RESEARCH PAPER

Determine the land and capability classification of soil: A Case Study Kohgiluyeh and Boyer-Ahmad

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Abstract

The aim of this study is to determine the land capability of the Posht Taveh area in Kohgilouye and Boyer-Ahmad province through soil taxonomy using American method. This study sought to determine constraints and capability resource of land for different uses. This research were conducted with four stage preliminary, field, experiments and complementary. In the preliminary stage topographic maps, aerial photographs and geological maps were prepared and used for analysis and interpretation. In the field stage the soil profiles were worked out and described. The samples of all the layers were collected for soil profile, physical and chemical analysis. Finally, soil classification was done based on the American method. The results showed that the soil in the region in all the work units were in Entisols Category and two of them are in the subgroup Aridic Ustorthent and others are in Ustifluvent Aridic. These soil is composed of new material mothers and it is possibly detected as a youth soil and lack of natural genetic horizons.

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Introduction

Genetic rankings of the soil for the first time, was proposed by Dokuchaev, a Russian scientist. Later, it was developed by European and American of Soil Science (Roca and Pazos, 2002). The rankings are based on certain soil morphology (shape and structure) that was based on the result of soil factors, (Jafari, 1959). This classification method development reached its peak in 1949 and used for soil science (especially in the United States) and continued until 1960 (Amirian Chekan, 2003). In 1960 the Ministry of Agriculture United States published soil classification system. In this classification system, emphasis was placed on the soil morphology, and the emergence or the underlying constituents of the soil so that the old classification, were less concerned (Ayyobi and Jalalian, 2006). From 1960 onwards soil classification system development has gained a comprehensive system and then published the Soil Taxonomy in 1975. In this study to classify soils in the study area, this soil classification system was used (Keys for soil taxonomy, 2006). Today, for the prevention of human poverty and land destruction, we must cope with nature and as much as possible not to exploit productive potential of land. In addition to the use of land planing based on the land use, estimation of land according to the human social and economic needs are necessary (Makhdoom, 2001). Soil erosion is a global problem that seriously threatens the Iran's soil and water resources. To form 1 cm of soil, length of time it takes 300 years (Tripathi, 2001). Kind of exploitation of land is a very important factor in erosion and sediment yield of the land (Kassas, 1983). Lack of care and appropriateness of the land, disruption of the proper functioning and watershed in the world (Grigsen *et al.*, 2009), land-use planning, systematic assessment of the land and water for different uses of the land, are taken into account for studying economic and social conditions, and choose and implement the best options for land use (FAO, 1993). In a broad sense, the context for land use and development within a set of controls permits development rights and full control over planning (Rydin, 2003).

New American Classification based on morphological properties of the soil having 6 levels from top to bottom are used: Order, Suborders, Great groups, Subgroups, Families, and Series. American soils in the rankings are divided into 12 categories. There are divided each Order has several Suborders, each Suborders has several Great groups, each Great groups has several Subgroups, each Subgroups has several Families, each Families has several Series. Each of these levels of classification has been divided into lower levels based on a series of features (Keys soil taxonomy, 2006).

The aim of soil studies and assessment of land capability, diagnosis and determination of the land capability for correct operation and principles are according to their capabilities and limitations of lands. Before any construction project, breeding and agriculture, should be examined in the land resources and that be determined according to the project, their talent and ability. And to the foundation's programs, they are based on sound scientific principles. In this study, will be highlighted the talent identification and the ability to use of land for agriculture use, range land use, forest use and so on.

Material and methods

Geographical location of the study area

Posht Taveh watershed has an area of 1070 ha located in the Bahmaie Kohgiluieh city and southwest of Iran. Areas have been along 50° 8' 21" to 50° 10' 45" longitude and 30°52'16 " to 30°56' 54" latitude. The highest point in the watershed is 2205 m and a minimum height of 560 m and slope of the area is 26.5% (Fig. 1). Climate of the region were determined dry using the method Emberger and Domarten. The study area consists of Mesozoic formations such as Gurpi, Ilam Sarvak, Asmari and Formation from the time of the fourth is like the Quaternary. Geological formations in the region based on the age include: Ilam Sarvak, Gurpi, Pabdeh, Asmari and Quaternary. The Posht Taveh watershed has been the great diversity of topographic. So that according to the hypsometric map of the studied area, the lowest in the output height of 560 m and the highest altitude is of 2205 m.

There are a variety of geological formations with different topography of the area and has created a variety of landforms. The evacuation of alluvial deposits and colluvium by drainage area for the middle alluvial terrace in the center area of the field is the most important topographical feature. The existence of an index alluvial fan in the output as a result of the discharge of sediments upstream from topographic effects is important.
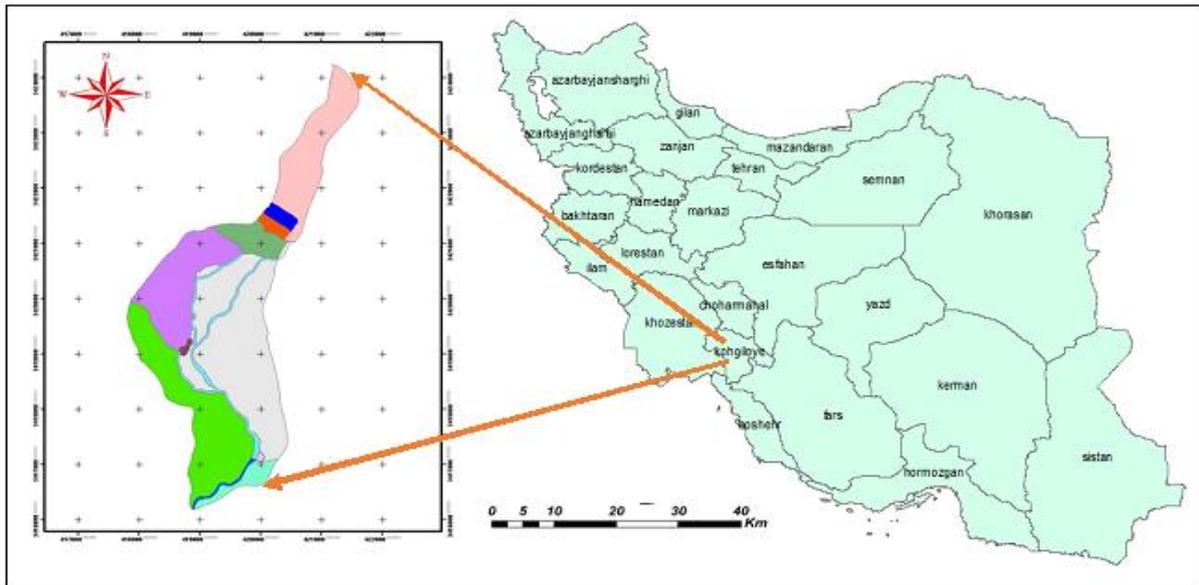
Fig. 1. Location of the study area Posht Taveh, Kohgiluyeh and Boyer-Ahmad.

Research methodology

Soil and land capability assessment studies of the Posht Taveh watershed during four stages *viz.* preliminary, field, experiments and complementary that offered a detailed explanation of each stage.

Preliminary studies

Collection of information: A series of public information were collected, including reports, geological maps, pedology, hydrology, vegetation, socio - economic, weather statistics and other regional public information that could be helpful and effective in carrying out relevant studies.

The preparation of 1: 50,000 topographic maps and implementation of the study limited area, and determining latitude and longitude on the desired area.

Fixing the aerial photograph scale of 1: 40,000. Determination of the scope of the study area on geological maps and aerial photos, and the interpretation of aerial photographs and delimitation of structures to achieve work unit. Specifying work units of slope, formation and geomorphology maps.

Field study

This phase of the study is to conduct operations in the field with the following objectives:

Control the boundaries of isolated and comparing them with maps and interpretation there with multiple visits to different parts of the watershed.

Determining profiles of each working unit for drilling profiles, study and separation of soils using the map formation, type and work unit.

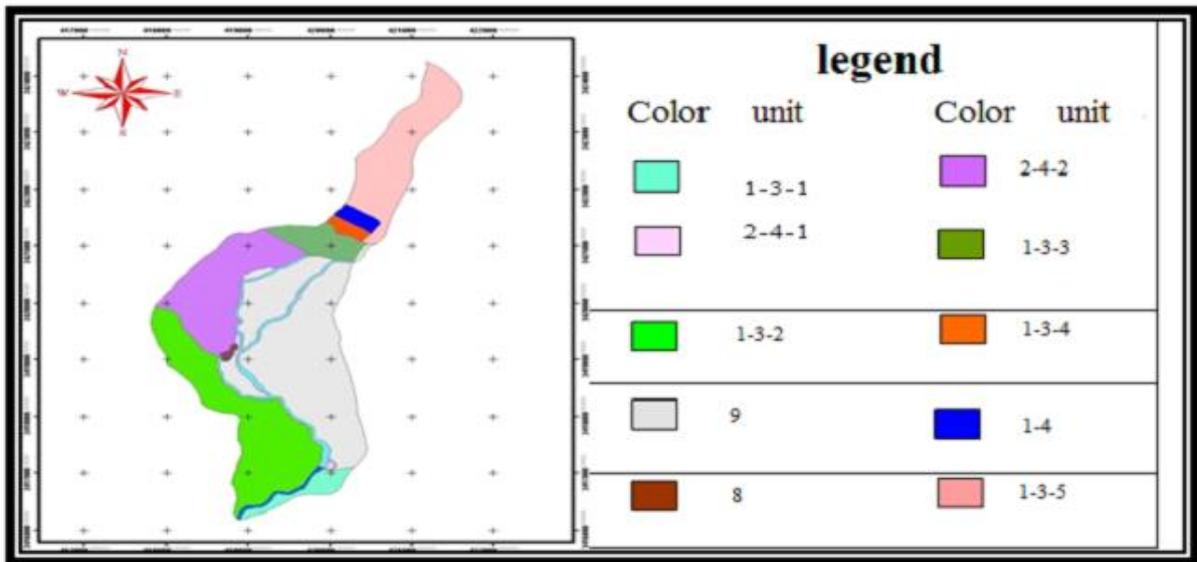Samples of water from rivers, wells and springs in the region.

Fig. 2. Working unit maps in the Posht Taveh- Kohgiluyeh and Boyer Ahmad.

Assessing how soil formation and their ingredients.

Study vegetation cover and collecting plant samples to identify.

Collection of samples of rocks to identify the region in terms of geology.

Characterization and study of field control profile in any work unit (Geology, vegetation cover, soil erosion, topography).

Sampling from different horizons and a full explanation of the profiles in each work unit and complete profiles were described serially.
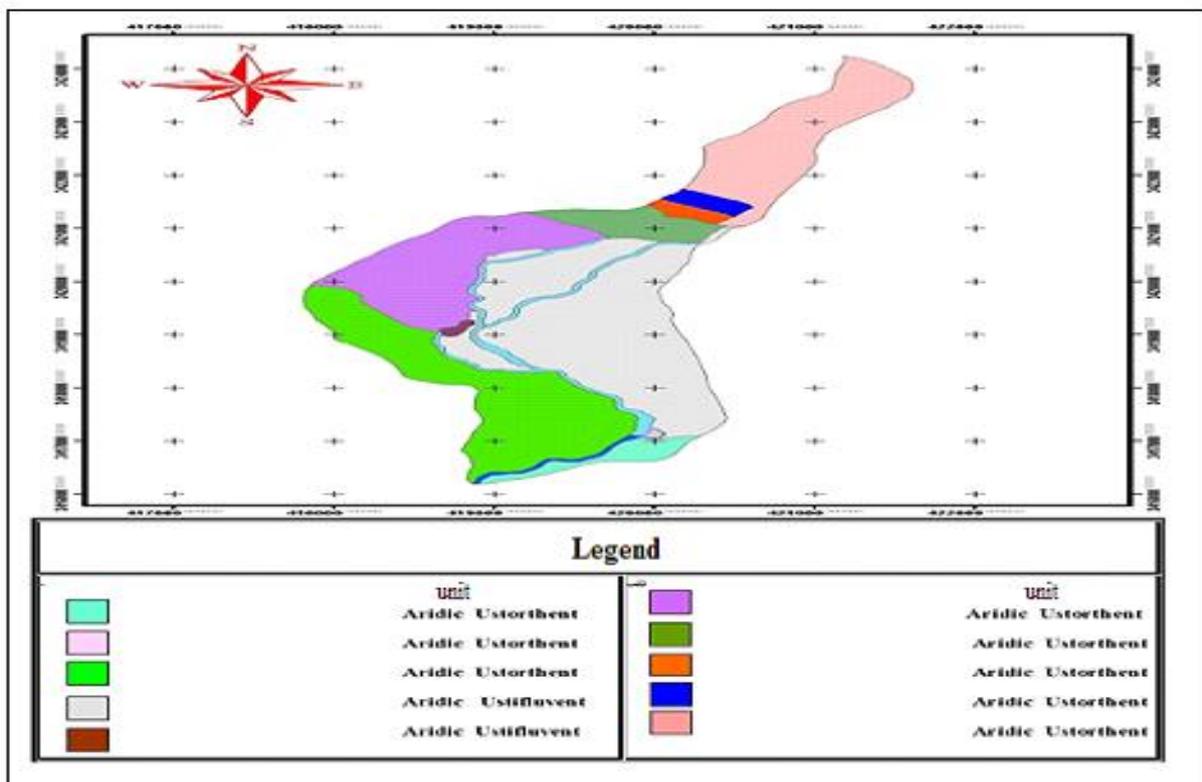

Fig. 3. Subgroup soil zoning of work units in Posht taveh area.

Laboratory studies

Soil samples taken from different parts of the study area was transferred to the laboratory And after drying, banging and sifting reject of 2mm, were made tests to determine the salinity (EC), PH, organic matter, texture, lime and gypsum.

Complementary studies and concluded

Following the studies, the field operations and interpretation were done.

Determination of thermal regime and soil moisture with surface characteristic depth horizons.

Rankings of soil at each work unit using American method (Keys Soil Taxonomy, 2006) as a subgroup.

Result and discussion

Determination of the work units

With geological formations map, slope and geomorphology map was prepared (Fig. 2).

The area physiographic units and its characteristics are given Table 1.

Table 1. Physiographic units of Posht Taveh.

Area (ha)	Slope (%)	Land types	Land unit	Formation type
3.52	5	Fan-shaped coarse debris	8	Quaterner
71.68	6	Fans of river gravel	9	
13.78	50	Mountain	1-4	Gurpi
11.23	50	Mountain	1-3-4	Pabdeh
158.22	>60	Mountain	1-3-5	Ilam Sarvak
1.57	20	Mountain	2-4-1	Gach-saran
167	20	Mountain	2-4-2	
28.27	30	Mountain	1-3-1	Asmari
230.43	50	Mountain	1-3-2	
46.9	50	Mountain	1-3-3	

For the classification of an area of soil, moisture and thermal regimes surface and depth soil horizons are specified. Soil moisture regime in the study area (Posht Taveh) was diagnosed as Ustic, on the map soil moisture regime in Iran. That is between the moisture regime of Aridic and Udic. The concept is that it caused moisture limits. But when moisture is present, the conditions are proper for plant growth. Thermal regime in the study area is hyperthermic on the map temperature due to regime soils of Iran. Hyperthermic thermal regime of the soil in the annual average temperature is 22°C or over that, sometimes the average temperature difference between summer and winter is at a depth of 50 cm, from the soil surface or on the border of stone or stone-like it's over 6 °C.

Horizons identified in the Posht Taveh area are A and C. A horizon, a horizon eluvial and dark color of it due to organic matter. This horizons high biological activity is due to ventilation, high organic matter and nutrients. In this horizon, it is usually clay, Fe, Al, minerals such as quartz transferred and remained as resistant particles. The horizons or layers are not hard cement of bedrock. Paedogenese process have little impact on them and it lacks features of the horizons B, E, A, O.

Identification of surface horizons in the study area (Posht Taveh)

Identifying surface horizon in study area is Ochric Epipedon. Ochric is taken from the Greek word meaning pale. This epipedon due to properties such as light-colored, (High-value, chroma) low thickness,

low organic matter, high coefficient, dry, mass and hard building, but cannot be considered as a component epipedon of malic, Ambric, Histic or anthropic. Subgroups of soil zoning in the study area is shown in Figure 3.

Soil classification in the 1.3.1 unit
This unit is located in Entisols soil. This category includes undeveloped or less developed soil horizon in Pedogenic. This unit has Ocric epipedon, and are generally horizons A and C and Lacking B. This unit is placed at Orthents suborders. Wich will be formed on eroded new surface. A few of them are formed in new wind sediments and debris caused by landslides and mud movement. There are created in any climate and any vegetation condition. The soil are not formed in areas with Aquic conditions, high levels of groundwater, fixed and moving sand hills. Because the moisture regime is Ustic, this group unit is Ustorthent.

Soil classification in the 2.4.1 unit
This unit has Ocric epipedon and lack of horizon depth, according to the horizon moisture and thermal regime, soil is placed in Entisols. In this unit, soil is a little evolution due to the relatively high slope Gachsaran, dry climate of the region, and rock outcrops. Regular decrease in organic matter with increasing depth and slope; soil, suborders of this unit is placed as Orthent. And because moisture regime is Ustic, great group of area is Ustorthent. Because the thermal regime is hyperthermic and humidity control in normal years or all parts when the soil temperature at a depth of 50 cm more than eight degrees, cumulative wet is less than 180 days, the great group will be in the Aridic Ustorthent subgroup.

Soil classification in the 2.3.1 unit
The unit has Ocric epipedon and lack of horizon depth. According to the horizon thermal and moisture characteristic, soil is placed in Entisol. Regular decrease in organic matter with increasing depth and slope of more than 25% of the units are placed suborder Orthent.

Because the thermal regime is hyperthermic, and humidity control in normal years some or all parts, is wet lower than 180 cumulative days, when the soil temperature at a depth of 50 cm, more than 8 degrees, and the great group placed in Aridic ustorthent subgroups.

Soil classification in the 9 unit
The unit has Ocric epipedon and lack of horizon depth. According to the horizon thermal and moisture characteristic, the soil is placed in Entisol. It is in the Fluvent subgroup as the soil colour is brown to red. There are new water deposits, including floodplains, alluvial fans and deltas of rivers. Because the soil moisture regime is Ustic, great group is Ustifluvent. Because the thermal regime is hyperthermic, and humidity control is normal in years some or all parts, are wet lower than 180 cumulative days. When the soil temperature is at a depth of 50 cm, more than 8 degrees, and the great group is placed in Aridic Ustifluvent subgroups.

Soil classification in the 8 unit
The unit has Ocric epipedon and lack of horizon depth. According to the horizon thermal and moisture characteristic, soil is placed in Entisol. The units are placed in the suborder Orthent. Because the moisture regime is Ustic, great group is Ustorthent. Because the thermal regime is hyperthermic, and humidity control in normal years some or all parts, are wet lower than 180 cumulative days, when the soil temperature at a depth of 50 cm, more than eight degrees, and the great group is placed in Aridic Ustorthent subgroups.

Soil classification in the 3-3-1 unit
This unit has Ocric epipedon and lack of horizon depth. According to the horizon thermal and moisture characteristic, soil is placed in Entisol. Regular decrease in organic matter with increasing depth and slope of more than 25% of the units and are placed in the suborder Orthent. Because the soil moisture regime is Ustic, great group is Ustorthent. Also, the thermal regime is hyperthermic, and humidity control in normal years with some or all parts,

are wet lower than 180 cumulative days. When the soil temperature is at a depth of 50 cm, more than eight degrees, and the great group is placed in Aridic Ustorthent subgroups.

Soil classification in the 4-3-1 unit
This unit has Ocric epipedon and lack of horizon depth. According to the horizon thermal and moisture characteristic, soil is placed in Entisol. Regular decrease in organic matter with increasing depth and slope of more than 25% of the units and are placed in the suborder Orthent. Because the soil moisture regime is Ustic, great group is Ustorthent. Also, the thermal regime is hyperthermic, and humidity control in normal years with some or all parts, are wet lower than 180 cumulative days. When the soil temperature is at a depth of 50 cm, more than eight degrees, and the great group is placed in Aridic Ustorthent subgroups.

Soil classification in the 4-1 unit
The unit has Ocric epipedon and lack of horizon depth. According to the horizon thermal and moisture characteristic, soil is placed in Entisol. Regular decrease in organic matter with increasing depth and slope of more than 25% of the units and are placed in the suborder Orthent. Because the soil moisture regime is Ustic, great group is Ustorthent. Also the thermal regime is hyperthermic, and humidity control in normal years with some or all parts, are wet lower than 180 cumulative days, when the soil temperature at a depth of 50 cm, more than eight degrees, the great group is placed in Aridic Ustorthent subgroups.

Soil classification in the 5-3-1 unit
The unit has Ocric epipedon and lack of horizon depth. According to the horizon thermal and moisture characteristic, soil is placed in Entisol. Regular decrease in organic matter with increasing depth and slope of more than 25% of the units and are placed in the suborder Orthent. Because the soil moisture regime is Ustic, great group is Ustorthent. Also, the thermal regime is hyperthermic, and humidity control in normal years with some or all parts, are wet lower than 180 cumulative days,

when the soil temperature at a depth of 50 cm, more than eight degrees, the great group is placed in Aridic ustorthent subgroups. Oji (2005) did study to identify, formation and classification of soils on Azad University lands in Fasa. Their study showed that there soils have xeric moisture regimes and Inceptisol order. Noormandi pour *et al* (2012) in their study for Classification and mineralogy of the area Kashkooeh - Anar in Kerman province, concluded after field investigation, and identified that the area is with Gypsic, Salic and Natric horizon. Moravvej *et al* (2003) in their study used satellite images to classify soils Varamin plain. According to the American method, Soils, were classified into two order Entisol and Aridisols.

Conclusion
Final goal of soil taxonomy are meet due to the maximum utilization of land for human demands. This requires grouping of similar soil in order to get the maximum agricultural products. In addition, soil properties that can be used to determine embedding of water pipes, gas, roads, parks and recreation centers, forestry, agriculture, native animal breeding center, buildings and etc. Soil is a complex mixture substances of biogeochemical that are used to growing plants. Soils, are activist's ecological systems who had undertaken the task of keeping plants and provide water and food for plants. On the other hand air necessary for the maintenance and growth of microorganisms that are involved in the cycle of vital substances provided by the soil. Therefore, awareness and familiarity with the characteristics and basics of soil science of soil is undoubtedly a prerequisite for the proper utilization and management of natural resources. Conservation of forest, grassland and create sustainable systems of agriculture depends on adequate knowledge of the soil. The study area of soils are in the Entisol order. The soil is composed of new material mothers and it is possibly detected as a youth soil and lack of natural genetic horizons. Genetic horizon may begin to form now. This order can be seen in all climates and found almost under any vegetation and not worth much agriculturally.

References

Amirian Chekan AR. 2003, land capability assessment booklet, Department of Natural Resources Behbahan, Shahid Chamran University, Iran.

Ayoubi S, Jalalian A., 2006. Land evaluation (Agriculture and natural resources), Press Center Isfahan University of Technology, Isfahan, Iran.

Food and Agricalture Organization of the United Nation. 1993, Guidelines for Land Use Planning, Development Series 1, ISSN: 1020-0819, Rome

Grigersen H, Failot P, Brooks K. 2009, Integrated Watershed Management (Water and Land to the People), Parvaresh H Translation, 1nd Edition, Publications University of Hormozgan. 52.p.

Jafari M. 1959. Saline soils in natural resources, the Institute of Tehran University Press, 194 pages.

Kassas M. 1983, the Global Biosphere: Conservation for Survival, Mazingira, **7(2),** 2-13 p.

Keys to Soil Taxonomy. 2006. Tenth Edition United States Department of Agriculture. 341p.

Makhdoom M. 2001, the basis for land use, Tehran University Press, Tehran, 300 pages.

Moravvej K, Sarmadian F, Mahmoudi SH. 2003. Evaluation of soil classification and mapping of the land of the plain using digital processing satellite images, Landsat TM. Iranian Journal of Natural Resources. Volume **56(3),** 177-190.

Normandy Pour F, Farpoor M, Sarcheshmeh Poor M. 2014, formation, Classification and clay mineralogy of soils in salt Kashkooyeh-Anar Kerman area. Iranian Journal of Crystallography. **23(2),** 269-280.

Oji M. 2005, study the formation and classification of soils, Journal of Crop Ecology (New Agricultural Science), Islamic Azad University of Fasa, Volume 1, Issue 2; 1 - 8.

Roca PN, Pazos MS. 2002. The WRB applied to Argentinian soils: two case studies. European Soil Bureau, Research Report No. 7. Latvia University of Agriculture, Jelgava, Latvia. 191-197 p.

Tripathi RP. 2001, Soil Erosion and Conservation, New Age International Ltd, Publishers ,New Delhi.

Yvonne Rydin, 2003, Urban and Environmental Planning in the UK, Palgrave Macmillan ,Hampshire.