©2019 International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies

International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies

http://TuEngr.com

ESTIMATION OF ECOLOGICAL FOOTPRINT FOR PARDIS CITIZENS OF IRAN

Rokhshad Hejazi [a*], Zahra Haji Ghorbani Doulabi [b], Sepideh Alikhani [b]

[a] *Olom Va Fonon, Department of Environmental Science, Islamic Azad University of North Branch; IRAN.*
[b] *Department of Environmental Management, Islamic Azad University of North Branch, IRAN.*

ARTICLE INFO

Article history:
Received 20 December 2018
Received in revised form 22 March 2019
Accepted 16 April 2019
Available online 03 May 2019

Keywords:
Human footprint; Environmental valuation; Sustainable Development; Ecological footprint method; Tehran; bio capacity; Pardis City.

ABSTRACT

Sustainable development is one of the most important global issues used to reduce destructive effects on the environment regarding economic growth and development to remove human needs. Various indicators have examined, estimated and interpreted the subject in different terms; ecological footprint is one of these indicators, which has been defined in recent decades. This index identifies and estimates all of variables related to producing and consuming life of people comparing them with resources' ability and determining changes in consumption patterns. Ecological footprint is a prospective index so that it indicates resources situation from the past to present time. Therefore, this index can be used for long-term planning in field of management and environmental economics. This study was carried out to estimate ecological footprint of Pardis, which is one of strategic cities around Tehran, Iran. With 2014 data, The obtained results showed tolerable ecological footprint of Pardis in electricity, transportation, natural gases heating, water, food, and waste sectors. Accordingly, Pardis can be used as supportive region and ecological footprint of Tehran applying a resource management.

1. INTRODUCTION

New cities in different countries are constructed based on their necessities and functions and this policy may differ in a country form other ones or from a region in a country form other regions in the same country so that necessity or lack of necessity of such actions are determined based on the socioeconomic conditions, in particular cultural features of people. Nowadays, new cities are not just constructed to have ideal residents, but the main goal is decentralization of megacities [1]. All of urban development programs aim to improve human life.

Ecologic sustainable development is the best and ideal type of development, which improves quality of human life in future. Ecological footprint is a method that helps sustainable development considerably and is underpinned based on the resources consumption and waste absorption by earth

*Corresponding author (Rokhshad Hejazi) E-mail: rokhshad47@yahoo.com

per capita area required for production [2].Ecological footprint indicator is an integrated method for natural resources consumption and waste absorption; in this regard, this index has been recognized as a potential index to estimate implications of indiscriminate consumption of natural resources.

Ecological footprint is a calculative tool for ecological benefits enabling us to identify deficits and resources accurately. It clearly indicates human's pressure on natural resources. In fact, this measurement index shows natural resource consumption rate by individuals, organizations, cities, areas, countries, and total human population. Estimation of ecological footprint of cities not only indicates consumption pattern of city during time but also help urban manages to modify natural resources and facilitate the relationship between human and environment making right decisions about natural resources consumption.

2. RESEARCH BACKGROUND

According to the Living planet report (2014), there was 52% drop in LPI (living planet index) from 1970 to 2010. Ecological footprint rate equals 18.1 billion global hectare and average ecological footprint of each person equals 2.6 global hectares. In addition, bio capacity equals 12 billion global hectares and 1.7 billion global hectares per capita; population diagrams indicate increasing population rate from 3.2 billion to 7 billion people. Therefore, increasing population rate have prevented from compensating human footprint until bio capacity is expanding [3, 4].

In [5] the study results of ecological footprint and green development obtained from study indicated that per capita footprint in Hangzhou city during 1988-2008 reached from 1.1561 hectare annually in 1988 to 2.233 hectare annually in 2008. Since 1995, ecological deficit emerged in Hangzhou and is now equal to 0.954 hectares indicating larger bio capacity footprint in Hangzhou that should be reduced by actualizing green development.

According to calculations in 2006, Islamic countries like Iran, Iraq, Afghanistan, Syria and Turkey with 227.7 million populations have 10.9 hectares ecological footprint per capita; of them, Turkey does have the highest footprint with 2.8 hectare. In industrial countries like UK, US, France, Russia and Germany with 650.6 million peoples, ecological footprint per capita obtained to 28.1 hectare. US had the highest ecological footprint with 9 hectare among industrial countries; in fact, footprint of US is almost as much as footprint of total Islamic countries [6].

According to study of ecological footprint in Australia, Filipina and South Korea during 1961-1999, conventional method was compared with real area method to examine effect of industrialization and increased energy consumption on ecological footprint in these countries. Total ecological footprint in Filipina obtained to 1.5gha/cap that has not been changed over 40 years, major energy contribution reached from 8% to 27% and per capita bio capacity dropped from 1.22 to 0.52gha/cap due to increasing population and rapid industrial development. Sharp industrial growth in South Korea over 40 years has led to excessive resources consumption so that this country has high ecological deficit having 5 greater times than its bio capacity to meet population needs; footprint contribution of fossil fuels in this country increased to 62% from 15% showing change in consuming energy type (converting wood fuel to fossil fuels) due to reduction in wood fuels consumption (from 0.06 in 1961 to 0 in 1991). Australia does have a high bio capacity so that footprint of Australia considering energy footprint has been higher than its bio capacity during studied period. Ecological footprint is a constant value regardless of energy footprint; energy footprint has increased dramatically since 1961 compared to monotonic trend of bio capacity in Australia. This means that increasing resources efficiency and modification of agricultural products (in short, industrialization) has led to consumption orientation in this country.

The work [7] conducted a study to evaluate sustainability of urban development using ecological footprint for Kermanshah city of Iran. The work introduced data collecting for ecological footprint measurement as the most important research study. Required data for initial measurement obtained from statistical tables of country. After obtaining footprint value in consuming scopes of Kermanshah, they concluded that continuous of current consumption trend in Kermanshah requires an area of 180 times greater than current area to supply food, energy and land for CO_2 absorption in this city. It means the natural environment of this city is no longer sufficient to meet needs so there should be a larger supporter area.

Work [8] estimated CO_2 ecological footprint caused by fossil fuels for Shiraz city comparing with green space rate in the city for CO_2 absorption. The emitted CO_2 volume caused by gasoline and diesel during 2006-2008 obtained to 521058, 476767 and 490106, respectively, which require 7816, 7125 and 7352 hectares land for CO_2 absorption while green space area of Shiraz requires 1869 hectares in 2008. Therefore, the generated CO_2 from gasoline and diesel is 3.9 times greater than bio capacity of Shiraz [8].

In [9] related to the appraisal of ecological footprint of urban transportation fleet, the data related to displacement of transportation fleets of Urmia city were analyzed. The highest ecological footprint in Urmia was related to minibus with 0.00055 hectares and the lowest amount was related to cycle with 0.000016 hectares. Comparing these values with global standard rate, it was concluded that all transportation fleets, except for bus, in urban system of Urmia have higher footprint compared to global standards [9]. The work in [10] studied the estimation of ecological footprint in Tehran Metropolitan, of 12 provinces existing in Tehran, of which 63.03% are industries area. The imposed pressure on ecological environment of this city is higher than its bio capacity.

3. ECOLOGICAL FOOTPRINT

Ecological footprint method was invented and developed for first time by [11, 12] in British University of Colombia. According to these scientists, each human unit (such as individual, city, or country) has effect on the earth since human consumes nature's products and services so that their ecological effect is equal to the nature area they have occupied for survival [13].

Estimation of ecological footprint is done based on two attitudes:

1) Population's footprint: what is footprint of populations; it means what is the effect of consuming nature by population on a region.
2) Bio capacity rate: what should be the population's footprint rate considering available resources and useful bio capacity; it means how much population is allowed to use natural resources. Combining above-mentioned methods, Ecological footprint matrix [12] was obtained. Table 1 introduces general methods to estimate ecological footprints comparing advantages and accuracy of each method.

*Corresponding author (Rokhshad Hejazi) E-mail: rokhshad47@yahoo.com

Table1. Summary of EF estimation methods.

Row	Method	Implementation method	Application
1	Combined Method	It is a method used to estimate national level of footprint in countries, which is obtained from import and export amount of countries.	This method is less precise compared to other methods as this method ignores details due to large data volume at national levels.
2	Components Method	This method is used to estimate footprint in cities and urban areas estimating population consumption in consuming groups.	It is one of practical method with higher precision than combined method. Number of consuming groups varies based on the studied topic and data volume.
3	Direct Method	This method is used to estimate footprint of individuals, families and companies and is related to direct consuming data.	This method is more accurate than two other methods and is prepared and calculated based on the questionnaire. Its accuracy depends on questionnaire precision.

4. STUDIED AREA

Pardis City is located in Pardis Province within 18km distance from eastern part of Tehran, Iran, in marginal way of Tehran-Abali. According to 2011 census by Statistics Organization, 37257 people live there and this rate is estimated about 46900 people in 2014 considering 1.29 growth rate and calculations done by experts in statistics organization. City area is about 3600 hectares and its privacy area about 11000 hectares ($110km^2$) [18, 20] with 1800m height above world open waters [14-16].

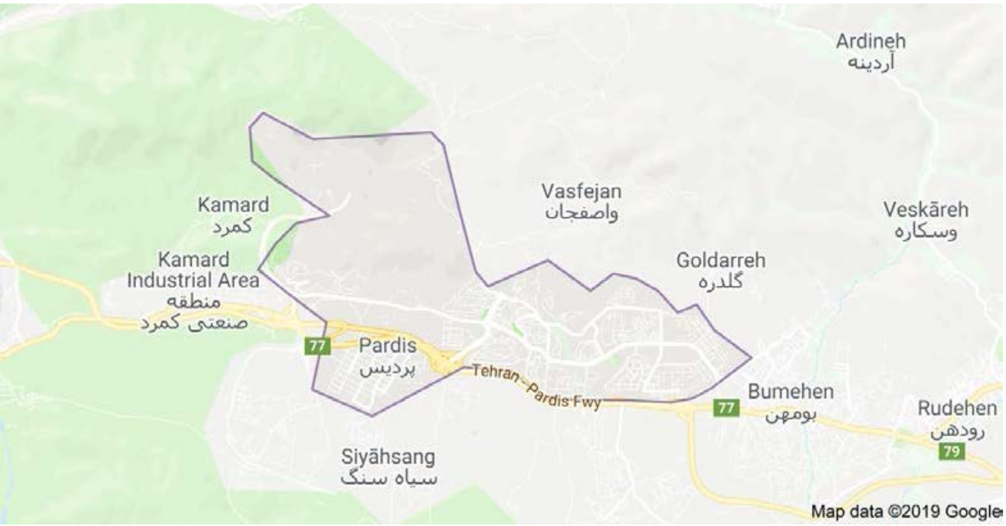

Figure 1: Pardis City location (Courtesy of Google.com)

5. RESULTS

To calculate EF, component and direct methods were used and calculations were done within 6 consuming groups of electricity, transportation, natural gases heating, water, food, and waste.

5.1 CALCULATION OF ELECTRICITY EF

There were 34462 electricity customers in Pardis with annually consumption level of 170000000 kw/h. electricity EF calculations are described in Table 2.

Electricity consumption (EC) in city is multiplied by constant amount 3.6×106j (k, in this regard, consumption rate is converted to h/j from kw/h) and consumption level (C) is obtained based on Joule. This formula calculates required coal amount for producing consuming power per gram unit (PC).

In this step, final coal production is calculated based on gram unit considering the point that plants cover 31.4% coal yield (RP, inactive carbon). Coal (Ct) contains 85% carbon (Kc); therefore, the carbon emission rate (Cp) is calculated through this equation, which transferred to area (Ac) which used this system by constant coefficient (Kc).

Finally, requiring land hectare (L) is divided by city population (P) for carbon absorption to calculate EF per capita. Citizens living in Pardis need 45373000m^2 land to absorb carbon emitted by electricity consumption; their electricity EF obtained to 0.096 hectare/member.

Table 2: Calculation of electricity EF

Formula	Calculation
EC ×K = C	$170000000 \times 3.6 \times 10^6{}_j = 612\times10^{12}$
C×1gr ÷1kj = PC	$612\times10^{12}\div10^3=612\times10^9$ $612\times10^9\times1\div20\ _{kj}=306\times10^8$
$PC\times RP = C_p$	$306\times10^8\times0.314=96084\times10^5$
$C_p \times K_c = A_C$	$96084\times10^5\times0.85=816714\times10^4{}_{gr} \div10^6=8167.14_{ton}$
$A_C \times K_h = L$	$8167.14\div1.8=4537.3\ _{ha}\times10^4=45373000_{m2}$
$L\div P = EF_e$	4537.3 ÷46900=0.096

5.2 CALCULATION OF HEATING EF

There were 24791 users in domestic sector so that consumption rate of Pardis' citizens obtained to 38476398 m^2 [19]; EF calculation associated with natural gas heating is detailed in Table 3.

This formula is related to gas rule used to obtain number of gas moles per cubic feet; (where P is pressure, Vis volume, R is constant fluid coefficient, T is Temperature and N is the amount of moles) and Number of moles per cubic feet (Cf) is obtained using molecular mass of methane (A). After calculating moles and obtaining 16.043g/m for methane molecular mass and 75% carbon content of methane, the carbon amount (gram per cubic feet, CGf) should be calculated. Produced carbon (tones, Rc) by town natural gas consumption (AC) (AC÷ Kgr = Rc), which Kgr is constant density to change the gram to ton. A cubic foot contains 0.02832 m^3 (Acf) and each 1m^3 contains 35.314 cubic feet. Therefore, natural gas consumption amount is converted to cubic feet (AC). Every hectare land absorbs 1.8 tones carbon. This equation calculates the considered land hectare.

Table 3: Calculation heating EF

Formula	Calculation
N=P×V÷R×T	N= (0.017 ×28.3) ÷ (0.08206 ×288.5)= 0.02
A×N= Cf	16.043 ×0.02= 0.32
Cf ×K= Acf	0.32×0.75= 0.24
CG×F= CGf	38476398×35.314= 1358755518.972
CGf × Acf =AC	1358755518.972×0.24= 326101324.553
AC÷ Kgr = Rc	326101324.553 gr ÷ 106= 326.101 ton
Rc ÷ Kc =L	326.101 ÷ 1.8= 181.167 ha ×104= 1811670 m^2
L÷P= EFh	181.167 ÷ 46900= 0.003

At final step, the required land hectare for carbon absorption is divided by population to calculated per capita EP. Citizens living in Pardis need 1811670m^2 land to absorb carbon emitted by domestic gas consumption; their natural gas EF (EFh) obtained to 0.003 hectare/member.

5.3 CALCULATING ECOLOGICAL FOOTPRINT OF PARDIS CONSIDERING TRANSPORTATION SECTOR

To follow calculations for transportation sector, three main products of petrol, gasoline and CNG were used. The data related to petrol, gasoline and CNG were collected from National Iranian Oil

Products Distribution Company and Provincial Gas Corporation [17-23].

5.3.1 CALCULATING FOOTPRINT OF PETROL

Among 6 selected petrol stations, only Pardisan, Kosar, and Siyahsang stations are located in Pardis and the other ones are around the city; however, 4 near petrol stations (i.e Kamard, Bakhsheshi and Tape Seyf) were considered due to daily travels of citizens of Pardis to Tehran. Totally, consumption level obtained to 121050800 liter annually and average daily amount of 331646.027 liter (BC) in 2014 [26,27]. Every gallon of petrol equals 3.7853 liter (K) than can be converted to consuming gallon using liter formula (B). Lead-free petrol releases 125000 BTU (generated heat, BS). Therefore, this formula can be used to calculate BTU petrol per gallon (Ab). Every gallon of petrol releases 19.35 tone carbon (C); therefore, the formula in the third row in table 3 calculates the carbon amount released (Fc) from consuming petrol. One hectare land (H) absorbs 1.8 tone carbon. This formula calculates the required land area (L) for carbon absorption. At last step, the required land area for carbon absorption is divided by population in city to calculate footprint of each person. Citizens living in Pardis need 117.73-hectare land to absorb carbon emitted by daily petrol consumption; petrol EF obtained to 0.002 hectare/member

Table 4: Calculation footprint for petrol.

Formula	Calculation
BC÷K=B	331646.027 ÷3.7853=87614.198
$B\times B_S = A_b$	87614.918 ×125000= 10951774750
$A_b \times R = F_c$	10.95177475 ×19.35=211.916
$F_c \times H \div R_c = L$	211.916×1 $_{ha}$÷1.8=117.73
$L \div P = \underline{EF}_b$	117.73÷46900=0.002

5.4 CALCULATIONG OF CNG EF

CNG consumption data were collected from Tehran Gas Organization; to calculate gas EF, CNG was converted to petrol liter to do calculations based on petrol liter. CNG consumption amount in private and public stations was equal to 3547481m^3 or 6547801 liter in 2014; this amount equals 1793.830 liter per day and one liter equals 1.32 petrol liter. Citizens living in Pardis need 0.841-hectare land to absorb carbon emitted by daily CNG consumption; CNG EF obtained to 0.00001 hectare/member. As this is a low value, it can be removed in general calculations of transportation EF

Of three selected petrol stations, two stations in Kamard and Tap Seyf near the Pardis and Kosar station in Phase II of the city sell gasoline products; total consumption rate of them was about 95826500 liter per year and average amount of 262538.356 liter daily in 2014.

5.5 CALCULATION OF FOOD EF

To estimate food EF, food consumption rate should be given. As these data are not available, relevant data were collected from questionnaires. Sample subjects were selected using Morgan Table at accuracy and confidence levels of 5% and 95%. Final statistics indicates food consumption rate of 522.35 tone.

The annual food consumption is multiplied by the required land area for production of one-tone products. The obtained value indicates the required land area to produce food for the city. The required land area for food consumption of city is divided to the city population to obtain this value.

The required land area to absorb the carbon emitted by food consumption obtained to 9445.60 hectare and food ecological footprint of citizens in Pardis obtained to 0.201.

At last step, the required land area for carbon absorption is divided by population in city to calculate footprint of each person. Citizens living in Pardis need 106.620-hectare land to absorb carbon emitted by daily gasoline consumption; gasoline EF obtained to 0.0022 hectare/member. Transportation EF is calculated by adding EFs of petrol, CNG and gasoline. The required land area to absorb the carbon emitted by transportation equals 225.191 hectare and ecological footprint of citizens in transportation sector equals 0.00421.

5.6 WASTE EF

Per capita amount of waste by each citizen of Pardis equals 500 g daily based on the statistics published by the Pardis waste management organization (According to the statistics of Pardis waste management organization, 2015). This value can be used to calculate annual per capital value of every citizen and total city per year.

Depth of each layer usually equals 2m for burying. Accordingly, the required land area for waste burying is calculated by dividing the value obtained from waste volume divided to the required depth for each waste layer burying to the constant value of converting the m^3 to hectares, which equals 10000. Finally, to calculate ecological footprint of waste in the city, the required area for waste burying is divided to the population; in this way, the required land to bury the waste generated by each person or waste EF is calculated. The required land area to absorb the carbon emitted by food consumption equals 0.237 hectare and food EF of citizens living in Pardis equals 0.000005

5.7 WATER EF

The consuming water volume in Pardis was about 4484819 in 2014 based on the statistics published by Pardis Water and Sewage Company; this value covers 23% of water loss that should be deducted from it (according to the statistics of Pardis-Rudehen Water and Sewage Company). Calculating the water loss, water consumption in Pardis in 2014 is calculated using following equation:

In 2014, the estimation of water loss was $4484819 \times 23\% = 1031508.$ million m^3.

Total water consumption in city was $4484819 - 1031508 = 3453311$ million m^3.

To calculate ecological footprint of water, the required land area for one-million-liter water that was obtained from pervious formula is divided by a number of population. A constant value of 0.08-hectare land area is required to generate one-million-liter water. The required land area to absorb the carbon emitted by food consumption equals 276.264 hectare and food EF of citizens living in Pardis equals 0.006.

Table 5: Summary of EF in Pardis

Row	Consumer group	EF (h/member)	Required land for carbon absorption (h)	Per capital EF	EF deficit
1	Electricity	0.096	39641.516	0.096	+
2	Heating	0.003	181.167	0.003	+
3	Transportation	0.004	225.191	0.096	+
4	Food	0.201	9445.60	0.00421	+
5	Waste	0.000005	0.237	0.000005	+
6	Water	0.0006	276.264	0.006	+
Total		0.0305	49769.975	-	

Pardis is a new structured satellite town that its bio capacity (6 land categories) cannot be estimated based on EF standards since its bio capacity depends on the bio capacity of its supporter region (Tehran). Hence, per capital land estimation method was used to compare EFs.

Considering the population (46900) and area of the city (3600 hectares) and surrounding area of 11000 hectares, 0.311-hectare land belongs to each person living in Pardis to meet her/his needs. According to Table 5, all of deficit values were positive and EF in Pardis suited to per capital consumption.

6. CONCLUSION

There has been a substantial attention to urbanism and construction rate in surrounding cities of megacities in recent years. Pardis is one of cities with proper location, which has provided a desired space for its citizens by considering all of aspects of urban life. It has been tried in this city to prepare more prior consumption pattern compared with Tehran making this city as a supporting region to reduce the resources consumption in Tehran. This study aimed at examining the situation of cities around metropolises (Case Study: Pardis) as such cities tend to reduce the spot pressure of population living in metropolises as well as population impacts. Pardis is a good case study due to its proximity to Tehran and accessibility to intercity commuting roads. EF index explains the relationship between human consumption and the impact of this consumption on environment in different sectors; this index also determines decisions about consumption method and amount examining the impact of human on various world climates during different periods. This index clarifies the relationship between bio capacity (nature power) and human footprint (human impact on natural resources consumption).

According to the compared statistics obtained from aforementioned districts, it was concluded in this research that citizens has suitable energy footprint since there is land availability in Pardis. As it was mentioned, because of citizens' inaccessibility to amenities related to natural gas heating, electricity, and water, low food consumption due to citizens presence in Tehran for long hours, high commuting rate between Pardis and Tehran, and not-calculated fuel consumption, total EF is low in Pardis. The results obtained from this study indicated a direct relationship between welfare level and ecological footprint; in this case, citizens living in Pardis have lower welfare level compared to Tehran citizens due to amenities shortage and lack of access to facilities so they show lower EF compared to people living in Tehran. It is recommended to protect Pardis' EF sustainability based on its desired situation in order to reduce footprint, manage resources in the area, control and monitor the environmental quality, and manage the new-constructed cities around the metropolises.

7. REFERENCES

[1] Hossein Zadeh Dalir, Karim; Pormohammadi, Mohammad Reza; Seyed Fatemi, Seyed Majid. *A study on the necessity of establishing a new system of urban cities of Iran*, 2009.

[2] Saraei, mohammad hossein and zareei farshad, abdolhamid. Sustainability analysis of ecological resources using ecological footprint index (case study: Iran). *Geography and environmental planning*, 2011, 41.

[3] Global Footprint Network. *Living Planet Report*. 2014. http://assets.panda.org/download/living_planet_report.pdf Accessed January 2019.

[4] Global Footprint Network. *Living Planet Report*. 2012. http://assets.panda.org/download/living_planet_report.pdf.

[5] Huang, qing; ranghui, wang; zhiyuan, ren; jing li and huizhi zhang. regional ecological security assessment based on long periods of Ecological footprint analysis. *Resources, Conservation and Recycling*, 2007, 24, 41-51

[6] Global Footprint Network. *Ecological Footprint Atlas*. 2010.

[7] Qarakholoo, mahdi; hatami nezhad, hossein; baqvand. Akbar and yalveh, mostafa. evaluating the sustainability of urban development with ecological footprint method (case study: Kermanshah city). *Human geography research*. 2013, 105-120

[8] Teimouri, iraj and fatemeh salarvandian, CO_2 Ecological Footprint of fossil fuel in Shiraz. *Scientific journal of geographic*, 2014.

[9] Habibi, kiomars; rahimi kakeh job, arman; abdi, mohammad hamed. Ecological footprint assessment of sustainable transportation, (case study: uremia city). Scientific journal of geographical space (university of golestan), 2012.

[10] Sasnpour, farzaneh. Fundamentals of metropolises development with emphasis on the stability of the metropolis of Tehran. First edition, 2011.

[11] Wackernagel.M, Ecological Footprint & Appropriated Carrying Capacity: a tool for planning toward sustainability, 1994.

[12] Rees.W; Wackernagel.M, Urban Ecological Footprint: why cities cannot be sustainable & why they are a key to sustainability, (1996), ENVRON IMPACT ASSESS Rev 1996, 16, 223-248

[13] Wackernagel.M;Monfreda.C; Heinz.Kerb; Haberl.H; schulz. N.B; Ecological Footprint time series of Austria, the Philippines & South Korea for 1961-1999: comparing the conventional approach an actual land area approach, land use policy 2003, 21, 261-269.

[14] Http:// www.footprintnetwork.org./en/index.php/gfn/page/ecplogical_footprint_atlas 2016.

[15] Gholami, mohammad javad; eftekhar nia, mina; molazadeh, abbas. Economical and environmental assessment of the increased population density (case study: 5 region of Tehran), the 6th national conference and exhibition on environmental engineering, 2006.

[16] Kitzes, J., Peller, A., Goldfinger, S., Wackernagel. M., Current methods for calculating national Ecological Footprint account, Science for environmental & sustainable society. 4(1), 2007.

[17] Larson.J;Moore.D ;Gracey.K, The Ecological Footprint & Bio capacity of California, 2013.

[18] Monfreda.C;Wackernagel.M;Deamling.D, Establishing national natural capital accounts based on detailed Ecological Footprint & biological capacity assessments, land use policy 21, 2003, 231-246

[19] Nationality Iranian gas Company. Report of domestic gas consumption, (2014).

[20] Nationality Iranian refining and Distribution Company. A report of Pardis fuel products and statistic of fuel positions, 2014.

[21] Samadpoor, parimah and faryadi, shahrzad. Determination of the ecological footprint in high density urban areas (case study: elahie district, Tehran). *Journal of environmental studies*, 2008, 45: 63-73.

[22] Sheikh azami, ali and div salar asadolah, comparative study of ecological footprint in asia western south countries and western industrial countries, *The 4th international congress of the Islamic world geographers*, 2010.

[23] Statistical center of Iran. *General population and housing census*. 2018. www.amar.org

[24] Tehran electricity distribution company. *A report of Pardis's electricity consumption*, 2014.

[25] Tehran water and waste water company, *A report of Tehran (pardis city) water consumption*, 2014.

Dr.Rokhshad Hejazi is Professor at Olom Va Fonon, Islamic Azad University of North Branch, Iran. Her researches pertain to Environmental Economics, Environmental Impact Assessment, Environmental Values, Economic Valuation.

Zahra Haji Ghorbani Doulabi is a master's degree student in Environmental Management at Islamic Azad University of North Branch. Her research is related to Environmental Impact Assessment.

Sepideh Alikhani is a master's degree student in Environmental Management at Islamic Azad University of North Branch. Her research is related to Environmental Assessment.