



The Relation between Land Tenure and Land Cover, Affecting Sustainability in Cities. Case Study the City of Prague

May Salama^{1*}, Jenan Hussein¹, Peter A. Kumble¹ and Henry Hanson²

Abstract

Land tenure is generally considered to be an important factor affecting land use development. Changes in land use and land tenure can influence both physical fragmentation and ownership fragmentation of the environment, with implications for biodiversity. In this study, we evaluate changes in land use and land tenure in cities, we believe through the development of the city of Prague as an example; changes of land use/cover effect on land tenure and reflect on conserved natural areas in the short and long time. Studying the city of Prague in the development of the relation of land tenure and land cover/use and the factors such as environmental, economic, and social factors that affect changes, using maps from aerial photographs and GIS data and measured changes between 2004 and 2017 in the city of Prague. Our results demonstrate that land-use/cover change between 2004 and 2017 was dominated by an increase of urban areas at the expense of green spaces and suggest that past predictions regarding future urban growth in the city region have proven accurate and highlights regions of change that merit further study and will affect the future development of the city leading for a green and sustainable place to live.

Keywords

Land tenure; Land use; Cover changes; Ownerships; Indicators and factors; Prague

Introduction

There is an ongoing debate on the effect of different property regimes on the use of land (i.e., deforestation or reforestation) now and in the future. Much of the discussion has been centered on two main forms of tenure regime: common-pool system and private property. Case studies around the world have provided evidence on whether one is more effective at preventing deforestation than the other, but there is not a clear pattern.

Studying land tenure, land cover, and both of them reflections of people's needs but how this affected nature and how it could help thinking of creating green infrastructure instead of grey ones and dealing with environmental problems made by natural development.

The process of creating a sustainable place with sustainability application through the time is starting from the concept to the real application and use, factors influence the adoption are: Education, Provision of Ecosystem Services, Financial Incentives, Coordination Among Actors, Laws, and Policies, and Planning Recommendation are used to encourage, rather than mandate, the use of sustainability applications. Define and understand the relation between Land Use/Cover Changes and Land Tenure will help to clarify the effect and ability to create ongoing organized steps to sustainability

This study illustrates that many of the projections regarding future urban growth in the city have proved accurate in the period since the last land-use analysis was conducted. The pattern of continuous urban growth from existing urban areas discussed in previous researches continues to be visible. Providing an example of the idea that urbanization can begin to dominate over all other uses, including agriculture, in a land bordering existing city. Our maps indicate that by 2017 urban land had expanded into areas that were green in 2004. This research also illustrates that the trend towards physical fragmentation of the landscape in the city, because each city has a unique type of land cover, it is important to know how land tenure has affected the land cover and land use through the time, giving priority for conservation, high-value development areas, and sustainability

Definitions of Terms

Land tenure

Land tenure systems vary among the countries and differ from one region to another within each country and from town to town. Thus, it is logical to talk about specific tenure arrangements in different parts of the country as each town has its own unique approach to tenure. Several different definitions are accorded to land tenure by different authors. Thorncroft [1] defines land tenure as "the basis upon which rights of ownership are exercised over a parcel of land". According to Wehrwein [2] "land tenure is all the relations established among men determining their varying rights in the use of land", whereas Parsons [3] says that "land tenure systems are social relations central to man's relation to man in the use of land". In simple terms, land tenure connotes systematic landholding that embodies legal, contractual, and communal arrangements under which people gain access to and utilize the land. It constitutes various laws, rules, procedures, and obligations that govern the rights, interests in land, duties, and liabilities of the people in their use and control of land resources [4]. Land access is viewed not just as the right to enter a defined physical property but includes access to rights to land [5].

Land use

Land use is the characterization of land-based on what can be built on it and what the land can be used for. It's determining what sort of community, environment, or settlement can be used on a specific type of land. One definition of land use is "the total of arrangements, activities, and inputs that people undertake in a certain land cover type." It's important to note that land use and zoning are not the same. Where land use is the way that people adapt the land to suit their needs, zoning is how the government regulates the land [6].

*Corresponding author: May Salama, Department of Land Use and Improvements, Czech University of Life Sciences, Prague-Suchbát, Czech Republic. E-mail: salama@fzp.czu.cz

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Land development

The term development has earned different meanings from different scholars. For the purposes of this paper the term “urban land development” is used to mean planned development, subdivisions of land, extension, and change of user as well as the preservation and enhancement of the natural environment. Land development is viewed as the process of putting up buildings on land for various uses. Land and property development is defined as a complex multi-disciplinary activity comprised of several processes and stages implemented by various actors through which built environments are produced [7].

Urban development

Urban development is a broad term that covers activities ranging from the creation of extensive urban areas to simply putting up new buildings or making extensions to existing buildings [7]. Tinsdale [8] describes cities as areas with large numbers of people living in concentrations. He defines urbanization as ‘the process of high increasing numbers and concentrations at high densities. Nsiah-Gyabaah [9] attributes this concentration of people and activities to social, economic, and political factors that underlie changes in land use transforming rural areas to urban patterns of organization and governance. Urbanization results in changes of land use (from rural to urban) and an increase in density of developments to meet the shelter, movement, nutrition, and income needs of urban residents [10]. The assertion that ‘urbanization does not take place in thin air but requires enormous amounts of the land’ by Dowall and Clarke [11] underscores the importance of the availability of land as a precondition for urban growth. This view is upheld by Fekade [12] who maintains that urban growth should be accompanied by the provision of ‘affordable buildable urban land’. He argues this can be achieved through efficient urban land management. Urban and management is a system made up of actors and activities which interact to produce efficient allocation and use of urban space especially land aimed at guiding and controlling the growth of towns and cities to ensure orderly growth and efficient functioning in the provision of urban housing, services, and facilities (ibid). Tools used in most cities to guide development include ‘master plans, zoning plans, subdivision plans, planning regulations, and building codes’ [11].

The link between land tenure and urban development

While the goal of urban land management is to ensure planned growth of urban areas, access to land developments and on which planning regulations are applied is governed by rules of tenure. Land tenure is a social relationship comprised of rules set up by societies that regulate how people relate to the land. Dowall and Clarke [11] identify poor tenure, cadastral and registration systems as one of the factors hindering the efficient growth of cities in developing countries.

This is affirmed by Fekade [12] who highlights ‘unreformed tenure relation’ as one of the casual factors for insufficient provision of affordable developable land in most cities. Payne [13,14] posits that “Land tenure rules define how people access rights to land” and define property as the right that a person exercises over an object. Rights over land are thus referred to as property rights and they define what can be done on land [15]. Land rights are perceived as being either formal or informal. Formal land rights have official government recognition and have their basis on legal rules set up within a country while informal rights do not have government recognition.

Land rights are seldom held by one person, often multiple rights to the same piece of land are held by different people [16]. This view is

consistent with the bundle of rights concept which likens land rights to sticks in a bundle. The sticks vary from time to time in number (representing the number of rights), in thickness (representing the ‘quantum’ of each right) and in length (representing the duration of each right [17]. In areas under the common law, freehold is the highest form of land ownership thus freehold landowners hold the complete bundle of rights [15].

Restrictions on land rights

Land tenure does not just cover land rights but also encompasses the restrictions and obligations/responsibilities associated with these rights [15,16,17]. Arguments for restrictions on private land rights are associated with the failure of the free market (where the use of which land is put in the sole discretion of owners) to deal with negative externalities arising from private land use and provide public goods [18,19]. Examples of negative externalities that could arise out of private land use include pollution and conflicting land-use which infringe on the land rights of others. They are according to [19] social costs are borne by third parties. Restrictions on private land rights are thus necessary and are applied by governments through ‘planning regulations, planning obligations, development bonuses, environmental performance standards, and moratoria to regulate the location, dimension, intensity, time, duration, and process of the production and reception of externalities [19]. Public goods include roads, sewer lines, water lines, and open spaces. A defining characteristic of public goods is their joint consumption. [11] posit that because of their joint consumption and inability of the private sector to profitably produce and sell public goods, the free market is unable to provide externalities on private land use.

Continuum of rights

Payne [13] in his research on urban land tenure in developing nations demonstrated that there is no clear distinction between formal and informal forms of land ownership (land tenure systems) in most urban areas in developing nations rather land ownership varies depending on the level of security from formal to informal forming a range or continuum of land tenure categories. He attributed the emergence of tenure subsystems to the failure of conventional land tenure systems to meet the land needs of urban populations within the low-income bracket creating room for agents who come up with informal mechanisms of accessing and developing land tailored to the needs and income levels of the urban areas. ‘Each continuum provides different sets of rights, responsibility, degrees of security, and enforcement’ [20]. Consequently, urban developments in developing countries exhibit. ‘Varying levels of legality or illegality ranging from squatting; unauthorized subdivisions on legally owned land, illegal construction to varying forms of rental arrangements consistent with the tenure subsystems existing within an area’ [13]. (Figure 1) below illustrates the continuum of rights concept.

Land rights are often a vital element when rural households balance their capabilities and assets and determine their resulting strategies to cope with their daily production and food security. However, rights to land are not just a source of economic production but are also a basis of social relationships and cultural values, and a source of prestige and often power. The resulting social networks that are built up within a specific social and cultural group are a very important asset in ensuring the sustainability of livelihoods of rural households [21].

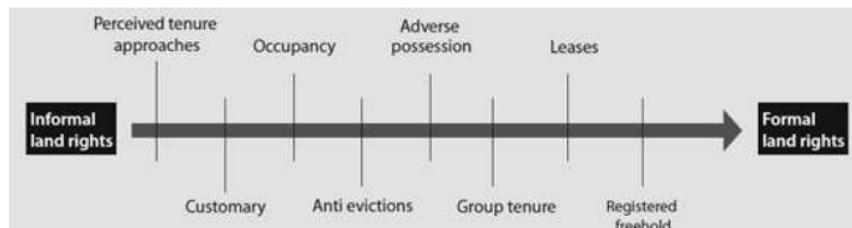


Figure 1: An illustration of the continuum of rights concept.

Importance of Land Tenure in land use planning

Nowadays the importance of considering land tenure in the land planning by illustrating some implications that projects promote environmental sustainability, gender mainstreaming, and resolution of conflicts and displacement have on land tenure; it is directly affecting.

- Environmental issues: Land tenure and environmental conditions are closely related: land tenure can promote land-use practices that harm the environment or it can serve to enhance the environment and help taking main steps to sustainability based on the law and rules that lead land tenure for acquiring access to land can lead to environmental degradation.

- Insecure land tenure is linked to poor land use which in turn leads to environmental degradation. Lack of clear rights can reduce the incentive to implement long-term resource measures. In the case of privately held land. Inappropriate tenure arrangements on state lands can also lead to environmental degradation [22,23].

Social and resolution processes

There is typically a close link between tenure and conflict over land. Within a society, competing claims for control and use of land may provoke conflicts. Population growth and changing economic factors can in turn increase competition access to land. Competition is usually regulated by a society's tenure rules which are developed in response to dynamic social, economic, and political relationships [24].

Land tenure and land-use changes support sustainable development

Access to land and guaranteed property rights are key to improve land use and cover development, the role of secure land tenure rights in protecting valuable natural resources in the environment has become critical in today's world where competition for access to resources and efforts to enhance the efficiency of land use are the main drivers of the development process.

Also, responding to environmental issues like climate changes secure access to land for the poor and vulnerable is increasingly affected by shocks and stresses induced by climate change, violent conflicts, and natural disasters, along with more structural trends such as population growth and urbanization, here comes the role of this relation in leading land development to encourage sustainable natural resource management, reducing household poverty and building sustainable respectable places to live [25].

The relation between land tenure and land cover/use and changes by the time of the development of the city is affecting sustainability related to the factors that combining together to create this relation

from a policy that puts the legal shape of the land rights, and giving legal guidelines for the future process for land cover/use, and the role of society and human as a resource and understanding the urban area is a place for people needs and activities in an equalization, providing these places with needed services; incorporation between urbanists and ecologists to protect natural valuable resources and create sustainable use for economic impacts to give people jobs and chances to raise their income with saving resources. All of this clarified by (Figure 2) as the following.

Important social and economic issues like food security, health, and welfare are supported successfully with thinking of the technical and institutional infrastructure required for efficient and equitable land tenure administration in development cities In the future development has been much more sustainable where policy-makers, recognized the need to reform land use supported by the protection of long-established rights of women and other disadvantaged groups to the resources they had held traditionally and naturally valued. On the other hand, new economic and financial incomes in small project investments like (urban farming in cities, small job companies supported by the government, etc...) [26]. In European countries, the development during the 21st century will probably very much depend on the development of society in general and the conflicts that can occur regarding land use. Another important factor will be the possibilities for the market to provide access to land and housing at affordable costs for an increasingly urban population. The urbanization shows tendencies to continue with concentration to larger and larger conglomerates and the immigration to Europe from other parts of the world seems also to continue for foreseeable future. The land use will become more and more complicated with more different and usually contradictory interests to accommodate in planning processes, driven in principle by the interest for sustainable land use at the same time as the competition for well-located land will increase with raising the value of natural resources [27]. It means, there will probably also be demands on more varied tenure forms to meet the future development, for instance, more ownership not only on land but on the horizontal division of the space in the air above the land and in the ground below the surface of the land for many varied purposes. Also, new forms of jointly owned facilities to provide a different kind of common services to the individual properties will probably develop, as the municipality or existing forms of companies and associations are not able to provide required services to appropriate costs and participation of the users [27]. Changes in society affected land tenure and land cover/ use which is the feedback that affects sustainable development assisted by society, human, policy, physical elements made by people, environmental resources, and economic finance in progress

Methodology

Focusing on collecting and analysing needed data to study the link

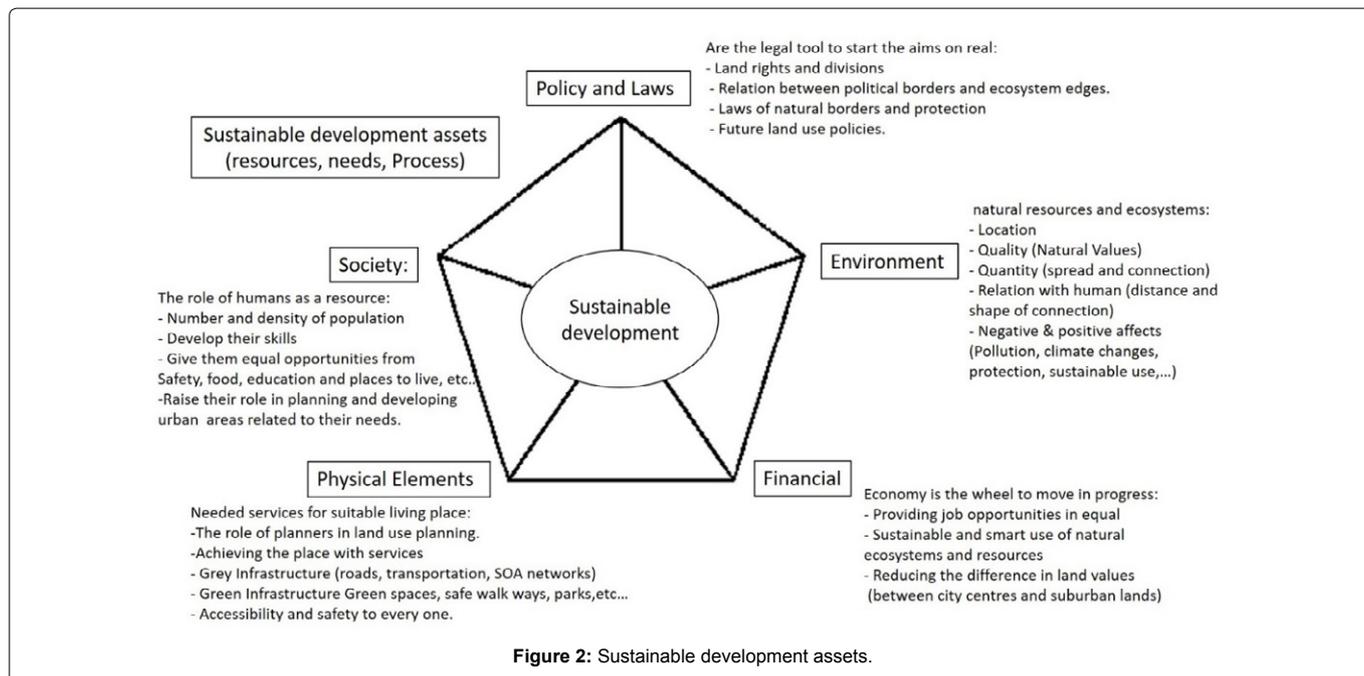


Figure 2: Sustainable development assets.

between land tenure security and land-use changes and development based on the factors.

Land use is influenced by the characteristics of the local biophysical environment that determine, to a considerable extent, land suitability for a range of uses. Formal and informal influence directly or indirectly land-use decision making. Land ownership and land tenure are the most influential factors. In the case of individual land ownership, social policies and regulations, spatial planning, finance, etc... [28,29].

Factors affecting land cover/use – Land tenure changes

Related to FAO [30], If we want to understand how to study Land Use Cover Changes (LUCC), we need to revolve around two central and interrelated questions:

1. What drivers or causes land use and land cover change? And What are the (environment and socioeconomic) impacts of these changes?

The main factors are:

Physical Factors: (slopes, soil, climate changes)

Economic Factors: (development of the economy to live and buy what people need for their needs, markets).

Human Factors: (Land Tenure, Traditions, the role of government).

Land use and land cover changes produce environmental and socio-economic impacts that frequently feedback and modify the biophysical and societal factors causing them to reflect on decision-makers [28].

While related to FAO [31-33] the basic factors that affect land tenure are:

It is not practical to generate a detailed checklist of issues that should be considered in project design and monitoring when

dealing with projects that may have land tenure related implications. However, areas that should be analysed include the legal framework, institutional framework, customary framework, and monitoring and evaluation indicators.

Interventions may have an impact on land tenure. The appropriate approach is to undertake a baseline study against which change will be measured by subsequent data gathering. The land tenure related elements that should be recorded and monitored will vary according to the nature of the place but it should be based on a range of indicators in the social and economic areas in order to identify what, if any, changes result. It should be noted, however, that information is rarely neutral. The land is a scarce resource over which there are competing interests and changes to land tenure arrangements may result in some people gaining while others lose [34].

Case study the city of Prague - Development of the City

The ongoing development of cities reflects an interactive process between landowners, property developers, and financial intermediaries, including investments. It is also an account of financialization in which 'things' are increasingly valued on strictly financial grounds" [35]. A city consists of a mosaic of plots with complex patterns of land ownership and land tenure.

This case study focuses on the city of Prague the capital and largest city of Czech Republic with a population of 1,280,508 inhabitants according to the Statistical Yearbook of Prague 2017 [36] ranking the 14th largest city in the European Union and included in the UNESCO list of World Heritage Sites. The city was founded in the 6th century and is located on the Vltava River, in the centre of the Bohemian Basin. (Figure 2).

The territorial development started from the historic core in 1784, straddling the Vltava River with four towns were merged in Prague, the last enlargement took place in 1974, has expanded East and West along stream corridors and over the hillsides that separate the stream valleys with a higher preference for South facing slopes. During which

30 municipalities were added, which together consisted of 37 cadastral territories (Figure 3). With significant areas of steep hillsides remain less intensively developed with primarily old orchards and vineyards, many of which have been within the historic fabric primarily include chateau gardens, urban parks, and cemeteries. (Figure 4).

Land tenure in the city: Territorial development was monitored from the point of view of cadastral territories. The process of

mapmaking was complicated by changes in the management of boundaries of the cadastral territories of individual municipalities connected to Prague. Although the cadastral territories of Prague [37]. Prague has seen the most intensive urbanization and suburbanization of any municipality in the Czech Republic. Between 1985 and 2000, built-up areas increased from 1.1% of the territory to approximately 8.1%. However, Prague continues to have a very large share of agriculture and natural lands in its territories. Around a quarter of

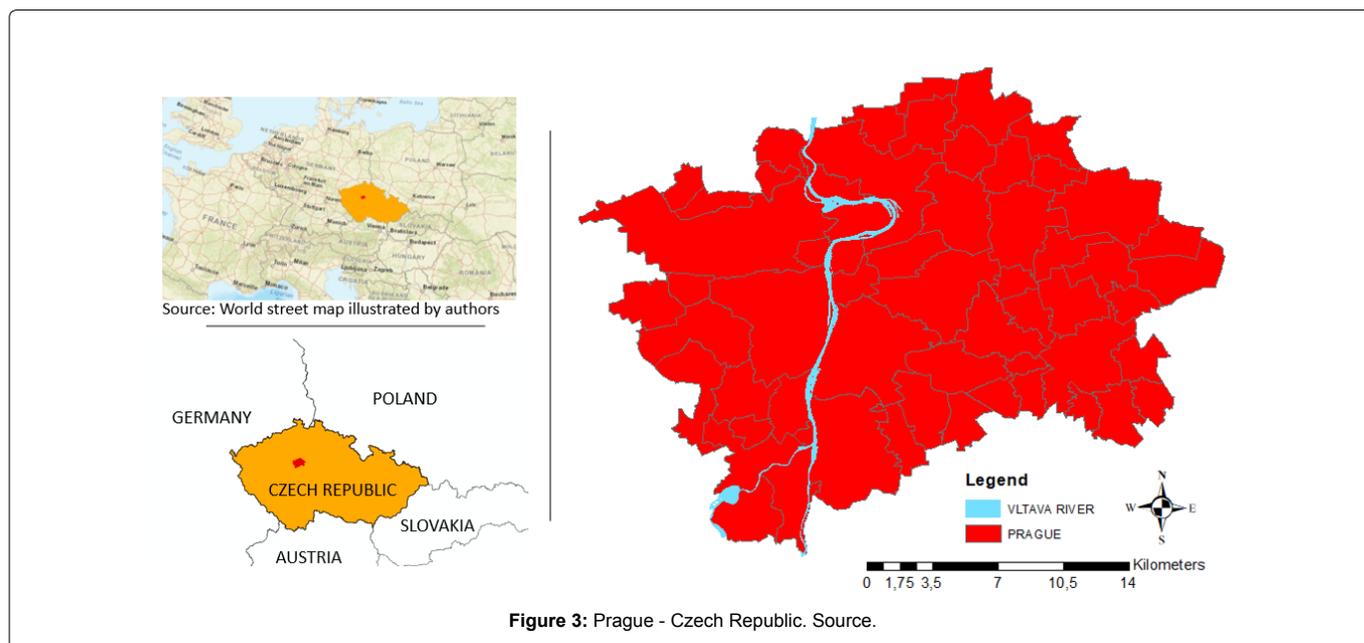


Figure 3: Prague - Czech Republic. Source.

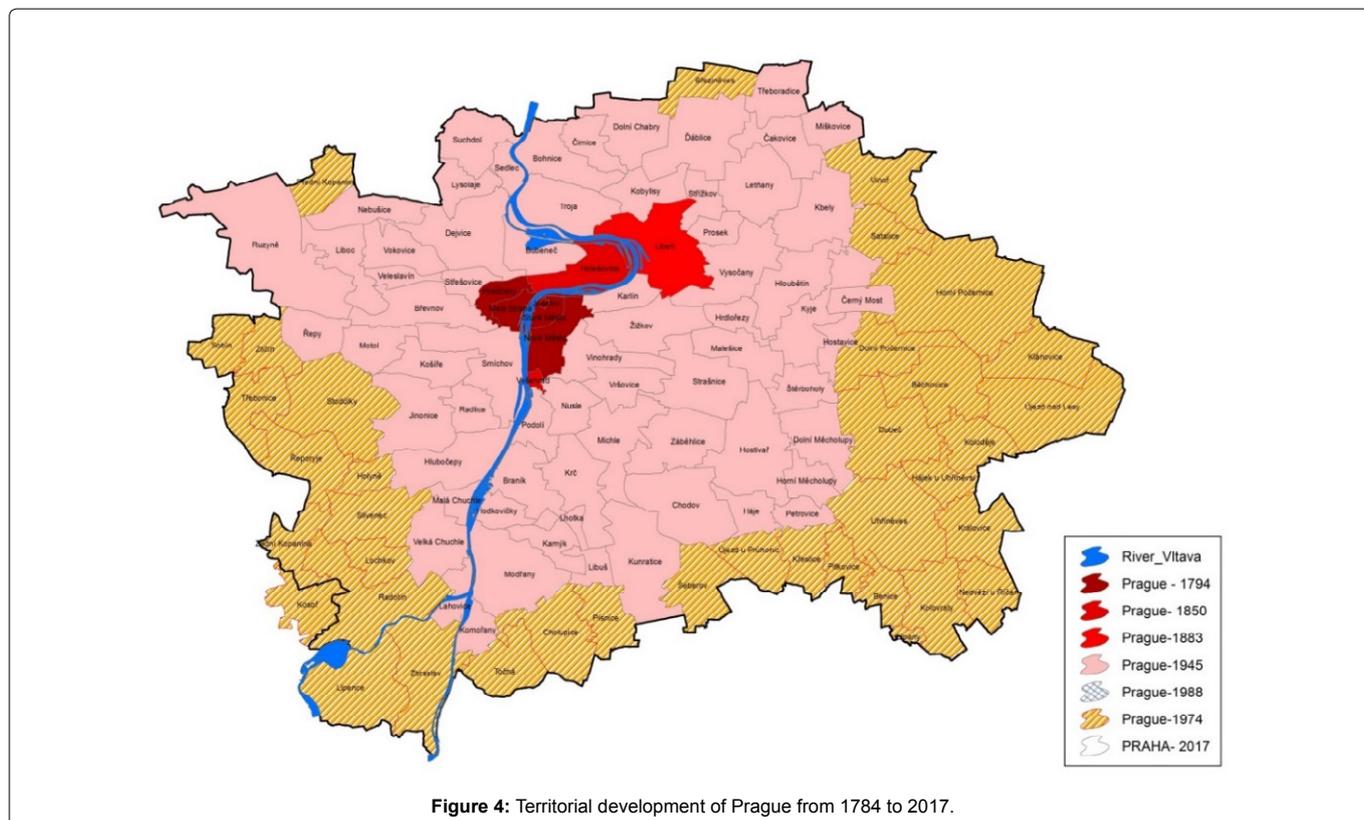


Figure 4: Territorial development of Prague from 1784 to 2017.

the city's is open countryside and almost a quarter of the city's land is open countryside and almost a quarter is agricultural land which we will focus on existence and development related to their important value in city progress [37,38].

Historical development of Land tenure

The city of Prague has a really special history, in development affected the land ownerships and tenures; depend to a large degree on varying social and economic developments we can briefly divide it into three phases related to the main historical events from being Czechoslovakia, later of the Czech Republic:

The period between 1918 and 1939 could be called the political-social period with a strong influence of the post-war Europe organization. The aim was to institute the parliamentary democracy, to redistribute the land to prevent social pressures, and to strengthen the national consciousness to the newly created state. [39]. This period of time is when Czechoslovakia became an independent Country; sometimes referred to as the First Republic.

The period of world war 2 could be marked as politically uncompromising dealing with the collaborators all property was confiscated including that of the aristocrats supporting the Nazi ideology, without any compensation. By 1948 the land was to be owned by the people who work on it", the land ownership was again partially fractioned to small pieces [40].

In 2004 there began the 6-year period of selling the state property (sell as much state property as possible at any cost). In this period, the state even sold the property which should have been used for new roads, railways, and other public buildings [41].

Nowadays, In Prague, the city owns a total of 14 776 ha

(representing about 30% of its total area), of which 26% are communications (roads, land used for transport), and 24 % vegetation or bodies of water. Other notable areas include 1411 ha, i.e. 10 % of land owned by the city or its individual districts, in the form of areas stylized as parks and this category includes large open areas within the large Prague housing estate projects. The remaining areas represent large development areas in the outlying parts of the city and areas relating to technical management/facilities within the city (metro and tram depot sidings and yards, bus garage lay-bys, central wastewater treatment plant areas, etc.) (Figure 5) [41].

- Municipalities situated near Prague's towns or directly adjacent to the former Prague wall, which characterizes the block of flats with apartment houses from the second half of the 19th to the first third of the 20th century. There have been multiple transformations of the nature of land use and utilization (agricultural background of Prague, the advent of industry and block building, the relocation of the industry, and the transformation into a residential or administrative-business district). The nuclei of former independent cities are generally recognizable, while at least the area of the village is preserved, and there is a larger green (park) area.

- Non-coherent built-up areas, separated by farmland and forests or industrial sites; Still recognizable nuclei of former villages, family houses or terraced houses in the neighbourhood or intermingling with housing estates with brick or more often panel blocks and their blocks outside the street line (there are three large independent residential housing estates - North, South, and Southwest).

- Residential neighbourhoods and garden towns on the boundary of the second and third stripes around the historic core of the Prague agglomeration.

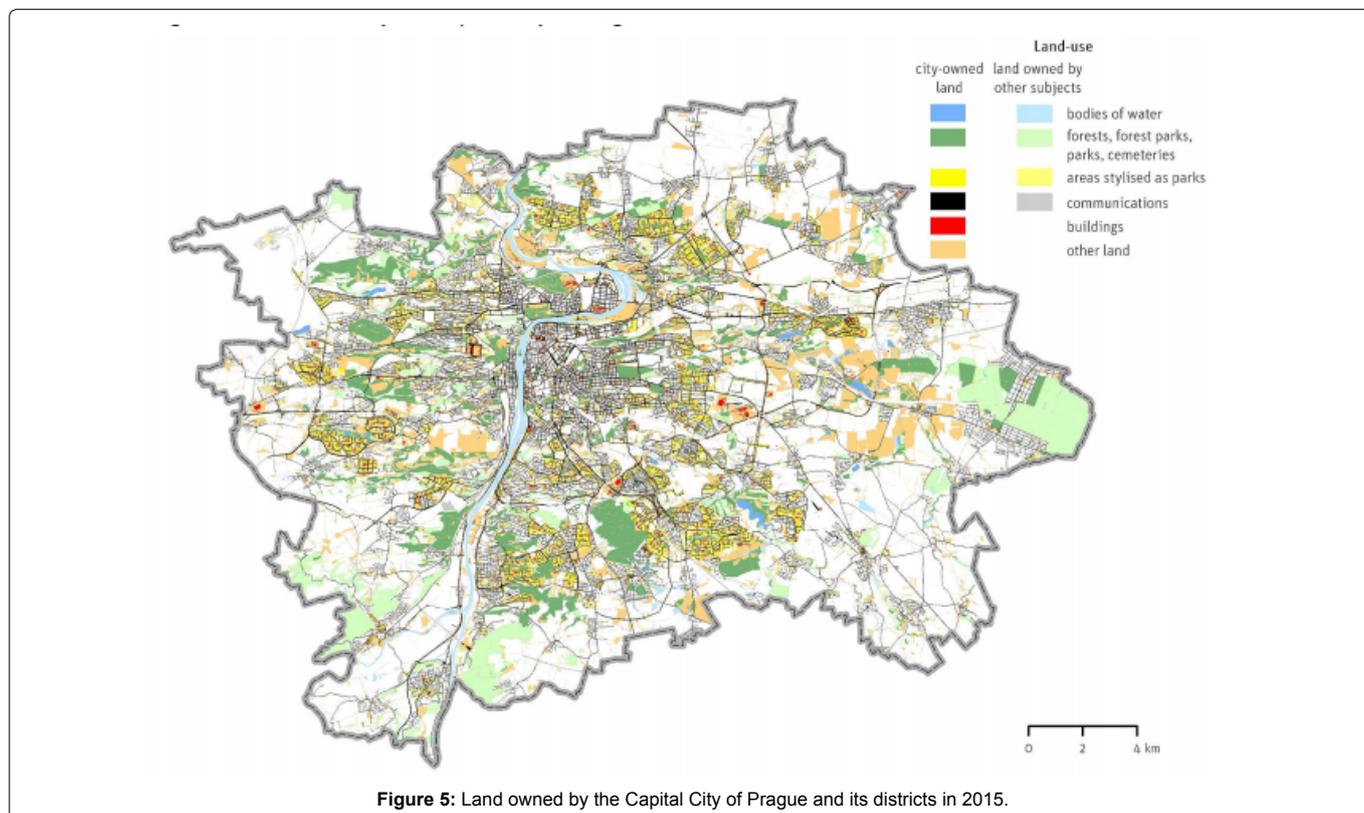


Figure 5: Land owned by the Capital City of Prague and its districts in 2015.

- Suburban commercial and residential areas [38].

Data collection

- Using the cost of the land as an indicator that shows the changes in the value of the land, and the ability to buy and sell lands as a reflection of economic development.

We notice this reflection on the land use map to describe where are the places in the city that have the high and low values (city centre-city edge- suburban areas- outer suburban areas). Unless we choose to study specific parts of the city.

Note: the study started to clarify changes in the city since the 1990th but related to available and clear data, we choose the two years 2004 - 2017.

Results and Discussion

Related to the defections and main factors that affect land cover, tenure changes and studying the relation between; that will influence the development of cities to become a sustainable place to live and working on the data of orthophotos for the city of Prague between the years 2004- 2017 and creating radial 200 sectors from the centre of the city; to have a new map with the farmlands and notice changes from farmlands to both farm and arable lands to recognize First Fields at lines (visually/by the eye) And then we can compare it with Aerial images from 2017 and distinguish changes. We can notice this reflection on the land use map to describe where are the places in the city that have the high and low values (city centre- city edge- suburban areas- outer suburban areas). [42]. as bellow in (Figures 6 and 7)

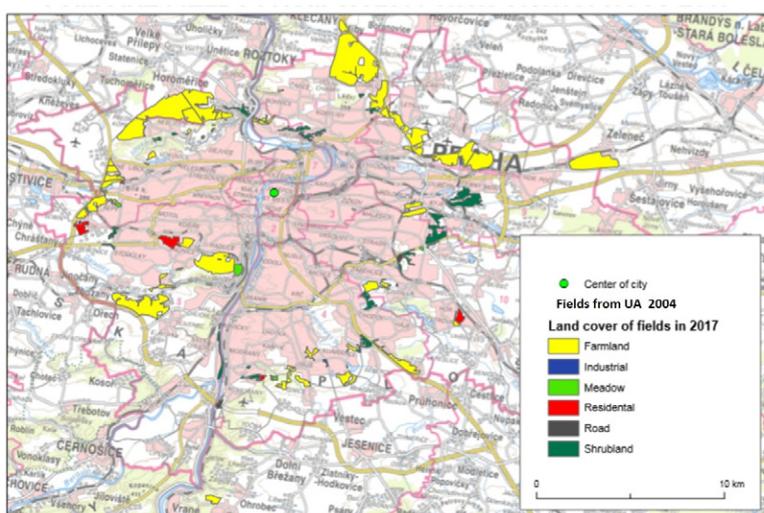


Figure 6: Compare fields between 2004-2017 with no sectors.

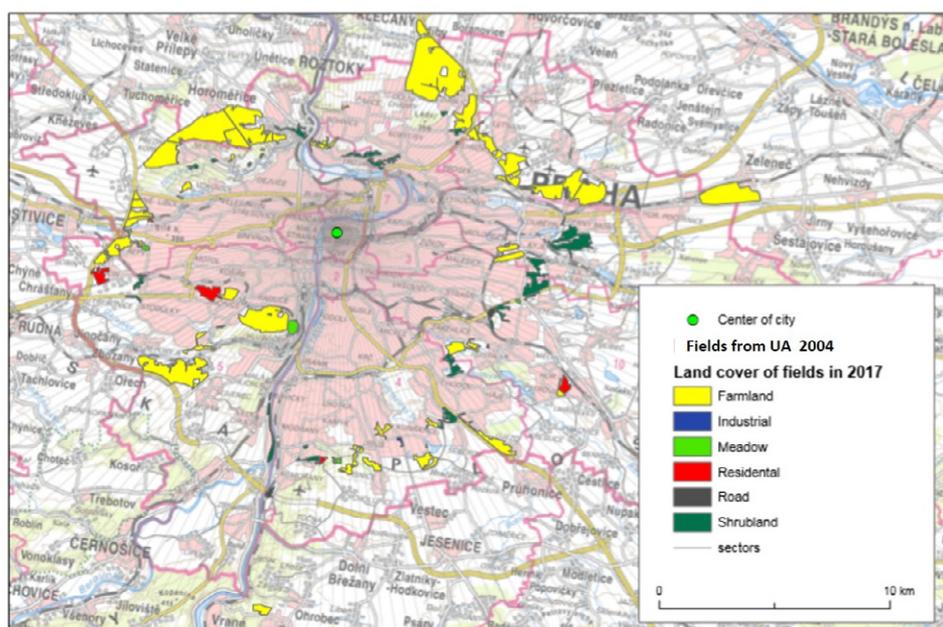


Figure 7: Compare fields between 2004-2017 with sectors.

Using the previous maps, 95 farmlands from the year 2004, were compared with the same map in 2017 to deduce changes as follows:

- 41 from 95 = no change (still farmlands as function).
- 34 from 95 = shrublands.
- 6 from 95 = residential areas
- 6 from 95 = Meadows.

- 1 from 95 = Industrial areas. (Tables 1 and 2) & (Figure 8).

Some of them have a mixed change with less percentage. Some of the shrublands are just the first step to the development of the area. We should distinguish just 3 general types of change [43,44]:

- 1) No change
- 2) Development (residential, industrial, etc.)

Table 1: The detailed results for changes year 2004-2017.

ID	2004	2017	Changes	Area	ID	2004	2017	Changes	Area
1	Farmland	Shrubland	No change	0.243	51	Shrubland		Shrublands	0.004
2	Road	Shrubland	Development	0.106	52	Farmland		No change	0.422
3	Shrubland		Shrublands	0.127	53	Farmland		No change	0.074
4	Residential	Shrubland	Development	0.063	54	Farmland	Road	No change	0.016
5	Meadow		Greening	0.067	55	Shrubland	industrial, farmland	Shrublands	0.809
6	Farmland	Shrubland, no change	No change	0.192	56	Farmland		No change	0.301
7	Shrubland	Residential	Shrublands	0.02	57	Farmland		No change	0.106
8	Farmland	No change	No change	0.214	58	Farmland		No change	0.207
9	Farmland	meadow, residential, shrubland	No change	0.076	59	Shrubland	Meadow	Shrublands	0.051
10	Farmland	Residential, shrubland	No change	0.38	60	Shrubland	residential	Shrublands	0.031
11	Meadow	Road	Greening	0.005	61	Shrubland	Residential	Shrublands	0.016
12	Industrial		Development	0.043	62	Shrubland	Farmland, residential	Shrublands	1.058
13	Shrubland		Shrublands	0.262	63	Farmland		No change	0.039
14	Farmland	no change	No change	0.166	64	Farmland		No change	1.14
15	Shrubland		Shrublands	0.015	65	Shrubland		Shrublands	0.018
16	Farmland	Residential, meadow	No change	0.1	66	Shrubland		Shrublands	0.016
17	Shrubland		Shrublands	0.046	67	Farmland		No change	0.013
18	Meadow		Greening	0.017	68	Shrublands	meadow, residential	Shrublands	0.174
19	Farmland	Meadow	No change	0.598	69	Farmland		No change	0.545
20	Shrubland		Shrublands	0.202	70	Shrubland		Shrublands	0.077
21	Farmland	Meadow	No change	2.14	71	Farmland		No change	0.156
22	Farmland	meadow, shrubland	No change	0.235	72	Farmland		No change	0.048
23	Shrubland	Meadow	Shrublands	0.019	73	Farmland		No change	0.111
24	Shrubland	Industrial	Shrublands	0.166	74	Farmland	Shrubland	No change	0.077
25	Shrubland		Shrublands	0.058	75	Shrubland		Shrublands	0.118
26	Farmland		No change	0.076	76	Shrubland		Shrublands	0.016
27	Shrubland		Shrublands	0.126	77	Shrubland		Shrublands	0.068
28	Residential		Development	0.229	78	Farmland	Shrubland	No change	0.119
29	Meadow	Shrubland	Greening	0.232	79	Farmland		No change	0.055
30	Shrubland		Shrublands	0.018	80	Farmland		No change	2.301
31	Farmland	Meadow	No change	1.752	81	Shrubland		Shrublands	0.209
32	Shrubland		Shrublands	0.01	82	Farmland	Residential	No change	0.98
33	Farmland	Shrubland	No change	0.351	83	Farmland		No change	1.651
34	Shrubland		Shrublands	0.082	84	Farmland		No change	1.547
35	Residential		Development	0.011	85	Farmland		No change	0.678
36	Residential	Farmland, meadow	Development	0.337	86	Farmland	Shrublands	No change	0.1
37	Shrubland	Residential	Shrublands	0.035	87	Farmlands		Shrublands	0.01
38	Farmland	Shrubland	No change	0.09	88	Shrublands		Shrublands	0.088
39	Residential	Shrubland, farmland	Development	0.465	89	Farmland		No change	0.023
40	Farmland	Shrubland	No change	0.261	90	Farmland		No change	1.776
41	Farmland	Shrubland	No change	0.197	91	Farmland	Industrial	No change	0.157
42	Shrubland	Meadow	Shrublands	0.046	92	Farmland	Shrubland	No change	0.373
43	Meadow		Greening	0.054	93	Shrubland		Shrublands	0.038
44	Road	Shrubland, meadow	Development	0.105	94	Farmland		No change	0.781
45	Farmland	Shrubland	No change	0.558	95	Farmland		No change	4.816
46	Shrubland	Roads	Shrublands	0.175					
47	Meadow		Greening	0.03					
48	Residential		Development	0.022					
49	Farmland	shrubland	No change	0.238					
50	Shrubland		Shrublands	0.034					

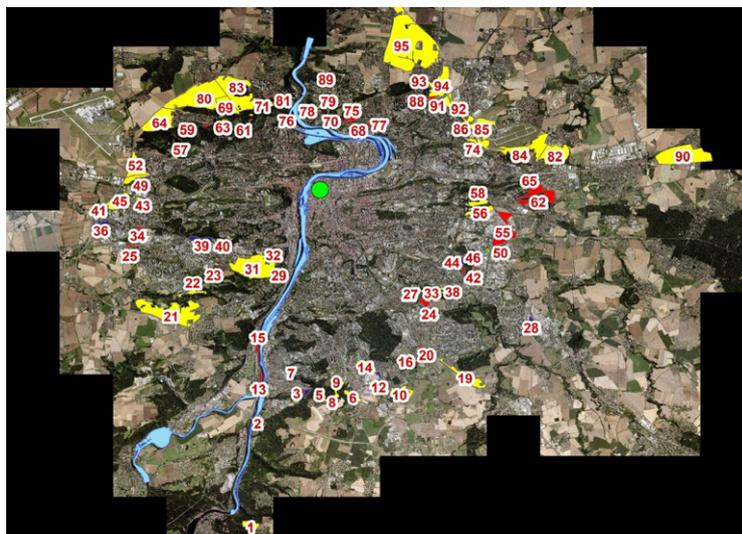


Figure 8: Changes in farmlands on Orthophoto of the city of Prague between 2004-2017.

Table 2: The kinds and areas of changes of farmlands between 2004-2017.

ID	Number of polygons	Area (ha)
Development	9	1.3808
Greening	6	0.40464
no change	46	26
Shrublands	34	4

Number of polygons in categories

■ development ■ greening ■ no change ■ Shrublands

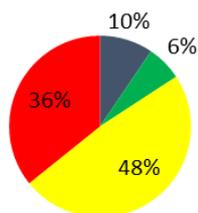


Figure 9: Charts of the percentage of polygons in total.

3) Greening (meadows, afforestation, natural succession...)

Two charts made to show the changes in relative years as follows (Figures 9 and 10)

As a result, the part of shrublands will be afforestation and the rest will be the first stage of development (temporal abandonment). About 50% of the land had no change and this shows the saving of land tenure affected land use and gives future ability to create applications of sustainable development.

Despite that Prague is one of the greenest cities in Europe [45-57] thinking of making sustainability a lead to develop the city in its future vision in planning and environmental protection will make the city going steps further than other cities especially in emergency crises (social, environmental, economic crises) [58-73].

Area of categories

■ development ■ greening ■ no change ■ Shrublands

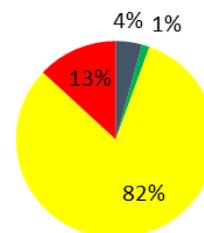


Figure 10: Charts of changes of polygons in total.

Note: The next step for the work for interested ones in this field is to distinguish which shrublands are developing areas and which are afforested areas.

Conclusion

Related to the development of the land tenure in the city of Prague affected by the nature of the landscape of the city, and the increasing numbers of people migrating from the countryside to the city and their need for new residential areas that changed the land use as we see now. The results showed that agriculture and farmlands located in the surrounded buffer areas of the city and some of them located in the inner city, have no change in land use, this gives the city opportunities to developed. opportunities to develop related to the needs. The results show that some agriculture and farmland still in need to be invested, this is important for the future of sustainability in the city, meeting society's needs in food and textile. Developing sustainable food systems contributes to the sustainability of the human population. Protection of the natural resources is one of the roles of land tenure to lead to sustainable development, and this can be achieved related to the location and use of the lands especially the green areas; on the other hand, reducing pollution from city resources so important and must be taken in consideration in dealing with lands like green areas, water resources and other. These changes

through the time is not a simple process; it is complicated and applied in many levels from the design of residential areas to planning and creating strategies for future land use plan, affecting on the economy and society as well to create a balanced place to live in between what you have and what you look for not only for now, also for future vision. It is an application of sustainable development in our details and everyday life for us and the coming generations as well.

References

1. Thornicroft M (1974) The economic reality. *Built Environment*.3:17-18.
2. Wehrwein G (1942) The rural-urban fringe. *Economic Geography*, 18:217-228.
3. Parsons H (1951) Land Reform and Agricultural Development in International Conference on Land Tenure and Related Problems in World Agriculture.
4. Louisvan G (2009). What tenure security? The case for a tripartite view. *Land Use Policy* Elsevier. 27: 449-456
5. Wickramasuriya R, Chisholm L, Poutinen, M (2011). An automated land subdivision tool for urban and regional planning, Concepts, implementation and testing environmental modelling. *Software*.26:1675-1684.
6. Eastman J, Toledano J (2018) A short presentation of the Land Change Modeler (LCM). In *Geomatic approaches for modeling land change scenarios*.28:499-505.
7. Williamson I, Enemark S, Wallace J, Rajabifard A (2009). *Land Administration for Sustainable Development California*. ESRI Press.
8. Muinde D (2013) Assessing the effects of land tenure on urban developments in Kampala. University of Twente Faculty of Geo-Information and Earth Observation (ITC).
9. Nsiah-Gyabaah K (2005) Polytechnic education in Ghana: The past, the present and the future. In *Kick-off Conference: NPT/UCC Project on Building Management and Leadership Capacity in Polytechnics*, University of Cape Coast
10. Mukoko S, Supriharjo R (1996). "Low-income Housing in Growing Urban Economies. A Case-study of Surabaya." Indonesia, United Nations Centre for Regional Development (UNCRD), Nagoya, Japan
11. David E, Giles C, Giles C (1996) A framework for reforming urban land policies in developing countries. Washington, DC. World Bank.
12. Wubalem F (2000) "Deficits of formal urban land management and informal responses under rapid urban growth, an international perspective." *Habitat International* 24:127-150.
13. Payne G. (2001). Urban land tenure policy options: titles or rights? *Habitat International*.25:415-429.
14. Payne G (2007) *Urban Land Tenure and Property Right in Developing countries; A Review*. London: Intermediate Technology Publications.
15. Dale P, Laughlin J (2000) *Land administration*. Oxford University Press.
16. FAO (2002) Land tenure and rural development Retrieved
17. Simpson J, Sullivan M (1984) Planning for institutional change in utilization of Sub-Saharan Africa's common property range resources. *African Studies Review*. 27:61-78.
18. Deininger K (2003) *Land Policies for Growth and Poverty Reduction*. Washington DC: The World Bank & Oxford University Press.
19. Lai L (1997) Property rights justifications for planning and a theory of zoning. *Progress in Planning*, 3:161-245.
20. Habitat U (2012) *State of the World's Cities 2008/9: Harmonious Cities*. Routledge.
21. Farley K (2011) Changes in land use, land tenure, and landscape fragmentation in the Tijuana River Watershed following reform of the ejido sector. *Land Use Policy*.29:187-197.
22. Brouwer F, Thomas J, Chadwick M (eds.) (1991). *Land Use Change in Europe: Process of Change*. Environmental Transformations and Future Patterns. Dordrecht: Kluwer Academic Publishers.529
23. Marsh G (1965) *Man, and Nature, or the Earth as Modified by Human Action*. Cambridge, MA: Belknap Press of Harvard University Press.537
24. Blaikie P, Brookkfield H (1987) *Land Degradation and Society*. London: Routledge. [This is an example socio-political and institutional analysis of the causes of land degradation].296
25. FAO (2016) Agriculture Organization, Livestock Primary. Food and Agriculture Organization of the United Nations.
26. Ludek H, Karel T (2019) Historical development of land ownership in the Czech Republic since the foundation of the Czechoslovakia until present. *Czech University of Life Sciences Prague, Czech Republic. Agric. Econ. – Czech*.216: 528-536.
27. Krčilková V (2016) Land tenure as a factore underlying agricultural landscape changes in Europe: A Review. *Czech University of Life Sciences Prague, Faculty of Environmental Sciences, Prague, Czech Republic*. 47
28. Briassoulis H (2000) *Analysis of the cause of Land Use Change: Theoretical and Modelling. Approaches*. The web book of Regional Science, Scott Lveridge. Institute. West Virginia University.
29. Oxford university Press (1987) *World Commission on Environmental and Development Our Common Future*.355
30. FAO (1999) *Thésaurus multilingue du foncier: version française*. Rome.
31. Herrera A (2000) *New approaches to land reform*. Rome
32. FAO (2002) *Gender and access to land* Retrieved
33. FAO (2002) *Land tenure and rural development* Retrieved
34. GTZ (1998) *Land tenure in Development Cooperation: Guiding Principles*. Wiesbaden, Universum Verlagsanstalt.
35. Christophers B (2010) On voodoo economics: theorising relations of property, value and contemporary capitalism, *Transactions of the Institute of British Geographers*.35:94 –108.
36. FAO (2018) *Statistical Yearbook of Prague*.
37. Spackova P, Jichova J, Riska M (2012) prognóza demografického vývoje suburbánní zóny prahy.
38. Kuca P (2002) *Charles, Cities and Towns in Bohemia, Moravia and Silesia*, Prague: Libri.
39. Zeman P, Benes C (2014) Peri-urbanisation, counter-urbanisation, and an extension of residential exposure to ticks: A clue to the trends in Lyme borreliosis incidence in the Czech Republic? *Ticks and tick-borne diseases*.5:907-916.
40. Kabrhel J (1980) *Basics of Agricultural Politics of Communist Party of Czechoslovakia*. Svoboda, Prague.
41. IPR Prague (2014) *Spatial Analytical Documentation of the Capital City of Prague*.
42. Sklenicka C (1917) How long do floods throughout the millennium remain in the collective memory? *Nature Communications*.1105:1-9
43. IPR Prague (2015) *geographical data of the capital m. Prague in the form of Open Data*.
44. Ball M (1977) Differential rent and the role of landed property, *International Journal of Urban and Regional Research*.1: 380-403.
45. Bromley D (1992) *Making the commons work*. San Francisco, Institute for Contemporary Studies.
46. Bruce J, Migot-Adholla S (1993) *Searching for land tenure security in Africa*. Dubuque, IA, Kendall Hunt Publishing Company.
47. Bryson R (1990) The property industry. *Geography*.75:368-371.
48. Cairncross A (1934) *The Glasgow building industry, Review of Economic Studies*.11:1-17.
49. Coakley J (1994) The integration of property and financial markets, *Environment and Plannin*.26: 697-713.
50. De Soto H (2000) *The mystery of capital*. New York, Basic Books.677.
51. Dorner P (1992) *Latin American land reforms in theory and practice*. Madison, WI, University of Wisconsin Press. 45: 169-171
52. Farvacque C, McAuslan P (1992) *Reforming urban land policies and*

- institutions in developing countries Urban Management Programme. Washinton
53. Feder G, Feeny D (1991) Land tenure and property rights: theory and implications for development policy. *The World Bank Economic Review* 5:135-153.
54. Feder G, Onchan T, Chalamwong Y, Hongladarom C (1988) Land policies and farm productivity in Thailand. Baltimore, MD, Johns Hopkins University Press.
55. FAO (1995) Planning for sustainable Use of Change. Environmental Transformations and Future Patterns. Dordrecht: Academic Publishers.529
56. Ghonemy R (1998) Affluence and poverty in the Near East. London and New York, Routledge.
57. Guironnet A, Attuyer K, Halbert L (2016) Building cities on financial assets: the financialisation of property markets and its implications forcity governments in the Paris city-region, *Urban Studies*.53:1442–1464.
58. Albert Z (1959) "A Multiple Land Use Classification System", *Journal of the American Planning Association*.25:143–150.
59. Halbert L, Attuyer K (2016) Introduction: the financialization of urban production: conditions, mediations and transformations, *Urban Studies*.53:1347–1361.
60. Hardin G (1968) The tragedy of the commons. *Science* 162:1343-1348.
61. Historický A (2017) Landscapes. *Science*.163: 133-134
62. Lamarche F (1976) Property Development and the Economic Foundations of the Urban Question.*Urban Sociology*.85–118
63. Macpherson B (1999) Property: mainstream and critical positions. Toronto, University of Toronto.
64. Palmer D (1999) Making land registration more effective. SD-Dimensions.
65. Prosterman R, Riedinger J (1987) Land reform and democratic development. Baltimore, Johns Hopkins University Press.313:29-50
66. Stockholm, Geneva (1987) HDP (International Geosphere/Biosphere Programme), Report No.35
67. Turner B, Meyer W (1994) Changes in Land Use and Land Cover: A Global Perspective. Cambridge: Cambridge University Press. 713
68. Turner B, Skole D, Sanderson S, Fischer G, Leemans R (1995) Land Use and Land Cover Change; Science/ Research Plan. IGBP (International Geosphere/Biosphere Programme).
69. Turner B, Richards J, Mathews J, Meyer W (1990) The Earth as Transformed by Human Action: Global and Regional Changes in the Biosphere over the Past 300 years. Cambridge: Cambridge university press.
70. UNECE (United Nations Economic Commission for Europe) (1996) Land Administration Guidelines. New York and Geneva: United Nations.
71. Van Asperen P, Zevenbergen J (2007) Can lessons be learned from improving tenure security in informal settlements? Paper presented at ENHR International Conference 'Sustainable Urban Areas.25-28
72. Weber R (2010) Selling city futures: The financialization of urban redevelopment Policy. *Economic Geography*.86:251–274.
73. Wilson D (1991) Urban change, circuits of capital and uneven development, *The Professional Geographer*.43:403–15.

Author Affiliation

[Top](#)

¹Department of Land Use and Improvements, Czech University of Life Sciences, Prague-Suchbát, Czech Republic

²Department of Spatial Planning, Czech Technical University, Prague, Czech Republic