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RESEARCH ARTICLE

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Hypsometric demography of Kosovo: the distribution of Kosovo population by altitude

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The original version of this article was revised to add a missing reference to the reference list

Abstract

This paper attempt to analyze how population dynamics changed in Kosovo through altitude and time. Altitude is one of the fundamental physiographic factor that determine the vertical distribution of human activities on earth. Altitude also determine the availability of natural resources because by increasing altitude somehow decreases the total surface of land available for agriculture, development and as well as increases the environmental constrains and restrictions in the use of land due to the topography, environmental regulations and policies. In order to concrete the research, Kosovo territory is zoned vertically into six hypsometric levels. Using digital Elevation Model for Kosovo the hypsometric zones are as follows: <500; 500–750; 750–1000; 1000–1250; 1250–1500 and >1500 m. Also, population changes are analyzed through six population censuses realized in Kosovo after the second WW, starting from 1948, 1953, 1961, 1971, 1981 and 2011. The basic analyzed unit is settlement as a centroid.

Keywords: Population, Density, Vertical zone, Index, Agricultural land, GIS

Background

Altitude determine the development of many human activities, among them the human settlement. By increasing altitude, the total amount of geographic area reduces and with it gradually reduce the opportunities for the development of settlements and life in general.

Among the factors that affects the altitude are: physiographic, environmental, biological and socio-economic factors. The importance of physiographic factors related to the fact that many human developments in their historical evolution have been conditioned by the factors such very early human settlements are located in lowlands and near rivers where the water and fertile soil were present. e.g. Ulpiana, an ancient city of Dardania (present Kosovo) extended to 577 m above sea level, in front of the Graçanka river and mainly in alluvial soil-fertile agricultural land. While biological factors in early development have played an important role in population or depopulation of geographical area due to the spread of infectious diseases, e.g. as malaria, cholera, etc. Altitude affects as well the socio-economic aspects of human development entirely, and is very much influential under development society rather than developed society. Altitude determine or complicate conditions of socio-economic development and human influence on normal life development, for e.g. the greater is the altitude, the less arable land is in disposal, the terrain has a high degree of slop, major centers are difficult to access, as well as the spread of innovations are very slow.

Methods

In this research are analyzed several data sets, ranging from elevation of Kosovo, population, settlements and population in different periods, as well as agricultural land in relations with hypsometry, population and settlements etc. Data on altitude or hypsometry are provided by Global Digital Elevation Model (MDR) called "Aster GDEM" 30 m/px (ASTER GDEM 2011). Then the Kosovo territory is zoned vertically in 6 hypsometric zones, ranging from <500, 500–750, 750–1000, 1000–1250, 1250–1500, and >1500 m. While demographic data are from the centroid of Kosovo settlements, namely

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according to the census years (1948, 1953, 1961, 1971, 1981, 2011). There is also the estimated population census of 1991 which was held during the occupation time and was rejected by Kosovo population, manly by Albanians due to the fear and risk of manipulation and its political purposes. This estimated or irregular census is not part of this research for reason mention above and its incompatibility that might effects this research.

The data on agricultural land are taken from dataset of agricultural land suitability divided into eight classes according to present Kosovo national classification system (Ministry of Agriculture, Forestry and Rural Development). Through applications of GIS data for the population are divided by hypsometric zones and other variables, which by various methods as spatial analysis, map algebra, historical method, comparative statistics are analyzed

Table 1 Vertical zoning of Kosovo surface (by authors)

No.	Vertical zones	Hypsometric zones (m)	Geographic landscape	Area km^2	%
Z1	Low	<500	Flat ground landscape	1763.10	16.17
Z2	Medium	500–750	Field-valley landscape	4481.10	41.09
Z3	Average high	750–1000	Valley-hilly landscape	2350.71	21.56
Z4	High	1000–1250	Mountainous landscape	912.60	8.37
Z5	Very high	1250–1500	Mountainous-alpine landscape	513.75	4.71
Z6	Extremely high	>1500	Alpine landscape	883.90	8.11
6	Total		–	10,905.17	100.00

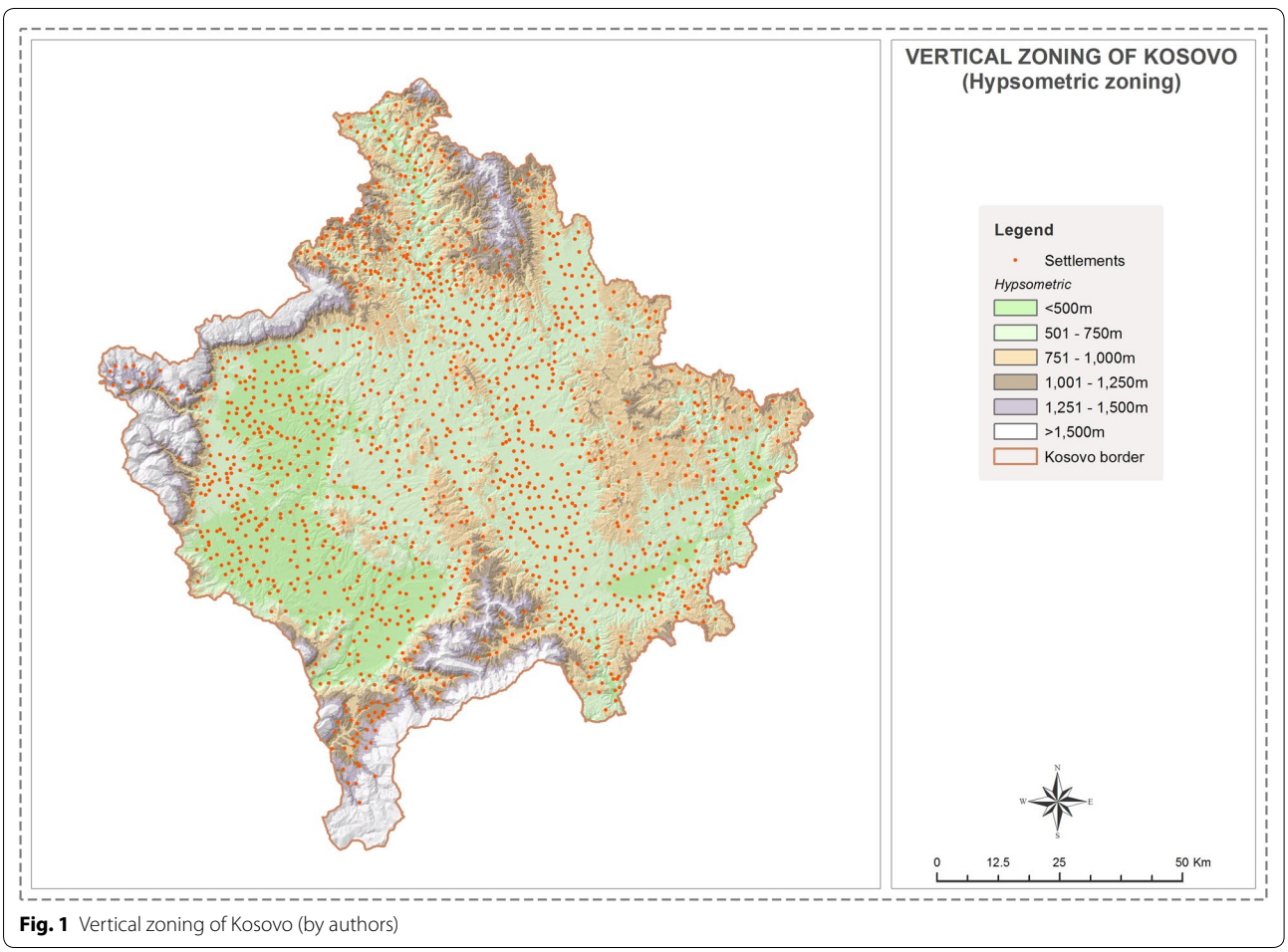


Fig. 1 Vertical zoning of Kosovo (by authors)

these three key variables and then acquired results are presented in this paper.

Results

Hypsometry—vertical zoning

For the purposes of this survey, Kosovo is divided into six vertical zones, relying mainly on a complex factor, such as morphological factors, micro climate, vegetation, agronomic, communication and anthropologic. So, while analyzing the above-mentioned factors in Kosovo circumstances zoning is divided as in Table 1.

The vast majority of Kosovo's surface is mostly flat ground, namely the 57.26% consists of lowland landscape coupled with some gentle river valleys, where 16.17% belong to first hypsometric zone <500 m and 41.09% belong to the hypsometric zone of 500–750 m, and zone from 750 to 1000 m represents 21.56% of entire territory of Kosovo. Mountainous terrain or zone >1000 m respectively comprise 21.19% of the total area of Kosovo, of which 8.37% lie in the hypsometric zone 1000–1250 m, from 1250 to 1500 m are 4.71%, and 8.11% are >1500 m (Fig. 1).

Hypsometry and agricultural land

Agricultural land in Kosovo is divided into eight classes of suitability, from which 1–4 are protected by law and intended for the purpose of agricultural production and it has a fund of 5183.59 km^2 or 47.53% of the total territory of Kosovo. In general, with increasing altitude decreases the fund of agricultural land due to natural conditions. The largest fund of agricultural land by hypsometric zones is closely linked with the largest fund of land that lies in the respective zone, so in the hypsometric zone 500–750 m are 58.59% of agricultural land, while 30.03% are under <500 m, which means that 88.62% of agricultural land of classes 1–4 lies in these two first hypsometric zones. While only 9.38% lies in 750–1000 m of hypsometric zone, and only 2.05% lies >1000 m.

Demographic development in settlements of Kosovo, from the population censuses of 1948 to 2011 the population density on agricultural land has grown consistently as follows: in the hypsometric zone <500 m population density on agricultural land of class 1–4 Increase from 121 inh/km^2 to 324 inh/km^2, in the

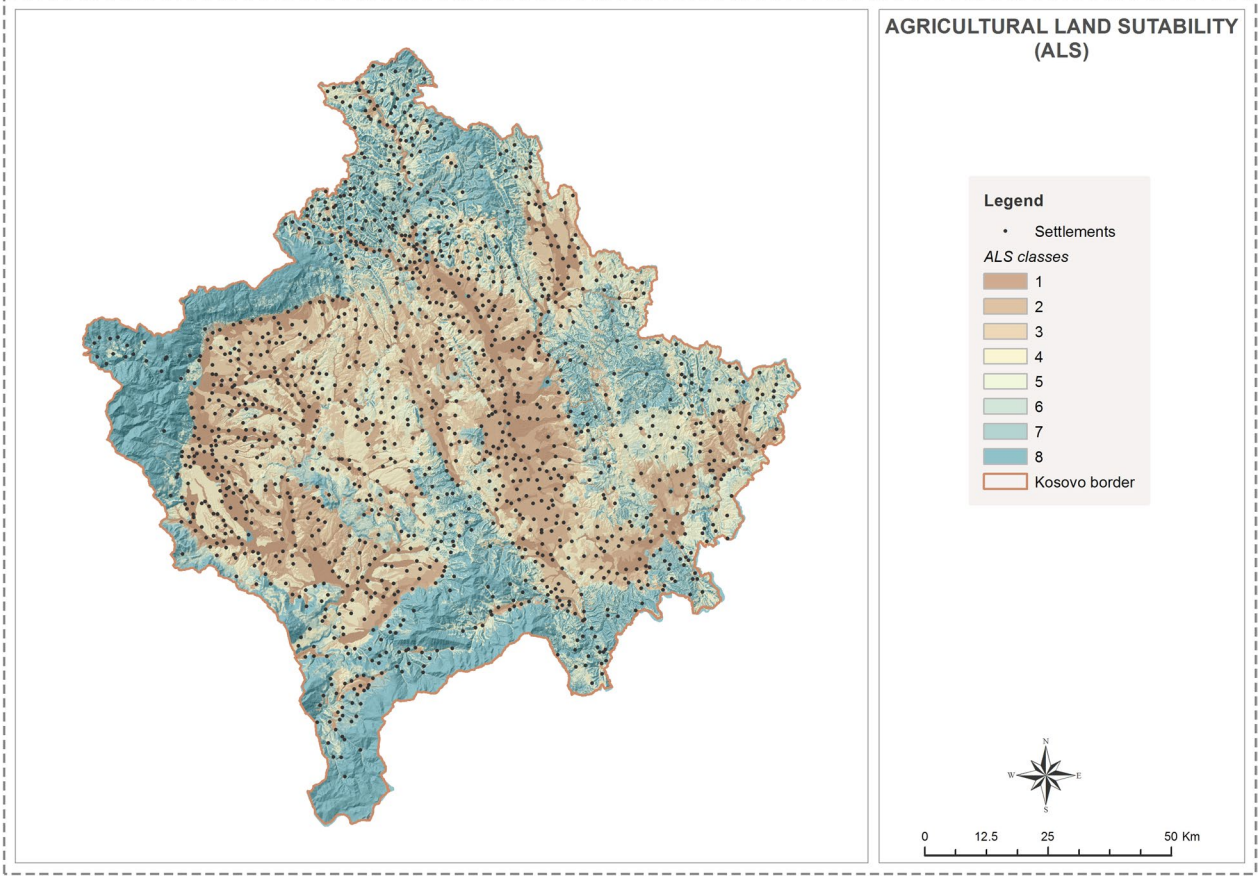


Fig. 2 Agricultural land suitability map of Kosovo (by authors)

Table 2 Participation of ALS through hypsometry (by authors)

Hypsometric zone	ALS classes															
	1		2		3		4		5		6		7		8	
Meters	Km^2	%	Km^2	%	Km^2	%	Km^2	%	Km^2	%	Km^2	%	Km^2	%	Km^2	%
<500	517.36	48.79	335.56	25.97	363.98	26.45	339.83	23.36	102.24	7.67	52.14	5.25	15.8	3.2	35.88	1.24
500–750	528.24	49.82	890.64	68.92	883.47	64.21	734.81	50.5	540.82	40.57	348.92	35.15	126.1	25.56	427.18	14.72
750–1000	10.83	1.02	50.28	3.89	106.46	7.74	315.44	21.68	528.46	39.64	388.55	39.14	158.65	32.16	789.69	27.21
1000–1250	3.84	0.36	15.16	1.17	20.27	1.47	58.9	4.05	127.58	9.57	146.08	14.72	105.63	21.41	430.6	14.84
1250–1500	0.02	0	0.69	0.05	1.83	0.13	5.84	0.4	32.93	2.47	55.5	5.59	84.72	17.17	329.53	11.35
>1500	0.00	0	0	0.00	0.02	0	0.12	0.01	1.14	0.09	1.45	0.15	2.41	0.49	889.67	30.65
Total	1060.29	100	1292.33	100.00	1376.03	100	1454.94	100	1333.17	100	992.64	100	493.31	100	2902.55	100

Table 3 Settlements by population size and hypsometry (by authors)

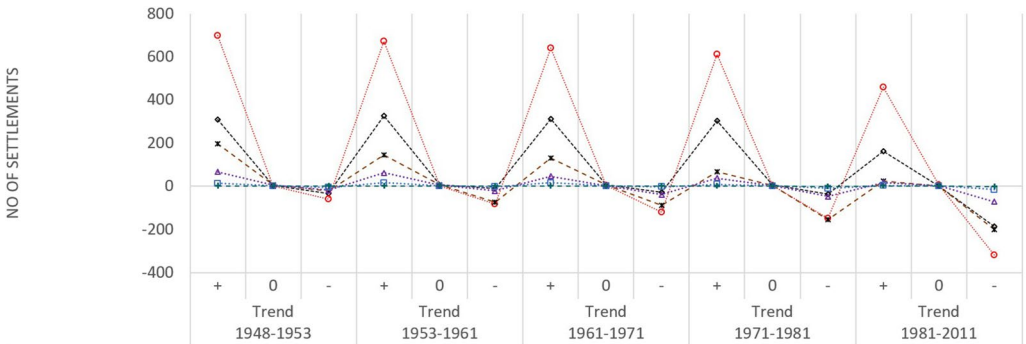
Period	Hypsometry (metric)	Classification of settlements by population sizes, inhabitants (inh.)						No	%
		<500	500–2500	2500–5000	5000–25,000	25,000–50,000	>50,000		
1948	<500	244	95	–	3	–	–	342	23.80
	500–750	477	277	2	6	–	–	762	53.03
	750–1000	172	52	–	–	–	–	224	15.59
	1000–1250	68	21	–	–	–	–	89	6.19
	1250–1500	14	5	–	–	–	–	19	1.32
	>1500	1	–	–	–	–	–	1	0.07
	Total	976	450	11	9	–	–	1437	100.00
	%	67.92	31.32	0.77	0.63	–	–	100.00	–
1953	<500	228	111	–	3	–	–	342	23.80
	500–750	439	315	4	6	–	–	764	53.17
	750–1000	163	61	–	–	–	–	224	15.59
	1000–1250	63	24	–	–	–	–	87	6.05
	1250–1500	15	4	–	–	–	–	19	1.32
	>1500	1	–	–	–	–	–	1	0.07
	Total	909	515	4	9	–	–	1437	100.00
	%	63.26	35.84	0.28	0.63	–	–	100.00	–
1961	<500	202	134	4	2	1	–	343	23.87
	500–750	394	355	8	3	3	–	763	53.10
	750–1000	156	68	–	–	–	–	224	15.59
	1000–1250	62	25	–	–	–	–	87	6.05
	1250–1500	13	6	–	–	–	–	19	1.32
	>1500	1	–	–	–	–	–	1	0.07
	Total	828	588	12	5	4	–	1437	100.00
	%	57.62	40.92	0.84	0.35	0.28	–	100.00	–
1971	<500	145	184	9	1	2	–	341	23.76
	500–750	323	420	11	6	2	1	763	53.17
	750–1000	154	70	–	–	–	–	224	15.61
	1000–1250	56	31	–	–	–	–	87	6.06
	1250–1500	13	5	1	–	–	–	19	1.32
	>1500	1	–	–	–	–	–	1	0.07
	Total	692	710	21	7	4	1	1435	100.00
	%	48.22	49.48	1.46	0.49	0.28	0.07	100.00	–
1981	<500	118	200	18	4	1	1	342	23.67
	500–750	280	450	24	8	2	3	767	53.08
	750–1000	166	62	–	–	–	–	228	15.78
	1000–1250	59	29	–	–	–	–	88	6.09
	1250–1500	12	6	1	–	–	–	19	1.31
	>1500	1	–	–	–	–	–	1	0.07
	Total	636	747	43	12	3	4	1445	100.00
	%	44.01	51.70	2.98	0.83	0.21	0.28	100.00	–
2011	<500	141	167	22	12	1	1	344	23.43
	500–750	303	424	44	14	4	2	791	53.88
	750–1000	204	23	–	–	–	–	227	15.46
	1000–1250	70	22	1	–	–	–	93	6.34
	1250–1500	6	5	1	–	–	–	12	0.82
	>1500	1	–	–	–	–	–	1	0.07
	Total	725	641	68	26	5	3	1468	100.00
	%	49.39	43.66	4.63	1.77	0.34	0.20	100.00	–

hypsometric zone 500–750 m population density increased from 141 inh/km^2 to 390 inh/km^2, while in the third hypsometric zone or 750–1000 m population density has decreased from 160 inh/km^2 to 96 inh/km^2. Hypsometric zone >1000 m due to the very small fund of agricultural land in spite of having very few inhabitants, the population density is high, for e.g. in hypsometric zone 1200–1500 m in 2011 lived 10,298 inh, while total agricultural land surface of classes 1–4 is 8.38 km^2 (Fig. 2; Table 2).

With the growth of the total population of Kosovo from one period to another one increases the average density of population which lies on agricultural land suitability of classes 1–4.

Settlements and hypsometry

Kosovo settlement are different in terms of territorial and demographic size. Change is evident in hypsometric scale and time and depending on the infringer's population and type, their number also varies according to the hypsometric zones and range size. On the threshold of hypsometric of the first and second zone or <750 m lies the largest number of settlements where depending on the time period their numbers increase or decrease. Also, by increasing the number of overall population also varies the range size of settlements, such as in 1948 about 67% of settlements in Kosovo have been of size <500 inh, 31.21% of size 500–2500 inh and only 1.38% of size 5000–25,000 inh and none settlement greater than 25,000 inh. Never the less the same situation is in census of 1953. This is mainly the period when Kosovo's economic base dominated by the primary sector, mainly extensive agriculture and forestry. While in the census of 1961 the majority of the settlements or 57.50% of them belonged to range size <500 inh, while 41.03% belongs to range sizes of 2500–5000 inh, and only 0.63% or 9 settlements belonged to the group of settlements 5000–50,000 inh, where 5 of them belonged to range size 5000–25,000 inh and only four settlements from 25,000 to 50,000 inh. By increasing the economic base of Kosovo, namely the increase of industrialization also increases the number of larger settlements and reduce the number of smallest, such as in the censuses of 1961 dominated the settlements size <500 inh with a number of 824 settlements. A decade later the number of settlements reduced to 688, while the number of settlements from 500 to 2500 inh increased by 588–710 representing the largest group of settlements in Kosovo. Growing marks, the settlements of range size 2500–5000 inh increased by 12–21, group of settlements 5000–25,000 inh grow for two settlements, while it appeared for the first time the type of range size settlements >50,000 inh (Prishtina). In terms of hypsometric participation, it is the same situation almost since the first registration census. In the 1981 group of settlements with over 50,000 inh added the 3 settlements. Growing settlements marks in range size 500–25,000 inh while the range size settlements <500 inh continue to decline. The greater the degree of industrialization became increase the number of larger settlements, because the industry was concentrated in the larger cities where required largely amount of worker and also skilled worker.



	Trend 1948-1953			Trend 1953-1961			Trend 1961-1971			Trend 1971-1981			Trend 1981-2011		
	+	0	-	+	0	-	+	0	-	+	0	-	+	0	-
<500m	308	4	-34	327	7	-12	312	6	-29	302	6	-39	160	0	-187
500.01-750m	698	0	-60	672	0	-85	641	2	-120	611	2	-150	459	5	-321
750.01-1000m	196	6	-24	145	7	-74	130	6	-90	67	4	-155	24	1	-201
1000.01-1250m	65	4	-19	61	4	-23	46	2	-40	37	2	-49	16	0	-73
1250.01-1500m	12	1	-7	15	1	-4	15	1	-4	8	1	-11	2	1	-17
>1500m	1	0	0	1	0	0	1	0	0	0	0	-1	0	0	-1

Fig. 3 Settlements with positive, negative and stagnant population trend according to hypsometry (by authors)

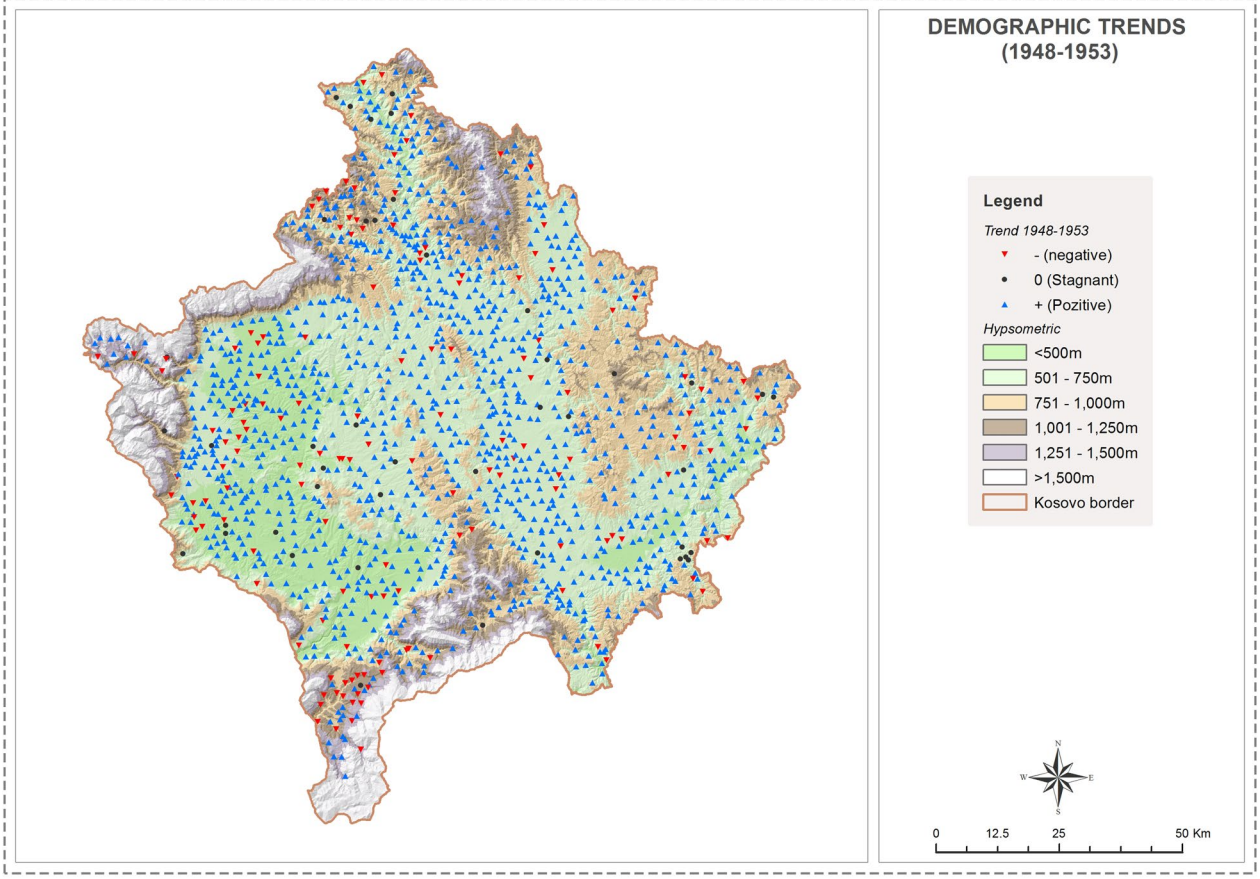


Fig. 4 The population trends by settlements in Kosovo for the period 1948–1953 (by authors)

In the 2011 census the situation is as follow: dominate the smaller settlements <500 inh with 49.39%, then all other settlements mark the growing except number of large group of settlements or settlements with more than 50,000 inh. This change is a result of changes in boundaries affecting large urban areas (city of Mitrovica is divided in two part, in the south and north).

Regarding the density of settlements under hypsometric and time periods, generally at the national level the situation is continuing mainly without any changes and continuously there is 13 set/km^2. The calculation is made using the following formula:[1]

$$D = \frac{n.100}{S} \quad (1)$$

D settlement density, n number of settlements, and S surface in km^2.

What does not change at all censuses is the average density of settlements which has consistently been around 13 settlements per square kilometer. A similar situation is also in the hypsometric level, for e.g. in the hypsometric zone <500 m is about 19 St/km^2, then 17 St/km^2 from 500 to 750 m of hypsometry, while in 750 to 1000 m is about 9 St/km^2. The hypsometric zone that shows increase of settlement density is 1000–1250 m from 9.53 St/km^2 to 10.19 St/km^2 because fragmented part of disperse settlement became a new settlement itself, while in the hypsometric zone 1250–1500 m marked decline from 3.70 St/km^2 to 2.34 St/km^2, and the last hypsometric zone >1500 it has a constant state 0.11 St/km^2. So, in general density of settlements is also invariant under hypsometry (Table 3).

Historically about 80% of Kosovo settlements lie at an altitude <750 m, where the majority of them belong to range size up to 2500 inh.

Trends in growth, reduction and stagnation of population in settlements from previous population census show that the number of settlements that have shown negative trend of the population has grown consistently,

[1] M. Radovanović, S. Nikolić, "Disperzija kao kvantitativni parameter prostornog razmeštaja i metode za izučavanje seoskih naselja", Zbornik radova, GI. Sv.xx. Beograd, 1973, p. 104.

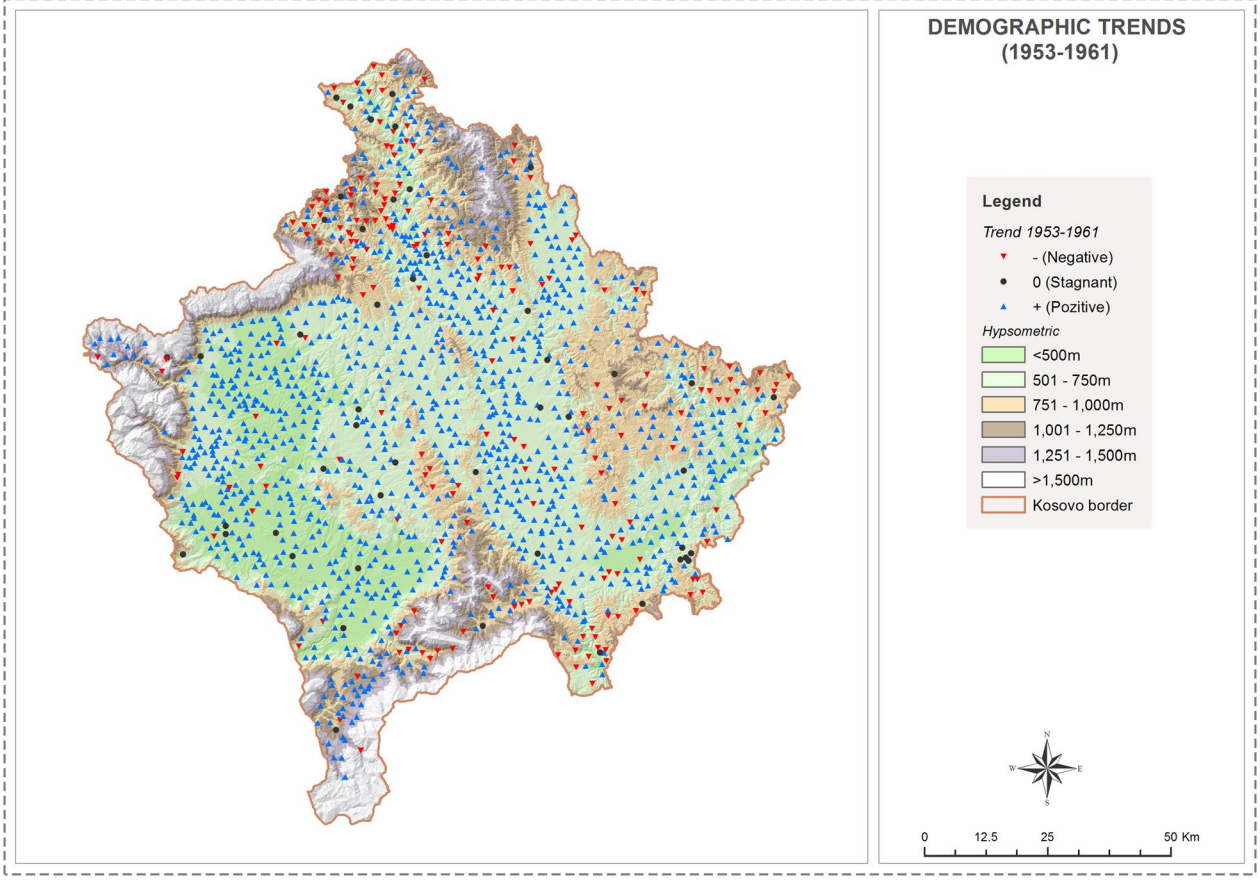


Fig. 5 The population trends by settlements in Kosovo for the period 1953–1961 (by authors)

and opposition to this category are settlements that have increased the number of population, while settlements with stagnation trend growth until the census of 1961, then decline. Settlements with negative population trend are as follows; from 144 settlements in the period 1948–1953; 198 settlements in the period 1953–1961; 283 settlements in 1961–1971; 405 settlements in the period 1971–1981; and 800 settlements in the period 1981–2011. While settlements that marked positive trend continually reduced, by 1280 settlements in the period 1948–1953; in 1221 settlements in the period 1953–1961; then 1145 settlements in 1961–1971; 1025 settlements in the period 1971–1981; and 661 settlements in the period 1981–2011. Changes in negative or positive trends magnify themselves occur mainly in settlements that lie on the first three hypsometric zones, namely in the hypsometric zone <500, 500–750 and 750–1000 m, and trends periods which has changed mostly is 1981–2011. The reasons for this are mainly the difficult conditions of life, the very limited number of social services and utilities, extreme low level of capital investment in infrastructure, the lack of prospects in the primary sector, the opportunity to migrate to settlements that lies in plains with plenty arable land and cities, and as well as migration abroad in order to ensure the welfare and long-term perspective for a family because of the state of frozen conflict-war in Kosovo during 1989–1999. In general, many of these factors are known as repulsive factors manifested by the removal of the population from agriculture and attractive factors that attract agricultural population in other economic activities Ramadani 2016.

The trend was calculated with a simple formula:[2]

$$P_t = P_1 - P_0 \quad (2)$$

P_t is the population trend for given period of time; P_0 is the first population state of given time; P_1 is the second population state of given time (Figs. 3, 4, 5, 6, 7, 8).

[2] The authors (R. Murseli and H. Dana) designed the formula for the purpose of this research.

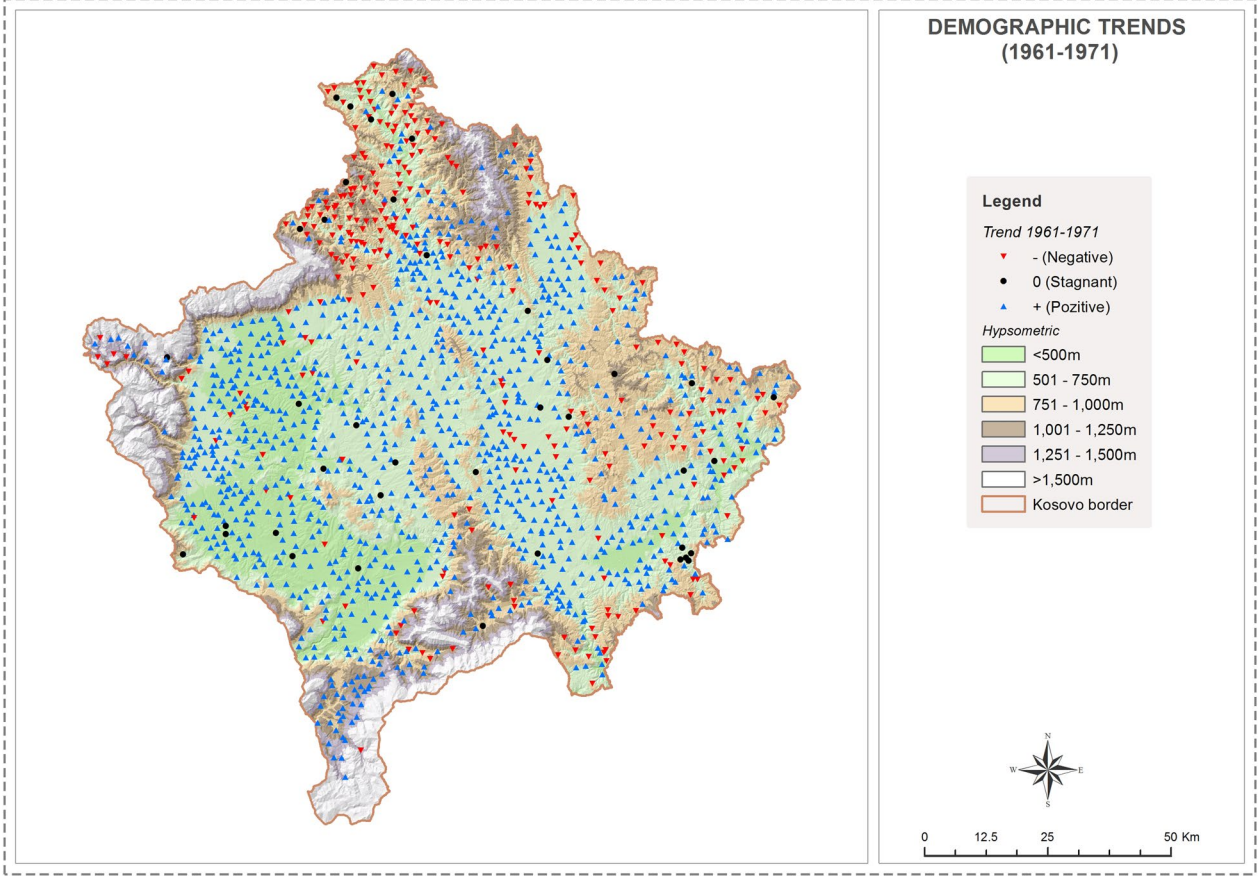


Fig. 6 The population trends by settlements in Kosovo for the period 1961–1971 (by authors)

Population and hypsometry

Lowest hypsometric zones <500 m and 500–750 have shown a continuous increase of population while others >750 m shown a periodical grown, some until 1971 and others until 1981 and after these two periods marked population decline. In general, there is a legality, with increasing altitude decreases the number of the population in relation to the surface (Table 4).

Hypsometric zones with greater pressure of population have been and are the lowest quintile, respectively the first two zones <500 m and 500–750 m where by all censuses have lived continuously over 80% of the total population of Kosovo. According to the census of 1948 up to 750 m of altitude lived 84.25% of the total population of Kosovo at 57.26% of the total territory, while in 2011 at the same altitude or hypsometric zone lived 95% of the total population of Kosovo. Hypsometric zone which is narrowed in demographic terms is the third level or hypsometric zone 750–1000 m (Table 5).

The main causes of reducing the number of population above second hypsometric zone are mainly shortage of arable land, reducing the proportion of people due to the lack of essential services, very low degree of public capital investment. While the swelling population in two first hypsometric zones is due to the much better conditions such as terrain is mainly field, agricultural land is in high quality, good access to the education, health and security services and proximity to local and regional malls and markets. In these circumstances exist a displacement of population within a mini-mezzo geographical territory in which the population migrates towards the lowland areas. This type of migration we call it "gravitational migration" of the population (Fig. 9).

Based on the data presented in Table 2. Kosovo's population for the period of 1948–2011 (63 years) increased to 1,046,947 inh or 16,618 inh per year, while the number of settlements has increased from 1437 as they were in 1948–1468 in 2011. Meanwhile, the population density continuously increased by increasing the number of the total population, which in 1948 was 67.22 inh/km^2 while in 2011 it increased to 163.23 inh/km^2, for i.e. for 63 years has grown to 96.01 inh/km^2.

The curve indexes indicate in which period the changes begun, and by listing the basic census period 1971–1981

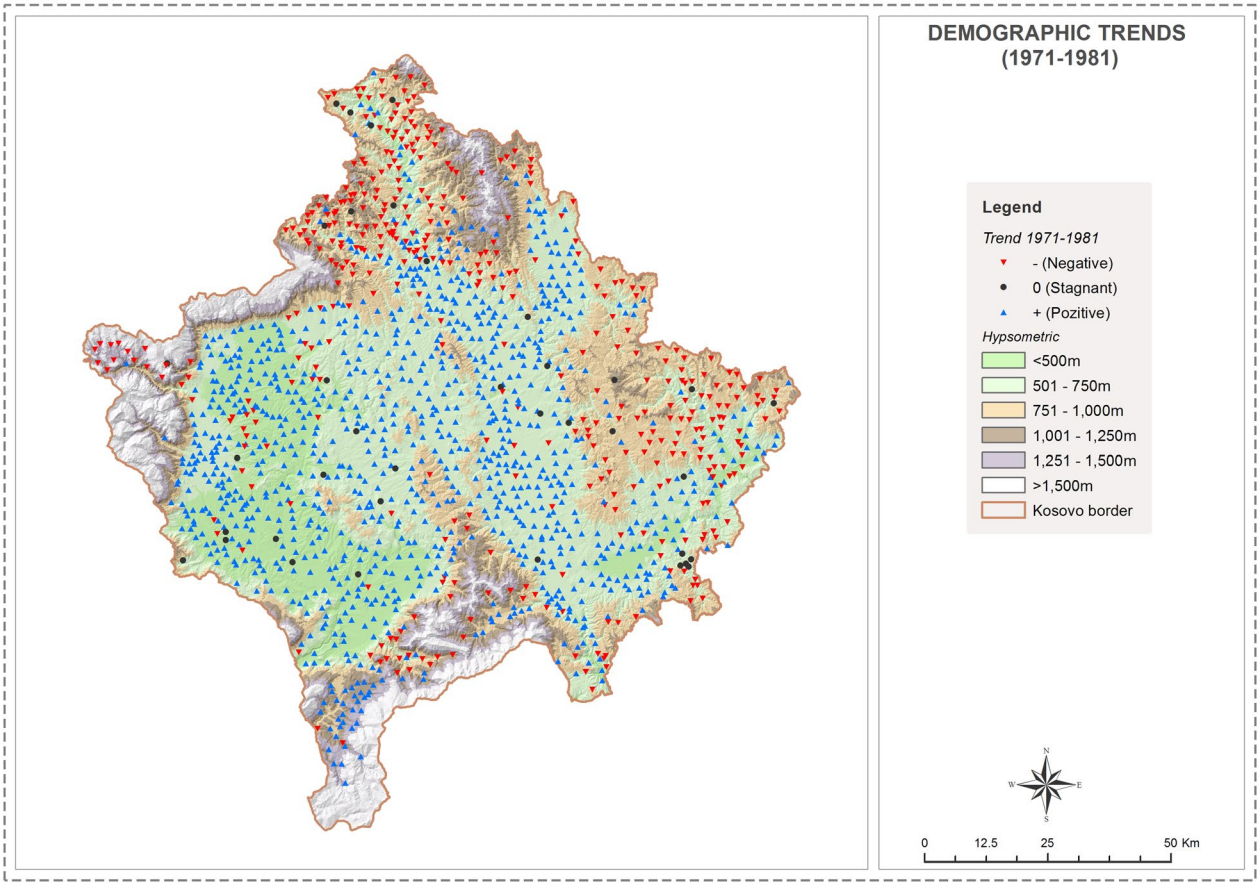


Fig. 7 The population trends by settlements in Kosovo for the period 1971–1981 (by authors)

is the beginning of population trend decline for many hypsometric zones>750 m.

Basic index curve varies depending on hypsometry and time period. For e.g. the first two hypsometric zones <500 m and 500–750 m in the basic index curve are continuously increasing, while for hypsometric zones >750 m basic index curve is increased up to 1971, namely 1981 and then declined to some zones it shows even the drastic drop.

Formula:[3]

$$Bi = \frac{X_n}{X_0} \cdot 100 \tag{3}$$

where Xn is the continues number or member range, while X_0 is the first and base member and it has constant value of 100 (Fig. 10).

While the curves of ranking index for hypsometric zone are changing though with a tendency to trend decline from previous periods, e.g. hypsometric zone >1500 m humbled curve starts since 1961, while for most of the hypsometric zone curve decreases of range index started in 1971 and 1981. In this case create a legality, where the higher the hypsometric zone is much early it starts to decline the curve of ranking index.

Formula:[4]

$$Ri = \frac{X_n}{X_{n-1}} \cdot 100 \tag{4}$$

where X_n is the continues number or member range, while X_{n-1} is the second member and it follows the X_n (Fig. 11).

Conclusions

Based on the results presented in this research with the increase of hypsometry the population decrease and at the same time reduce the resources in general. Since the census in 1948 until the 1971 the population

[3] Pushka (1985).

[4] Pushka (1985).

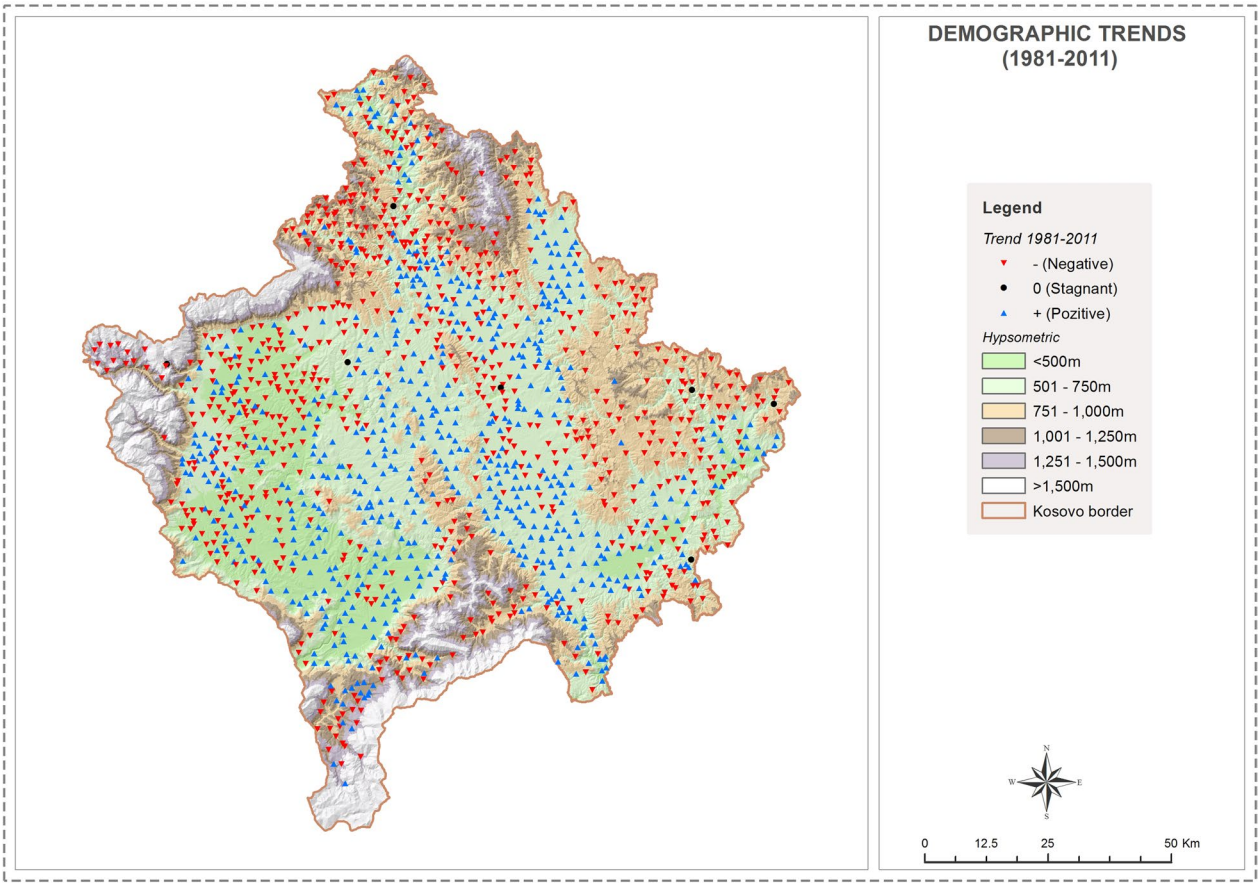


Fig. 8 The population trends by settlements in Kosovo for the period 1981–2011 (by authors)

of hypsometric zones >750 m has marked a very low increase while after the 1971 census and especially after the 1981 census population decreased drastically. In general, the hypsometric zone which is loaded mostly by the "gravitational migration" of population is the hypsometric zone 500–750 m where 53.5% of Kosovo settlements stretch. This zone poses also the overwhelmingly agricultural land fund (41.09%) especially for central and eastern part of Kosovo.

Based on the facts elaborated above it can be concluded that there are three major flaws in demographic hypsometry of Kosovo:

(1) population of rural mountainous or high hypsometric zones >750 m tends continuously to move into lowest hypsometric zones, mainly in the second zone 500–750 m;
(2) the rate of discharge settlements from hypsometric zones <500 m and 500–750 m was high mainly because of migration within the same zone but in urban areas or largely cities, and
(3) the rate of discharge settlements from all hypsometric zones was high mainly because of migrated to the third countries.

If these trends continue in the future where the agricultural land continuously reduce from population growth and urban expansion in general and the construction of network infrastructure then general fund of arable land resources, agricultural land per capita, and the possibility of Kosovo to raise funds and yields of agricultural products will be much more limited. These trends lead to the unavoidable conflict between the continuous tendency of agricultural land reduction and urban expansion that will create a permanent conflict in the first two hypsometric zones. Of course, in these conditions suggestion is to achieve sustainable policies, integrated protection of agricultural land, to achieve the sustainable

Table 4 Population according hypsometry and population censuses (by authors)

Hypsometric classes	Sip. km²	1948	1953	1961	1971	1981	2011
<500 m	1763.10	188,027	210,057	250,105	329,379	436,423	504,992
500.01–750 m	4481.10	429,616	482,294	583,818	772,317	1007,162	1185,796
750.01–1000 m	2350.71	77,470	83,463	87,833	93,522	87,341	46,518
1000.01–1250 m	912.60	28,770	30,792	32,813	37,708	41,580	32,407
1250.01–1500 m	513.75	9041	9179	9219	10,574	11,728	10,298
>1500 m	883.90	150	157	194	202	159	10
Total	*10,905*	*733,074*	*815,942*	*963,982*	*1243,702*	*1584,393*	*1780,021*

Table 5 Population increased or decreased by period of time and hypsometry (by authors)

Hypsometry/years	1948–1953	1953–1961	1961–1971	1971–1981	1981–2011
<500	22,030	40,048	79,274	107,044	68,569
500–750	52,678	101,524	188,499	234,845	178,634
750–1000	5993	4370	5689	−6181	−40,823
1000–1250	2022	2021	4895	3872	−9173
1250–1500	138	40	1355	1154	−1430
>1500	7	37	8	−43	−149

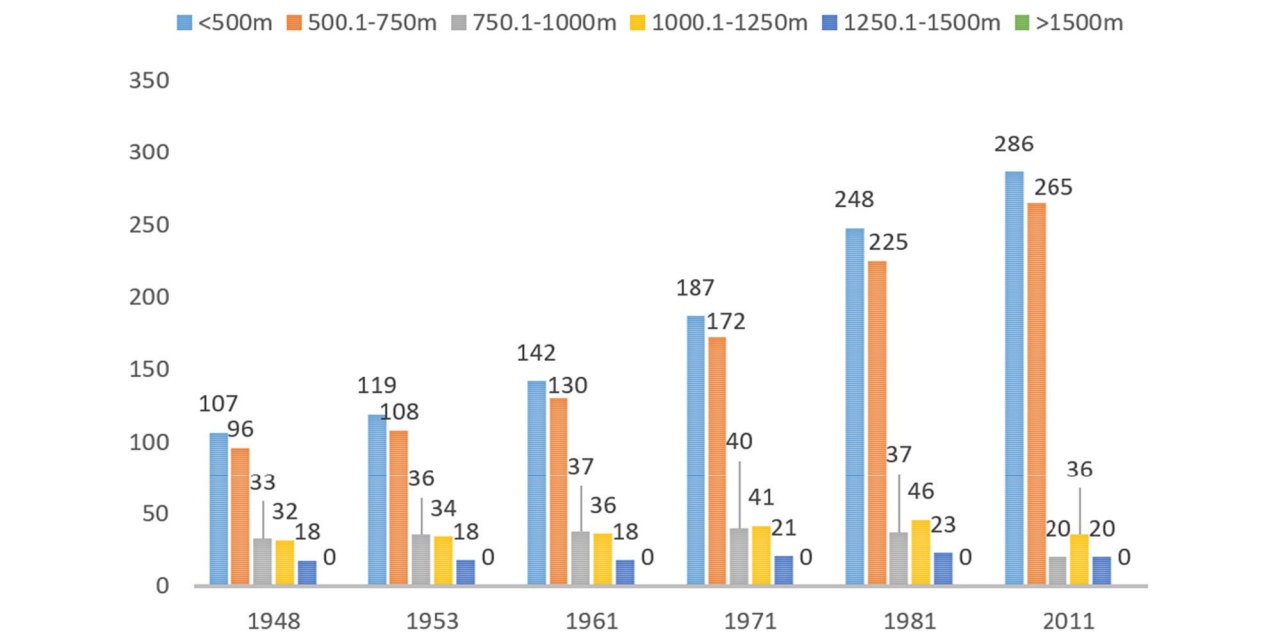


Fig. 9 Population density with altitude over the years (by authors)

management of the environment, as well as integrated and balanced spatial-urban planning and development, to support sustainable densification of urban areas, and urban expansion into areas or locations that do not conflict with environmental protection policies and the loss of agricultural land.

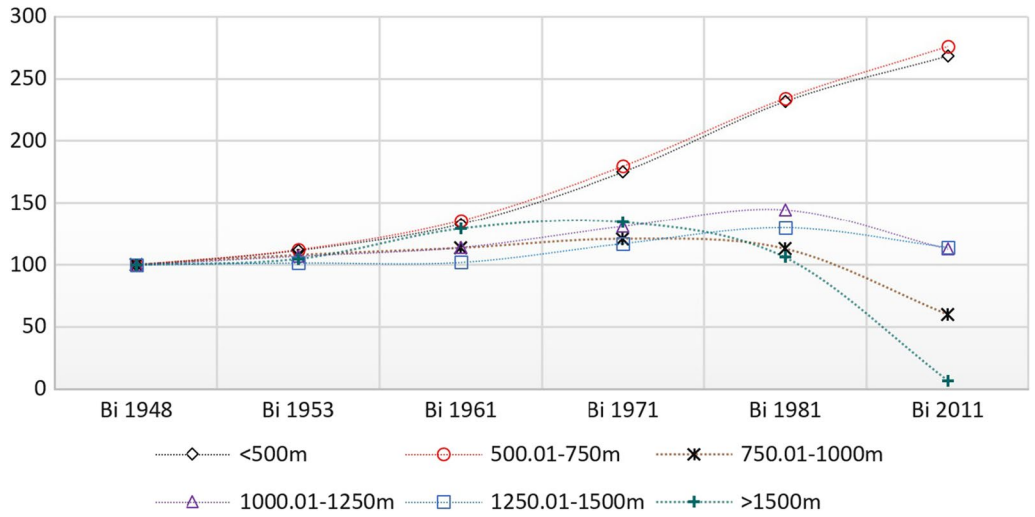


Fig. 10 Basic index (by authors)

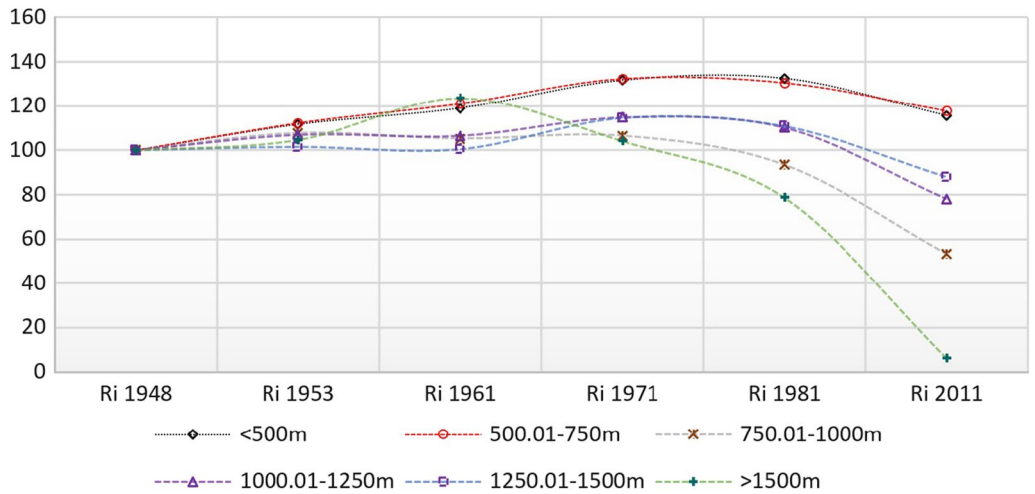


Fig. 11 Range index (by authors)

Authors' contributions

RM set up the idea of this research and performed all necessary analysis, maps and other graphic content of the research. Working as a Spatial Planner and GIS expert at the Institute of Spatial Planning in Kosovo for more than 12 years where the chances of applying geographical knowledge are unlimited has helped very much to address many qualitative issues within this paper research. HD participated in its design and coordination and helped to draft the manuscript. Both authors read and approved the final manuscript.

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Competing interests

The authors declare that they have no competing interests.

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References

ASTER Global Digital Elevation Model (GDEM) version 2. http://www.jspacesystems.or.jp/ersdac/GDEM/E/4.html. Accessed 03 Oct 2011

Centroid of Kosovo Settlements (GIS) of population censuses of 1948. Kosovo Agency of Statistics, Prishtinë 2014

Centroid of Kosovo Settlements (GIS) of population censuses of 1953. Kosovo Agency of Statistics, Prishtinë 2014

Centroid of Kosovo Settlements (GIS) of population censuses of 1961. Kosovo Agency of Statistics, Prishtinë 2014

Centroid of Kosovo Settlements (GIS) of population censuses of 1971. Kosovo Agency of Statistics, Prishtinë 2014

Centroid of Kosovo Settlements (GIS) of population censuses of 1981. Kosovo Agency of Statistics, Prishtinë 2014
Centroid of Kosovo Settlements (GIS) of population censuses of 2011. Kosovo Agency of Statistics, Prishtinë 2014
Pushka A (1985) Quantitative Methods in Geography. University of Prishtina, Prishtinë, p 25
Ramadani I (2016) 'Settlements of Kosovo'—spatial and functional organizations. Libri Shkollor, Prishtinë