Land cover statistics as a measure of natural capital distribution fairness among altered administrative territorial divisions

Artan Hysa*

Abstract

This paper presents an evaluation method for decision making processes of territorial and administrative reform. It makes a case on a comparative analysis of two sets of statistical data derived from a single land cover evidence being spatially subdivided according to the spatial pattern of two different versions of local administrative maps of Albanian territory. The comparison is focused on the distribution fairness of natural land surfaces at each spatial division. Natural landscapes are introduced as zones of ecological services, consequently as natural capital measurements.

According to the officially published criteria of the reform, the socio-cultural and economic properties are highly considered, while the environmental assets of the land are almost ignored. Bearing in mind that the *land cover* is a dimension of environmental properties of geography, by utilizing it, this paper aims to evaluate the recent Albanian territorial restructuring. The study relies on CORINE land cover (CLC) spatial data of 2012. A set of spatial statistical data have been produced per each local administrative division (36 and 61 units), utilizing ArcGIS software. A comparison between sets is performed by interpreting mainly a single inferential statistical measure, being the coefficient variation (CV).The relative standard deviation (RSD) serves to express the difference of the relative distribution behaviors of each land cover type separately.

Furthermore, the discussion on distribution fairness of natural land cover types among municipalities being responsible for managing/ benefiting from them, goes beyond the numerical facts of a coverage map. The ecological service function of each landscape type and their distribution is an important measure in calculating the natural capital of a territory. The statistical outcomes aim to serve as a judgment of the recent administrative reform. Moreover, the research gives clues on how to introduce the environmental factors of a territory in the decision-making process of an administrative territorial reform.

Keywords: Coefficient of Variation (CV), Environmental Economics, Land Cover statistics, Administrative Territorial Reform, Albania
JEL Classification: Q15

Introduction

Ecosystem services flows and natural capital stocks, as concepts, make ground for very useful methods in order to highlight, measure, and assess the degree of interdependence among humans and nature (Costanza, et al., 2014). Referring to the conceptual scheme at figure 1, Costanza, et al. (2014) have highlighted the *natural capital* and *ecological services* as fundamental mediators of human well-being. The awareness about this interconnection,

*Epoka University, Tirane, Albania, artanh@gmail.com

urges for further attention on the natural values of the territory. There are different methods of quantifying natural capital, while in this article land cover is introduced as an evidence to measure it. Among different types of land cover classes the study focuses on the natural and semi-natural landscape surfaces.

In the field of geography, *landscape* is mentioned as the external surface of the earth underneath the atmosphere, in other words, it is a noticeable expression of many dynamics in the area (Hartshorne, 1939). Land cover properties of geography may give reliable facts on the state of its natural assets and especially about natural capital capacity of the area. Even though, majorly the land cover statistics are utilized to compare and contrast the changes of the natural capital through certain temporal sequences due to land use alterations (Zhang et al., 2015), in this study they are employed to compare and contrast two spatial distribution versions of the same land cover dataset.

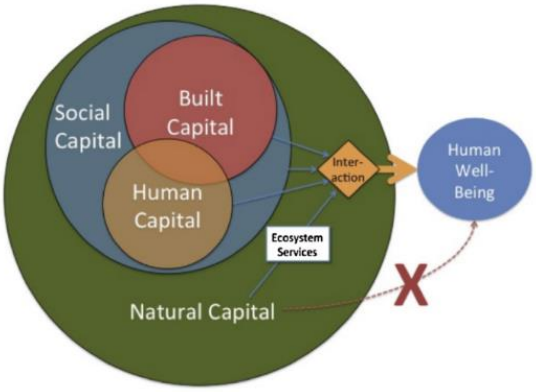


Figure 1: Interaction between built, social, human and natural capital required to produce human well-being. Built and human capital (the economy) are embedded in society which is embedded in the rest of nature. (Costanza, et al., 2014).

On the other hand, the problem of natural capital exclusion from the processes of policy making is a well debated issue in global scale (Costanza, et al., 2016). Beyond the reasonable criticism on the assignment of real market values to natural resources, there are successful efforts on considering the natural capital functions as ecological services and introducing it into agendas of policy making in developed countries. But, the case is not the same in developing geographies, where the short-term development pressures cast a total shadow on the long-run values of ecological services in the territory.

In this context, this study makes a case of evaluating the recent (2014) territorial/ administrative reform (as a policy making sample) in Albania (as a developing country). The research goes beyond a critical reading of the objectives and goals of the reform by highlighting the lack of the environmental concerns during the decision-making processes. The study relies on a statistical analysis methodology; in order to stress the importance of considering the natural assets during the decision-making process of territorial and administrative reform. This is done by statistically examining the distribution fairness of natural capital among administrative units in two different versions of spatial division of the territory. Natural and semi-natural land cover data are analyzed under two spatial distribution schemes of pre-reform and post-reform versions of Albanian territory, respectively consisting of 36 (rrethe) and 61 administrative units. As a result, via this method it can be derived a critique on the natural capital distribution fairness according to dissimilar spatial division of a region.

Albanian Territorial/ Administrative Reform in the Scope of Ecological Services

The new local administrative reform and territorial restructuring of Albania has entered into force in 2014, as a demand by the European Union in the scope of the local government decentralization (Reçi &Ymeri, 2016). Within the directives by the EU, the new administrative divisions would be responsible for the management of economic and social development of candidate countries (Ghinea & Moraru, 2006). Basically, the territory is re-organized from 36 (rreth) administrative units into 61 municipal districts (Ndreu, 2016). The core administrative unit of the pre-reform version such as "rreth" being previously reported as governmentally unfeasible (Saltmarshe, 2001) was removed. As a consequence of the reform, the institutional inter-dependency and the centralized scheme between central and local governments have been highly weakened.

The new reform is widely condemned for being politically motivated (Krasniqi, 2014). This is a common concerning developed European countries as well, such as the Netherlands (De Peuter, Pattyn, &Wayenberg, 2011). Being mainly due to the fact that changes via the administrative reforms may lead to changes in political representativeness, security of employment and prestige of political identities (Swianiewicz, 2010). Yet, the study aims to bring a critique beyond politics, based on certain measurable information derived from technical reports of the reform.

According to the report on the technical criteria of the division process, the newly proposed division highly considers the economic and social properties of the territory by bringing forward the concept of Functional Zones. The notion infers to a territorial area that is characterized by dense and substantial interaction between citizens and institutions with economic, social, development and cultural interest (MLA, 2014). Basically, any area that have a relatively considerable level of economic and cultural state, is considered to become a local administrative unit under the new division. On the contrary, the environmental concern which is principally accepted as the third pillar of an integrated sustainable development model (Giovannoni & Fabietti, 2013; Hens, 1996) is not introduced as part of the decision-making process.

While, the environmental dynamics are neglected in the recent administrative reform in Albania, some of the assets of natural capital of the territory are increasingly becoming more valuable in the new local administration law 115/2014 dated 31.07.2014(QBZ, 2014). For example, according to the new reform the management and benefiting from Forest Lands is exclusively given to the municipality governing those areas. According to the Directive by the Ministry of Environment dating June 2016, the local government can rent areas from the Forest Fund contributing directly to their institutional budgetary income (MEA, 2016). Besides the forest fund, municipalities may rent other natural lands, like grasslands, marshes, and heathlands for mainly supporting the livestock industry. All these bring new financial opportunities for local government based on the natural properties of the lands they own and are responsible of, which is something worth to be assessed.

Research Questions

The objective of this paper is based on discussing and searching for answers to the following questions;

- Can the local administrative and territorial reform be criticized/ evaluated based on the Land Cover territorial data as an evidence of natural capital properties of a geography?

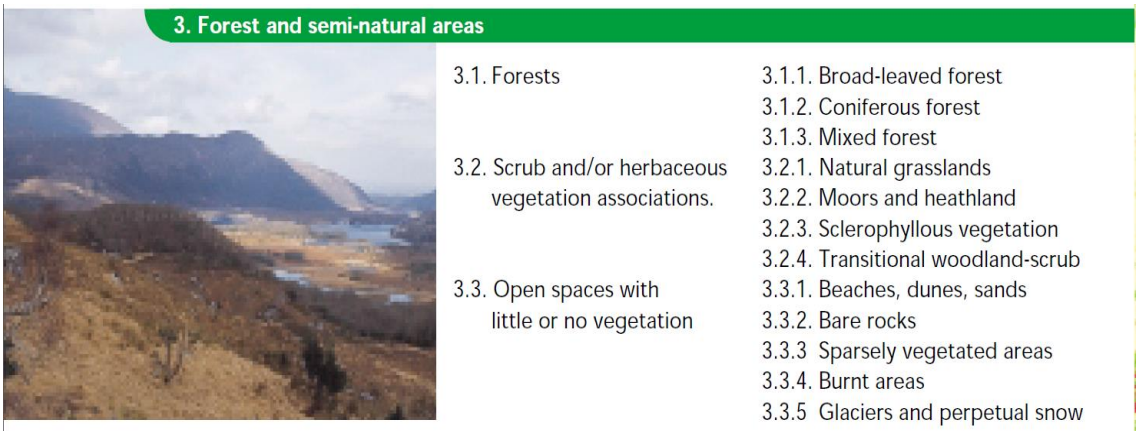
- Which administrative territorial division of Albanian territory is providing a fairer distribution of natural land cover?
- Can this method tried via Land Cover be comprehensively expended by including simultaneously parameters of social, economic, and environmental achieving multi-criteria character?
- Can this method contribute during the process of decision making in the scope of a Territorial Administrative Reform in order to provide fairer distributed natural capital among local administrative units?

Materials and Methods

CORINE Land Cover as Natural Capital Inventory

In this study, the land cover statistics are used as the specimen mean in measuring the Natural Capital of the territory. More precisely, the experiment will rely on the CORINE Land Cover (CLC) data of 2012 of Albanian territory. CLC provides structured spatial data on the land cover under certain typologies (JRC-EEA, 2005). The CLC nomenclature is structured in three hierarchical levels of surface cover types. The first divides the land surfaces into five main categories; artificial surfaces, agricultural areas, forests and semi-natural areas, wetlands, and water bodies.

Figure 2: The hierarchical typological division of Forests and semi-natural areas under CLC nomenclature (European Topic Center, 1999).



The subcategories follow detailing into two other typological sets. In figure 2, it is shown the hierarchical typological division of forests and semi-natural areas. The analytical part of this study will focus on the statistical data of the 3rd category (CLC 300, Forests and semi-natural areas) including all its subclasses. The main selection criteria is based on the high natural capital value this land surface has compared with the other types (Costanza, et al., 2011).

Spatial Statistics via ArcGIS as Measuring Medium

CLC data of Albanian territory is serving as the main input of this experiment. Open source spatial data derived from EIONET database; provide enough spatial distribution information about the land cover types of several year intervals. In this study it is decided to proceed with the data of 2012, since they coincide with the timeline of the decision making

process of the new territorial reform in Albania, happening between 2013 and 2014.The original shape file is spatially split according to two versions of administrative units utilizing the ArcGIS package, version 10.2.2. At this stage, it is produced a set of statistical tables, to be further analyzed via certain statistical interpretations, such as *relative standard deviation (RDS).*

Coefficient of Variation as a Measure of Distribution Fairness

Since the same surface area of land cover data is subdivided into two different distribution schemes, the results have to be analyzed in a relative rather than absolute method. This becomes even more crucial while the amount of subdivisions increases from 36 to 61 districts, decreasing the mean surface area of administrative units by approximately 40 %, respectively from 78488ha to 46569 ha. Thus, absolute statistical values on natural lands surface areas cannot provide ground for reliable comparative analysis.

On the other hand, the coefficient of variation (CV) or the RDS is used to measure the relative distribution of natural surfaces among different layouts of local administrative units. Furthermore, CV is advocated to fulfill the requirements for a measure of economic and distribution inequalities (Champernowne & Cowell, 1999) which adds a further dimension to the discussion on equal territorial distribution of natural resources.

Results and Discussion

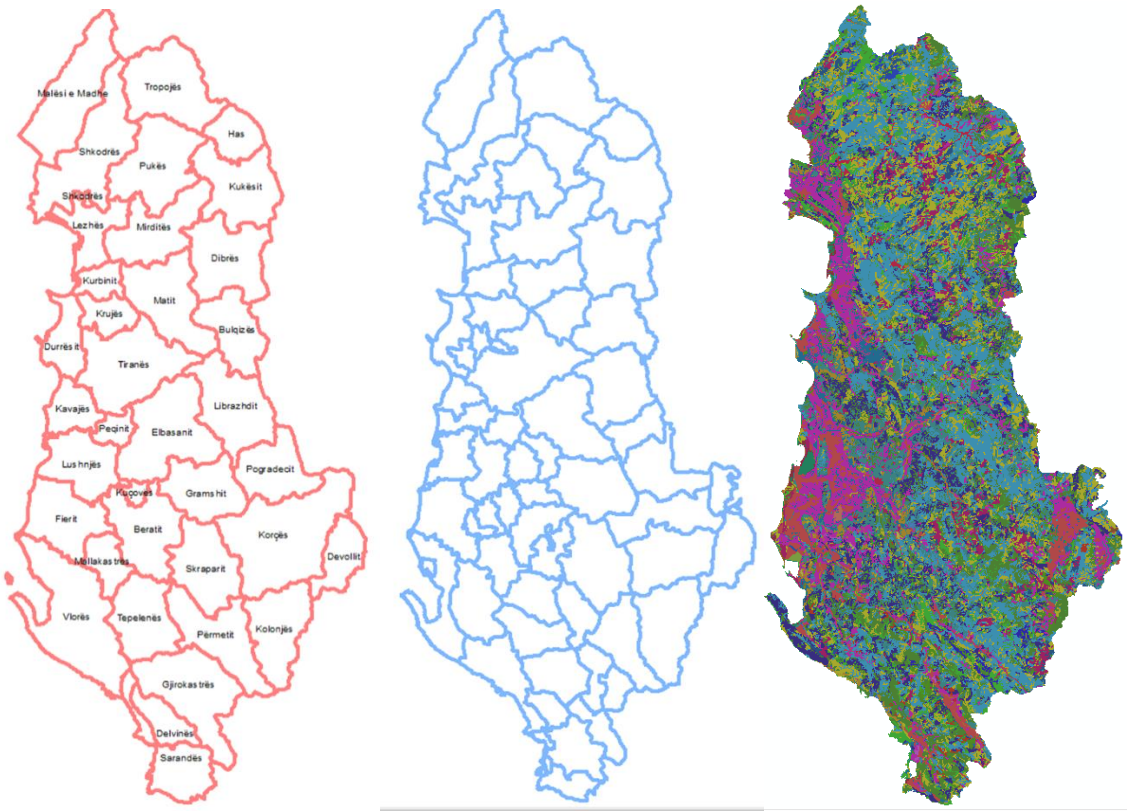
As the first stage, the Albanian CLC data of 2012 derived via EIONET (figure 3.c), is subdivided according to two different distribution schemes. Firstly, it is split into 36 subdivisions according to the local administrative map of pre-2014 (figure 3.a), and later according to the post reform version it is divided into 61 subsets (figure 3.b). The operation is utilizing the split analysis tool of ArcGIS package.

The spatial distribution of CLC data into two different versions leads to statistical data about the surface areas (ha) of each CLC class under each local administrative unit. Consequently, two separate tables of numerical data is produced. For example, in table 1 it is shown the top five cases of numerical data about natural surfaces distribution among each municipality in both spatial division versions. A complete version of the table presenting statistical data per each administrative unit is given in appendixes. Besides, a cumulative column represents the total surface area of natural lands (CLC-300) inside the borders of each administrative unit. Furthermore, based on the numerical data, there are derived other statistical information about the mean, standard deviation and the coefficient of variation of surface areas distribution of each CLC subclass. All these measures make ground for further discussion on the natural surfaces distribution behaviors under different territorial divisions.

First of all, referring to the absolute values of surface areas of each 3rd level CLC class, it can be stated that the municipality that leads the possession of broad-leaved forested surfaces (clc-311) remains the same as Tropoje, but municipalities like Librazhd, descends from the 2nd place to the 4th after the new administrative reform, with a total broad leaved forest area reduction of about 5000 ha (see appendixes). Similarly, considering the numbers of coniferous forested surfaces (clc-312), after the reform there is a decrease by 50 % in the case of the former leading municipality, Puke. Furthermore, referring the summary (SUM) column of both tables, it can be stated that Korça as the former leader district has dropped to the 14th place among municipalities possessing the largest amount of natural lands under their administration. The comparative analysis of the absolute values may lead to further comparison between different municipalities and the

municipality in itself about pre and post reform conditions. Besides that, additional important deductions can be drawn via inferential statistics derived from the tables.

Figure 3: Local Administrative Units in Albania; [a] before 2014, [b] after 2014 and [c] CORINE Land Cover map of 2012



Referring to table 2, with the increase of the number of administrative units, the mean of surface areas of each land cover class in focus per each district, is reduced by 40 %. Similarly, standard deviation values for the distribution of each CLC-300 class, are decreased with an average of 25 %. Thus, relying on the absolute values of mean and standard deviation while trying to compare the distribution behaviors is not useful. Instead, the relative inferential values may imply reliable information about the distribution fairness of the same resource into two different dispersal schemes.

The coefficient of variation (CV) is selected as the proper inferential value to be used in this study. CV consists of the ratio between the standard deviation and the mean of surface area values (ha) of each natural land cover class. As it is represented in table 2, CV is calculated for both territorial division versions; 61 and 36 administrative units. In principle it can be stated that the lower the CV value, the fairer distributed natural lands we have. For example, from the same board it can be inferred that the fairest dispersed natural land under the new reform is CLC-323 (Sclerophyllous vegetation) having a CV value of 0.82. On the other hand, the least fair dispersed natural land under the same scheme is CLC-332 (Bare rocks) with a value of 1.55. Whereas, considering the scheme of 36 districts, CLC-311 (Broad

leaved forests) is the fairest distributed land cover class with a CV of 0.66. Whereas, the least fairly spread areas in the pre-reform distribution scheme again is CLC-332 (Bare rocks). Meanwhile, land cover classes such as mixed forests and burned areas, face almost no change in their CV values, implying an unchanged distribution behavior under two different schemes, consisting of difference of 0.02.

Table 1: Numerical data of top five municipalities with larger surface areas (ha) of CLC-300 classes in two versions of 36 (a) and 61 (b) districts.

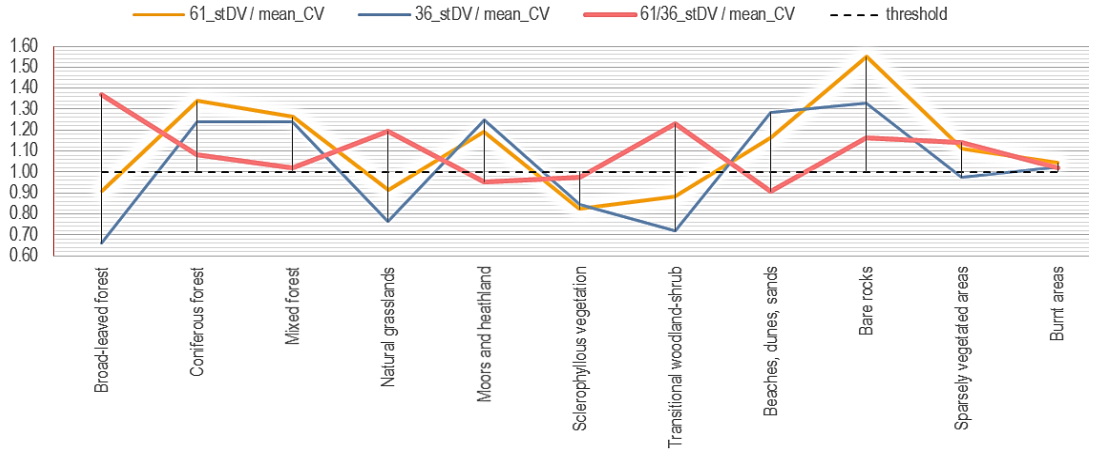
		Broad-leaved forest	Coniferous forest	Mixed forest	Natural grasslands	Moors and heathland	Sclerophyllous vegetation	Transitional woodland-shru	Beaches, dunes, sands	Bare rocks	Sparsely vegetated areas	Burnt areas	
		311	312	313	321	322	323	324	331	332	333	334	SUM
a													
Korce	1	29995	10521	4254	25588		14179	23790	325	116	4830	110	113708
Vlore	2	22934	3406	1235	16962	172	32788	14341	2148	176	5814	1225	101200
Puke	3	31204	14336	6152	2376		6614	28181	158		6193		95215
Tropoje	4	35931	981	2570	16143	50	8682	15017	158	3731	8273		91536
Shkoder	5	29281	818	653	5204	65	10263	20216	1539	642	17161	127	85968
b													
Tropoje	1	35258	1013	2575	15960	50	8462	14913	158	3903	8204		90495
Mirdite	2	30993	7789	3534	3223		4847	21900	199		5610		78094
Kukes	3	16734	3794	4778	16534	1336	6497	19350	227		6890		76140
Diber	4	15734	5839	4264	18648	714	6098	17871	547		5902	68	75683
Tirane	5	30948	513	477	10425		17055	8947	1584		4163		74112

Table 2: Joint inferential statistics of CLC-300 classes

CLC- Classes	CLC- code		61_Grand Total	61_mean	61_stDV	61_stDV / mean of stDV	**61_stDV / mean_CV**	36_Grand Total	36_mean	36_stDV	36_stDV / mean of stDV	**36_stDV / mean_CV**	61/36_mean	61/36_stDV	61/36_stDV / mean of stDV	**61/36_stDV / mean_CV**
Broad-leaved forest	**311**		623603	10393	9442	3.09	**0.91**	621403	17261	11434	2.77	**0.66**	0.60	0.83	1.11	**1.37**
Coniferous forest	**312**		89883	1798	2408	0.79	**1.34**	89570	2634	3261	0.79	**1.24**	0.68	0.74	1.00	**1.08**
Mixed forest	**313**		42009	1105	1396	0.46	**1.26**	41542	1385	1718	0.42	**1.24**	0.80	0.81	1.10	**1.02**
Natural grasslands	**321**		320627	5344	4880	1.59	**0.91**	319776	8883	6788	1.65	**0.76**	0.60	0.72	0.97	**1.19**
Moors and heathland	**322**		15871	992	1181	0.39	**1.19**	15801	1215	1520	0.37	**1.25**	0.82	0.78	1.05	**0.95**
Sclerophyllous vegetation	**323**		276045	4525	3729	1.22	**0.82**	275816	7662	6469	1.57	**0.84**	0.59	0.58	0.78	**0.98**
Transitional woodland-shrub	**324**		358491	5975	5285	1.73	**0.88**	356610	9906	7113	1.72	**0.72**	0.60	0.74	1.00	**1.23**
Beaches, dunes, sands	**331**		20823	463	539	0.18	**1.16**	19621	595	763	0.18	**1.28**	0.78	0.71	0.95	**0.91**
Bare rocks	**332**		6568	938	1455	0.48	**1.55**	6571	1095	1457	0.35	**1.33**	0.86	1.00	1.35	**1.17**
Sparsely vegetated areas	**333**		147610	2590	2878	0.94	**1.11**	146824	4195	4081	0.99	**0.97**	0.62	0.71	0.95	**1.14**
Burnt areas	**334**		8540	449	468	0.15	**1.04**	8446	768	785	0.19	**1.02**	0.59	0.60	0.81	**1.02**
cumulative mean			**173643**	**3143**	**3060**	**1.00**	**1.11**	**172907**	**5054**	**4126**	**1.00**	**1.03**	**0.68**	**0.75**	**1.00**	**1.10**

Another inferential statistical instrument is the ratio of CV_{61} to CV_{36}. The result is a coefficient that implies direct comparison between two spatial division conditions being relatively contrasted. Considering the previous assumption that the lower the CV, the fairer the distribution, it can be further assumed that the lower ratio CV_{61}/CV_{36}indicates for an improvement in distribution fairness of natural lands under the new reform. In other words, the ratio value above 1.00 imply for a worsening of the distribution fairness. On the contrary, the values below 1.00 indicate increases of dispersal equality of land cover surfaces. Referring to the final column of table 2, it can be identified that the most negatively affected distribution with the new reform resulted in broad leaved forested surfaces (CLC-311) which stands with the highest ratio of CV_{61}/CV_{36} scoring a value of 1.37. Whereas, the most positively affected one is beaches, dunes and sand surfaces (CLC-331) holding a ratio of 0.91.

Figure 4: *The Coefficient of Variation of two versions [36 and 61], and the ratio among them.*



In addition, referring to figure 4, the land cover classes being above the threshold line of 1.00, thus being negatively affected by the new territorial reform are 8 out of 11 land surface types. Only, moors and heathlands, sclerophyllous vegetation and beaches, dunes and sands surfaces are positively affected by the new reform. Moreover, according to table 2, the cumulative mean value of separate CV61/CV36 ratios is 1.10. In other words, it indicates for an overall worsening of the natural lands distribution under the new reform, compared with the pre-reform territorial subdivision scheme of 36 districts.

Conclusions

This paper presents a methodology of evaluating a policy making process such as territorial reform, relying on the concept of natural capital distribution fairness. The method is applied to the case of the Albanian administrative/ territorial reform approved in 2014. The land cover properties of the territory have been used as tangible measures of the natural capital. The specimen of the experiment is the 3rd category of the first level of CORINE Land Cover classification (CLC-300). Under this main group, there are 11 subclasses of natural land surfaces such as broad leaved and coniferous forests, which are considered to have the highest natural capital values among other land cover types.

The open source CLC data via EIONET portal, split into two different spatial distribution schemes of pre-reform and post-reform versions, resulted in referable numerical data on surface areas of each land cover class. The need for a relative comparative statistical evaluation tool proceeded to the introduction of the coefficient of variation concept. Values of CV_{61} and CV_{36}, as well as the ratio between them, guided the evaluation process to remarkable findings.

First of all, it can be concluded that in overall the natural surfaces- as part of the natural capital- of Albanian territory are less fairly distributed under the new reform than it was under the case of the pre-reform local administrative division map. Meanwhile, among 11 subclasses of natural surfaces, only 3 of them seems to be better fairly distributed than before; being moors and heathlands, sclerophyllous vegetation and beaches, dunes and sands surfaces. Furthermore, it can be stated that with the new reform the most adversely affected distribution fairness, happened to the broad-leaved surfaces. This fact becomes bolder, since this land cover type holds the highest natural capital value among others. On the other hand, the most positively affected land cover type by the reform is beaches, dunes and sand. This can be considered positive while thinking of the touristic potential of beaches along Adriatic and Ionian coast.

Also, according to the results of the study, the fairest distributed natural land cover type in the map of 36 districts was broad-leaved forests, which drops to the 4th place after the redistribution into 61 units. Whereas, the fairest dispersed natural surface after the reform is sclerophylous vegetation, climbing from the 3rd place of the pre-reform distribution.

In overall the work presented in this paper can be considered as an original utilization of a statistical concept such as the coefficient of variation in assessing the natural capital distribution fairness among altered administrative territorial divisions. Additionally, the technique experimented in this work can be considered as rational critique to a decision-making process such as territorial/ administrative reform in terms of fair distribution of resources.

As a conclusion, the method proposed in this study can be accepted as a contribution to the comprehensiveness of a policy making process such as territorial reform. Even though, relying just on the land cover statistics is not strong enough, the strategy holds the potential to be expanded by including a variety of environmental properties of a territory facing a local administrative reform. Finally, the main goal of the study more than criticizing the recent administrative and territorial reform in Albania, is to highlight the importance of considering environmental factors during the decision-making processes besides social and economic criteria.

Acknowledgment

The author is grateful to the European Environment Agency (EEA), for providing CORINE Land Cover data as an open source via European Environment Information and Observation Network (EIONET). This article is prepared within the scope PhD thesis by the author in the Graduate School of Science, Engineering and Technology at Istanbul Technical University.

References

Champernowne, D. G., & Cowell, F. A. (1999). *Economic Inequality and Income Distribution.* Cambridge: Cambridge University Press.

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., et al. (2016). The Value of the World's Ecosystem Services and Natural Capital. In P. Newell, *the Globalization and Environment Reader* (pp. 117-134). West Sussex: John Wiley & Sons.

Costanza, R., de Groot, R., Sutton, P., van der Ploeg, S., Anderson, S. J., Kubiszewsk, I., et al. (2014). Changes in the Global Value of Ecosystem Services. *Global Environmental Change*, 152-158.

Costanza, R., Kubiszewski, I., Ervin, D., Bluffstone, R., Boyd, J., Brown, D., et al. (2011). Valuing Ecological Systems and Services. *F 1000 Biology Reports*.

De Peuter, B., Pattyn, V., &Wayenberg, E. (2011). Territorial Reform of Local Government: Evaluation Criteria Underpinning Decisions and Debate in Flanders. *Local Government Studies, 37* (5), 533-552.

European Topic Center. (1999). *Corine Presentation.* Retrieved 02 20, 2017, from https://faculty.washington.edu/eliezg/research/FinlandWolves/corinepresentation.pdf

Ghinea, A., &Moraru, A. (2006). *Aspects Regarding Decentralization Process in Romania, The Administrative Territorial Reform.* Bucharest: Institute for Public Policy.

Giovannoni, E., &Fabietti, G. (2013). What Is Sustainability? A Review of the Concept and Its Applications. In C. Busco, M. L. Frigo, A. Riccaboni, & P. Quattrone (Eds.), *Integrated Reporting; Concepts and Cases that Redefine Corporate Accountability* (pp. 21-40). Switzerland: Springer International Publishing.

Hartshorne, R. (1939). *The Nature of Geography: A Critical Survey of Current Thought in the Light of the Past.* Lancaster, Pennsylvania: Association of American Geographers.

Hens, L. (1996). The Rio Conference and thereaft. In L. Hens, & D. Devuyst (Eds.), *Sustainable development European Centre for Pollution Research* (pp. 81-109). Brussels: Free Univer- sity of Brussels and UN Educational Scientific and Cultural Organisation VUB Press.

JRC-EEA. (2005). *CORINE land cover updating for the year 2000: image 2000 and CLC2000.*Ispra: JRC-Ispra.

Krasniqi, A. (2014, July 19). *ORANEWS.* Retrieved September 07, 2017, from http://www.oranews.tv/analiza/reforma-territoriale-produkt-i-pazareve-politike/

MEA. (2016, 06 09). *Forest Fund Legislation.* Retrieved 02 25, 2017, from Ministry of Environment of Albania: http://www.mjedisi.gov.al/files/userfiles/Pyjet/Udhezimi_Nr._1_Date_09.06.2016_merged.pdf

MLA. (2014). *Albanian Administrative- Territorial Reform; Technical Criteria.* Ministry of Local Affairs. Tirana: MLA.

Ndreu, A. (2016). Implementation of the Administrative- Territorial Reform for a Sustainable Development of the Economy in Albania. *Social and Natural Sciences*, 1-4.

QBZ. (2014, September 1). Retrieved from Center of Official Publications: http://www.qbz.gov.al/botime/fletore_zyrtare/2014/PDF-2014/137-2014.pdf

Reçi, S., &Ymeri, I. (2016). Administrative and territorial reform in Albania and the issue of decentralization: Comparative overview of relevant international legislation. *Academic Journal of Business, Administration, Law and Social Sciences, 2* (1), 175-183.

Saltmarshe, D. (2001). Developments in Albanian Local Government. *Local Government Studies, 27* (2), 111-129.

Swianiewicz, P. (2010). If Territorial Fragmentation is a Problem is Amalgamation a Solution An East European Perspective. *Local Government Studies*, 183-203.

Zhang, Y., Zhao, L., Liu, J., Liu, Y., & Li, C. (2015). The Impact of Land Cover Change on Ecosystem Service Values in Urban Agglomerations along the Coast of the Bohai Rim, China. *Sustainability* (7), 10365-10387.

Appendixes

Appendix 1: Surface area statistics of natural lands per each 36 administrative unit

		Broad-leaved forest	Coniferous forest	Mixed forest	Natural grasslands	Moors and heathland	Sclerophyllous vegetation	Transitional woodland-shru	Beaches, dunes, sands	Bare rocks	Sparsely vegetated areas	Burnt areas	
		311	312	313	321	322	323	324	331	332	333	334	SUM
Berat	1	13079	1899	418	10117		12265	7072	603		1451	84	46988
Bulqize	2	22801	474	42	16104	140	6332	9809	198		1371		57270
Delvine	3	4923	319		10768		2187	4257	179		2243	458	25333
Devoll	4	9023	1529	1194	3658	48	1842	7699			214	820	26026
Diber	5	16094	6175	4687	18996	782	6027	18520	608		5897	68	77854
Durres	6	6565	554		1787		1312	863	138		29		11248
Elbasan	7	25912	1471	253	12540		16157	10420	2936		4055		73742
Fier	8	1514	1769	83	609		2135	2107	314		448		8979
Gjirokaster	9	22240	1470	188	18897	2403	12241	13921	846	54	9263	2541	84064
Gramsh	10	19856	5438	1855	8883		12329	7550	2687		1437		60036
Has	11	12209			5009		2696	7513			947		28375
Kavaje	12	867	589		3375		5694	1001	99		168		11793
Kolonje	13	18333	6812	3200	14583	4654	3832	8954	152		4201		64721
Korce	14	29995	10521	4254	25588		14179	23790	325	116	4830	110	113708
Kruje	15	6972	1467	59	1012		1690	2853	169		687		14909
Kucove	16	217			264		731	59	27				1298
Kukes	17	16436	3770	4449	17047	1373	6596	19421	206		6893		76190
Kurbin	18	9202	226	52	340		1326	1407	35		193		12782
Lezhe	19	7848	1205	855	2337		3207	7209	223		4780		27664
Librazhd	20	35840	331	247	13600	1840	10235	11878	710		4294	307	79282
Lushnje	21	2338	873	1	989		571	1235	106		56		6169
Malesi e Madhe	22	22776	1438	2602	7124	271	7475	14835	334	1852	14217		72925
Mallakaster	23	3720	123	209	1725		7943	1721	650		1120		17210
Mat	24	35069	3272	905	11399		14807	12652	392		2407		80904
Mirdite	25	30725	7866	3514	3194		4839	22135	199		5627		78100
Peqin	26	245	910		2723		1764	1450	9		162		7262
Permet	27	29943	2427	267	6842	3654	7163	10669	10		9658		70634
Pogradec	28	23042	480	153	5766		3512	9384			66		42403
Puke	29	31204	14336	6152	2376		6614	28181	158		6193		95215
Sarande	30	6780	93	105	17580		6220	7869	32		6717	1418	46815
Shkoder	31	29281	818	653	5204	65	10263	20216	1539	642	17161	127	85968
Skrapar	32	21573	5266	417	10977		8356	10230	1059		6796		64674
Tepelene	33	14226	709	447	14444	350	13447	11078	770		4946	1288	61704
Tirane	34	31689	553	477	10814		18360	9294	1601		4209		76998
Tropoje	35	35931	981	2570	16143	50	8682	15017	158	3731	8273		91536
Vlore	36	22934	3406	1235	16962	172	32788	14341	2148	176	5814	1225	101200
Grand Total		621403	89570	41542	319776	15801	275816	356610	19621	6571	146824	8446	1901979
Mean	a	17261	2634	1385	8883	1215	7662	9906	595	1095	4195	768	52833
Standard Dev.	b	11434	3261	1718	6788	1520	6469	7113	763	1457	4081	785	32217
CV [b/a]		0.66	1.24	1.24	0.76	1.25	0.84	0.72	1.28	1.33	0.97	1.02	0.61

Appendix 2: Surface area statistics of natural lands per each 61 administrative unit (continue)

		Broad-leaved forest	Coniferous forest	Mixed forest	Natural grasslands	Moors and heathland	Sclerophyllous vegetation	Transitional woodland-shru	Beaches, dunes, sands	Bare rocks	Sparsely vegetated areas	Burnt areas	
		311	312	313	321	322	323	324	331	332	333	334	SUM
Belsh	1	1103			1843		442	235	136		47		3807
Berat	2	5740	540	117	4048		5568	3033	424		326	84	19879
Bulqize	3	21511	1118	190	16139		7854	11513	276		1007		59608
Cerrik	4	816	204		2391		3973	308	784		119		8595
Delvine	5	2883	389		5139		1214	2292	178		1259	303	13656
Devoll	6	9188	1375	1128	3703	297	1957	8377			211	819	27056
Diber	7	15734	5839	4264	18648	714	6098	17871	547		5902	68	75683
Divjake	8	1752	916		174		44	1097	402		34		4419
Dropull	9	9188	793	55	6092	1629	3658	6287	374	54	3803	1395	33327
Durres	10	6002	558		1417		944	647	349		46		9961
Elbasan	11	24243	1201	277	8234		12001	9438	2024		3654		61071
Fier	12	1316	1720	84	315		1732	1935	558		549		8209
Finiq	13	5691	93	105	12648		3078	5155			2769	1323	30862
Fushearrez	14	19914	7051	3575	592		1803	13103			2207		48245
Gjirokaster	15	9154	472	175	7881	653	6145	3756	362		3544	1152	33293
Gramsh	16	19315	5588	1831	9406		12525	7557	2650		1477		60350
Has	17	12462			5263		2936	7508			970		29138
Himare	18	14807	183	179	11026	172	8432	8153	490	137	4148	471	48200
Kamez	19	74					69		30				173
Kavaje	20	223	194		1926		3126	485			47		6000
Kelcyre	21	5368	481		2989	479	4162	2509			3700		19689
Klos	22	9867	2416	465	4099		7363	4150	93		1084		29537
Kolonje	23	18835	7287	3675	15433	4777	3913	9303	152		4205		67579
Konispol	24	581			6460		3202	3414			1605	60	15322
Korce	25	11903	8609	3357	11847		3706	11598	69	116	3693	55	54951
Kruje	26	7549	1570	59	1005		1438	2988	154		685		15448
Kucove	27	2419			1631		2492	313	94				6949
Kukes	28	16734	3794	4778	16534	1336	6497	19350	227		6890		76140
Kurbin	29	9385	316	65	391		1399	1727	83		234		13599
Lezhe	30	7006	1186	916	2441		3284	7473	379		4946		27632
Libohove	31	3662	35		4383	1226	2122	3989	100		2361	35	17913
Librazhd	32	30792	274	201	11711	1603	8644	8024	720		4203	72	66242
Lushnje	33	672	2		773		538	578			38		2601
Malesi e Madhe	34	22438	1438	2601	7076	271	6989	14774	368	1830	12840		70625
Maliq	35	11774	1547	945	9064		7684	6242	252		1055	57	38620
Mallakaster	36	3805	123	313	1924		7960	1492	473		838		16925
Mat	37	20108	507	741	4197		4957	6716	299		1301		38827
Mirdite	38	30993	7789	3534	3223		4847	21900	199		5610		78094
Mmemaliaj	39	5061	300	447	4416		8702	3932	484		2426	233	26001
Patos	40	462			216		166	29			82		953

Appendix 3: Surface area statistics of natural lands per each 61 administrative unit (continued)

Peqin	41	264	926		2681		1640	1379	2		159		7052
Permet	42	24874	2057	284	3095	1932	3610	8042	15		5036		48946
Perrenjas	43	11967	122	40	4989	301	2757	5107	36		666	235	26221
Pogradec	44	22697	464	150	5542		3654	9392			70		41968
Polican	45	4922	1013	250	2552		3483	3261	145		1094		16720
Puke	46	10973	7331	2127	1593		4706	14827	111		3477		45146
Pustec	47	6655			3183		2580	6030					18447
Roskovec	48	238			97		769	26			81		1211
Rrogozhine	49	573	396		1644		2811	826	169		149		6568
Sarande	50	146			42		237	588			2529		3542
Selenice	51	7209	50	72	7634		10837	3874	1327		2558	382	33941
Shijak	52				225		216	107					548
Shkoder	53	21110	213	653	2794	65	5495	11856	1148	489	12070	127	56019
Skrapar	54	21680	5595	319	12146		7759	10230	1012		6755		65497
Tepelene	55	8652	421		10310	367	4237	7329	334		2774	1047	35470
Tirane	56	30948	513	477	10425		17055	8947	1584		4163		74112
Tropoje	57	35258	1013	2575	15960	50	8462	14913	158	3903	8204		90495
Ura Vajgurore	58	595	150	1	1939		707	324			5		3721
Vau I Dejes	59	9451	571		2500		5035	8306	505		6928		33297
Vlore	60	4197	3142	985	3988		14936	3665	550	39	952	622	33077
Vore	61	667			590		1397	212			27		2893
Grand Total		623603	89883	42009	320627	15871	276045	358491	20823	6568	147610	8540	1910071
Mean	a	10393	1798	1105	5344	992	4525	5975	463	938	2590	449	31313
Standard Dev.	b	9442	2408	1396	4880	1181	3729	5285	539	1455	2878	468	24621
CV [b/a]		0.91	1.34	1.26	0.91	1.19	0.82	0.88	1.16	1.55	1.11	1.04	0.79