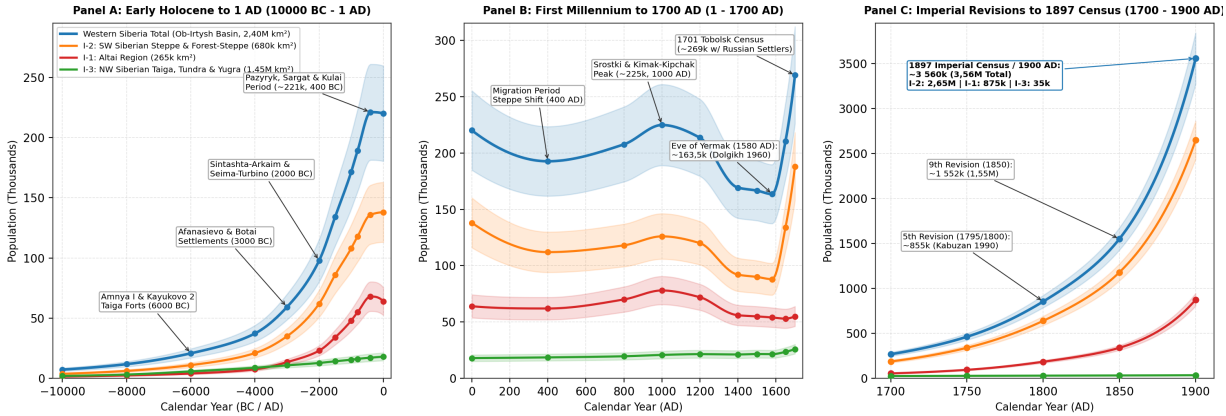


Figure 4. Estimated Population of Western Siberia (10000BC - 1900AD) Across the Altai Region (I-1), South-West Siberian Steppe and Forest-Steppe (I-2), and North-West Siberian Taiga, Tundra, and Yugra (I-3), with Uncertainty Bands.

2. Under-Representation of Children and Commoners in Kurgan Cemeteries (I-1 and I-2): Skeletal studies of 43 Sargat burial grounds (705 individuals; [37]) and Mountain Altai Pazyryk and Bulan-Koba cemeteries [9][10] show that infant and child burials (d_{0-14}) are under-represented in monumental burial mounds compared with flat communal cemeteries (Sopka-2, Tartas-1; [47]), requiring life-table adjustments ($e_0 \approx$ 25-27 years and $f_{\text{preserved}} \approx 0{,}08$-$0{,}15$ for elite kurgan fields).
3. Freshwater Reservoir Effects in Radiocarbon Dates and Under-Registration in Early Revisions: Fish-rich diets across the Tobol-Ishim lakes, Baraba, and the Lower Ob can make radiocarbon dates on human bone collagen and pottery food crusts appear 200-500 years too old [8][13][22]; all chronological benchmarks in this review therefore rely on terrestrial wood, charcoal, or ungulate bone dates. In the early Imperial period, the 1st and 2nd Poll-Tax Revisions (1719-1747) under-counted fugitive peasants, Old Believers in the Altai foothills, and remote tundra camps by an estimated 8-15% prior to the more complete 5th Revision (1795) and 1897 Imperial Census [4][6].

Conclusion

The archaeological, bioarchaeological, and historical evidence from the 2,40M km^2 Ob-Irtysh basin demonstrates five major phases of demographic development in Western Siberia: (1) an Early Neolithic expansion of fishing and hunting communities in the boreal forest and forest-steppe (c. 6000 cal BC at Amnya I and Kayukovo 2, supporting ~20,8k inhabitants across Western Siberia); (2) an Eneolithic and Bronze Age pastoral and metallurgical expansion (Afanasievo, Botai, Sintashta-Arkaim, Andronovo, Irmen, and Chicha-1, raising total population from ~59,3k at 3000BC to ~189,2k at 800BC); (3) an Early Iron Age and High Medieval period of mounted pastoralism and fortified forest-steppe chiefdoms (Pazyryk, Sargat, Kulai, Bulan-Koba, and Srostki / Kimak-Kipchak cultures, sustaining ~220,0k-224,8k inhabitants between 400BC and 1000AD); (4) a Late Medieval division between the Siberian Khanate (~39,3k core subjects in 1580AD) and the ten fortified Ob-Ugrian Yugra principalities (~21,5k inhabitants); and (5) Russian agricultural and industrial colonisation from the 17th to the 19th centuries, which expanded the basin's population from ~269,0k at the 1701 Tobolsk census to ~855,0k in 1800AD and ~3,56M by the time of the 1897 First All-Russian Imperial Census and 1900AD.

Appendix

Settlement Estimates

Settlement	Region	Calibrated Date	Area	Excavated / Mapped Dwellings	Estimated Pop. (Range)	Primary Reference
Amnya I & II (Kazym Basin)	I-3	6100-5900 cal BC	0,45 ha	20 pit-houses (15-40 m^2)	40-75 (Mean 60)	Piezonka et al. 2023; Dubovtseva 2020
Kayukovo 2 (Salym-Yugan)	I-3	6000-5500 cal BC	0,25 ha	6 ring-houses (16-32 m^2)	30-55 (Mean 42)	Kardash et al. 2020; Borzunov 2012
Botai Type-Site (Ishim Steppe)	I-2	3700-3100 cal BC	15,0 ha	158-250+ pits (160 active)	450-800 (Mean 650)	Outram et al. 2009, 2021
Arkaim (Trans-Ural Steppe)	I-2	2050-1750 cal BC	2,0 ha	60-67 radial longhouses	600-1 000 (Mean 800)	Koryakova & Epimakhov 2007
Kamennyi Ambar (Olgino)	I-2	2050-1750 cal BC	1,8 ha	46 row longhouses (150-220 m^2)	460-700 (Mean 580)	Krause et al. 2019; Epimakhov 2009
Berezovaya Luka (Alei / Ob)	I-1	2100-1800 cal BC	2,2 ha	18-25 frame-post houses	120-180 (Mean 150)	Grushin 2011; Dashkovskiy et al. 2024
Chicha-1 Fortified Town (Baraba)	I-2	900-700 cal BC	5,2 ha	100-110+ houses (Zones I-IV)	800-1 250 (Mean 1 050)	Molodin, Parzinger & Schneeweiss 2009
Rafailovskoye (Iset Valley)	I-2	400BC - 200AD	13,8 ha	155 multi-room houses	1 200-1 650 (Mean 1 450)	Matveeva 1999, 2000; Chikunova 2005

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Settlement	Region	Calibrated Date	Area	Excavated / Mapped Dwellings	Estimated Pop. (Range)	Primary Reference
Ust-Polui (Salekhard, Arctic)	I-3	260BC - 140AD	0,42 ha	Sanctuary + smithy enclosure	Regional catchment 1,5k-2,5k	Losey et al. 2018, 2020; Vodyasov 2017
Sherkaly-1 / Shorkar (Koda)	I-3	1250-1600AD	1,2 ha	42 log cabins w/ stone ovens	200-350 (Mean 280)	Zykov 2012; Solodkin 2015
Emder (Endyrskoye-1)	I-3	1100-1600AD	0,35 ha	25-35 citadel + posad cabins	120-220 (Mean 170)	Zykov & Koksharov 2001
Ust-Voikary (Voikar Gorodok)	I-3	1350-1720AD	0,35 ha	30 permafrost log cabins	100-165 (Mean 135)	Vizgalov & Parkhimovich 2008
Nadym Gorodok (Lower Nadym)	I-3	1200-1730AD	0,12 ha	6 apartment log-blocks	40-75 (Mean 58)	Kardash 2009; Lobanova 2016
Isker / Qashliq (Gorod Sibir)	I-2	1495-1598AD	2,6 ha	Citadel + posad (95 structs)	450-850 (2k-3,5k assembly)	Tataurov & Maslyuzhenko 2016, 2018

Table 3. Dwelling Counts, Enclosed Areas, and Population Estimates for Key Fortified and Open Settlements of Western Siberia (6100 cal BC - 1598AD).

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Footnotes

[1] Between benchmark dates, regional population series are interpolated smoothly while keeping long-run annual growth rates within historically plausible bounds ($r \in [-0{,}0015, +0{,}0030]$ yr^{-1} for pre-modern societies, rising during 18th- and 19th-century peasant immigration), avoiding artificial swings caused by uneven radiocarbon sampling.