



Environmental Effects of Extension of National Highway No. 1 – A Case Analysis

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ABSTRACT

This research has been conducted with a view to assess the environmental effects as a result of the expansion of Panipat – Jalandhar expressway that began in 2008 to the present day of May 2016 for the purpose to uplift it from four (4) lanes into the six (6) lanes which covers the total of 291 km and yield into the serious change of vegetation cover. The study also is to assess the decreasing area of vegetation along the construction road site, which found the severe decline of vegetation vicinity from 1631.3 km in 2002 to 1344.8 km in March 2016 and to identify the intensity of vegetation alteration with indication of 2002 having the dense vegetation in respect of the 0.688 value as correlate it with the 2016 value of 0.5176 that entails present of shrubs and a lesser amount of trees for the entire road environs. It also has a bunch of negatives impact that honestly linked to the environmental imbalance which affects the whole ecosystem due to the decreases of vegetation cover. This study, adopted the secondary source of data in order to assess the realistic change in vegetation dense area with aid of Normalised Difference Vegetation Index (NDVI), that selected the buffer region with limited of three (3) km from both road sides and the two range value that is below 0.6 indicates the shrubs and small trees while above 0.6 means high concentration of vegetation cover and also the Data set with assist of land sat image was derived from the United State Geological Survey (USGS) and finally the derived satellite map or image was processed.

KEYWORDS :

ABOUT THE PROJECT

The Indian government under the National Highway Authority of India (NHAI) concluded to expand Jalandhar – Panipat National Highway One (NH-1) from four lane to six lane via its five phase of National Highway Development Programme (NHDP), The road covers 291 km in north western part of the country consisting of 175 km in the state of Punjab and 116 km in the state of Haryana (Hindustan Times 2014). This project was taken by the two major partners, that is Soma Enterprises limited of India and Isolux Corsan Company limited of Spain which was awarded in 2008, with a view to complete it within 30 months period of time, from May 2009-November 2011 (Hindustan Times 2014).

The construction of six lanes is consisting of 2.0 m paved shoulder with additional 3.5 m bituminous on the existing side of initial lanes. The Soma-Isolux is responsible to provide road facilities (Bridges, passengers underpass and vehicular underpass), to maintain and to via any liable for a maximum time of 15 years, that commenced from the date of appointment on 11 May 2011 (Soma- Isolux 2014). The expansion of Jalandhar Panipat express way is linked four national highway one namely Himachal Pradesh, Uttar Pradesh, International border with Pakistan, Jammu and Kashmir and also along with 570 junctions that connected between express way and minor ways, it crossover nine railway track. (Soma Isolux 2014).

The Soma – Isolux will equip six new emerged roads with amenities such as major bridges (19 on mcw and on service road) and minor bridges (11 on mcw and 97 on service road), underpass (44 vehicular and 55 pedestrian), flyovers (71 Nos, ROB 9) as well as 112 vehicle rams which can take shape according to the Indian standard (Soma Isolux 2014).

HOW PROJECT WILL BE BENEFITED

The National Highway No. 1 is a hub path that connect major cities, capital and its likes and it's also characterised with high road users which serve as a nerve point of any development (TDONH). This project on Jalandhar – Panipat highway will encourages and attract many more investors that can improve economic growth of both the state of Punjab and Haryana (Keane 2015). It also facilitates effective and reliable input and output of commercial activities.

This elevation of four lanes into six lanes of Panipat Jalandhar NH 1 will accentuates both internal and external trade which can dole out a focal point of a successful economic development (Keane 2015). As a consequence of converting six lanes, so many new structure may take shaped and it yields into direct and indirect employment FHWA 1996, 1998 in Keane 2015. It will also reduce traffic jam and decreases frequent occurrences of accident particularly along Jalandhar express way (Cameron 2016), that can pave a way to a sound and comprehensive economic development in the north western corridor as well as India in general (Cameron 2016).

The widening of the national highway one indisputably will accelerate agricultural sector and encourages number of agro allied industries in the entire region (Pernicario and Crawford 2014). The upgrading of NH 1 that crossover Punjab and Haryana in the north western corner of India will lied a crucial artery in tourism industries at national and international level due to the presence of international border, golden temple and its likes, immensely boosting the economic status of both state of Punjab as well as Haryana (Pernicario and Crawford 2014).

The portion of Panipat Jalandhar express way stretches North West from national capital Delhi is progressively improve social wellbeing in both states (Punjab and Haryana) in various aspect of life such as educational access, reducing inequality etc. (ARC 2011). It leads to the surfaced of ultra-modern structures on the both road side which includes motel, hotel, hospital, cinemas, marriage places and others development facilities that continues escalating urbanisation in the region (ADHS 2008 in ARC 2011).

The Panipat - Jalandhar national highway serves as a cornerstone of the whole region districts in terms of socio- economic phase (Isserman and Rephann 1994) and reinforces urban growth into peripheral area (Hansen 1966, Newman 1972, in Isserman and Rephann 1994). The extension of Jalandhar - Panipat express way has crucial impacts in improving the social wellbeing of the peoples by providing employment opportunities which is directly decreases the rate of unemployment that can sustain gross domestic product (Manzo 2013). It can facilitate into emergence of good health care facilities in the Punjab and Haryana (Liu).

ADVERSE EFFECTS OF ROAD EXPANSION

The mainstream of losing biodiversity crosswise is human action (Vitousek 1997).The construction and expansion of road a chief source of trouncing habitat and degradation (Van der Ree et al 2011). The widening of Panipat - Jalandhar express way will continue escalating the disintegration habitat and mortality of wild animals due to removal of vegetation (Di-Giulio and Holderegger 2009 in Van der Ree et al 2011).

Soil degradation is enormously escalating as a result of land filling(D-FID report 1994,1997 in lawrance 2010).This project has destroyed ecological and seclusion of wildlife ecological niche (Seiler 2001),it modifies hydrological dynamics as well as polluting the immediate environment by a different impurity of chemical (Seiler 2001).The construction of Jalandhar - Panipat NH 1 deeply affects the surrounding areas, because of the necessitate of cutting, clearing and level (Findlay and Bourdages 2000 in Seiler, 2001).

Another harmful effects of road expansion are the loss of forest that can pave a way to ecological imbalance (Caliskan 2013) and lessening of nitrogen oxides and amplify carbon dioxide that is commonly ignite by the road users (Gloria et al 2000).It also assists invasion of pests, weeds pathogens and pilot dimensions of soil nutrient report by the council on environmental quality 1974 in Noss.

Furthermore, it also spawns noise pollution by the road users which can negatively destruct human inform of physiological strain (Kight and Swaddle 2011) and also make corollary animals to migrate permanently or temporarily (Forman and Deblinger 2000, Berber et al 2010 and Schneider 2009).

Finally,the upgrading of national highway one (NH 1) from four lanes into six lanes is keep on swelling detrimental of natural habitat (Abu-Qudais and Odais 2000),which dislodge numerousnumber of species and butt in ecological equilibrium and dwindling ecosystem World Bank 2006 and South Africa Government 2006 in Karani.

HOW MUCH WORK HAS BEEN DONE AND IT’S PENDING?

The National Highway Development Programme (NHDP) was established in January 2005, by the Indian Government for the purpose of facilitating enlargement of the Indian express ways that primarily managed by Engineering Procurement and construction (IAAD 2013 Report). The Indian ministry of road transport and highways was placed a benched marked of upgrading and widening of national highways at 20 km per day (IAAD 2013 Report).

Though, it has been observed that, national highway authority of India (NHAI) is not capable to convene its target of complete construction of 20 km for each day, but it able to attainment of 3.06 km – 17.81 km in a day, in the course of 2009-2010, 2012- 2013 (IAAD 2013 Report).The Indian express ways or national high way one has covered the total of 65569 km and account for more than 40% of the overall country traffic (IAAD 2013 Report).

This expansion project of Jalandhar Panipat is divided into five phases, which include the following;

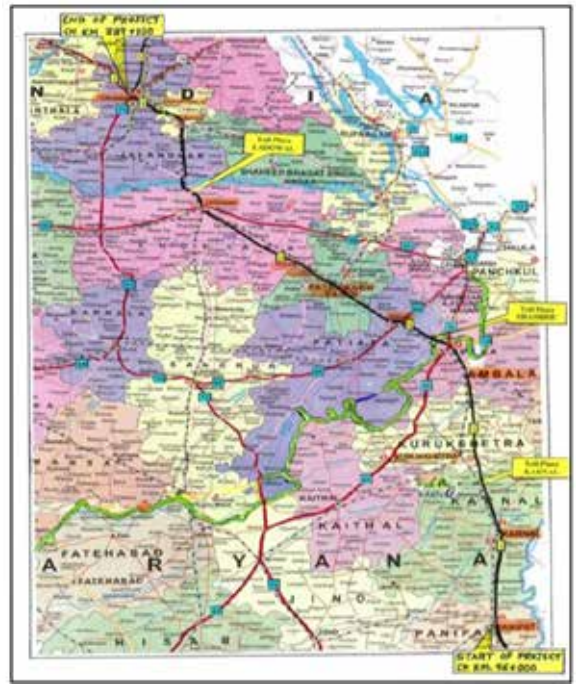
Phase 1 - 96 km - 146 km in the state of Haryana

Phase 2- 145 km - 212 km in the state of Haryana

Phase 3- 212 km – 267 km in the state of Punjab

Phase 4 - 267 km - 329 km in the state of Punjab

Phase 5- 329 km – 387 km in the state of Punjab



The above work schedule was revealed by the Soma Isolux Company limited in 2014.The progress report of the project base on the phase’s schedule was revealed by Soma – Isolux from March 2008 to September 2014 and indicated that, numerous number of structures (Passengers underpass, Vehicular underpass and Flyovers) has been completed and also operating in both Punjab and Haryana.

The Table 1 below showing length of completed road with DBM – TOP

| Phases | Left Hand side | Right Hand Side |
|-------------|----------------|-----------------|
| Phase 1 | 49 | 45 |
| Phase 2 | 48 | 47 |
| Phase 3 | 43 | 43 |
| Phase 4 | 46 | 47 |
| Phase 5 | 49 | 47 |
| Aggregate | 235 | 229 |
| Grand Total | 465 | |

Source; Soma 2014

The table 1 depicts, the length of road with DBM – TOP completed in both road sides (left and right) on the basis of phases which should be adumbrated as follows; Phase one has 49 km on the left side and 45 km on the right side, Phase 2 having the total of 48 km from the left hand side and 47 km from the right hand side, while, the third phase covers 43 km left and 43 km right, the fourth phase with 46 km left side and 47 km right, the fifth phase has 49 km left and 47 km right. Furthermore, the sum of 235 km on left hand side of the road has been absolutely done and totting up 229 km entirely ended from right hand side and having the grand totalof 465 km on the Panipat Jalandhar express way on the two face of the road.

The advancement of the Panipat Jalandhar NH 1 from four lanes into six lanes has almost achieved as at March 2015, When the Soma Isolux Company was able to finished 250 km out of 291 km (Tribune 2016) and also capable to ended 150 structures (Passengers underpass, vehicular underpass as well as flyovers) out of 176 total structures that are expected to surfaced on the task (Tribune 2016).

PENDING WORK

Almost 40 km of the major carriageway is yet to take shape and pending of 28 structures (underpasses, bridges and flyovers) are yet to be built both in Haryana and Punjab reported by the Tribune 2016 in reference with Neelokheri, Shahabat, and Pipi, Ambala, Kamal, Phagwara, Jalandhar and likes. This left over project is yet to be resumed by the Soma Isolux Tribune 2015 in Tribune 2016.Similarly,the elevat-

ed express way on Panipat Jalandhar is still on progress in areas such as Samra bypass in ludiana, khana, sirhind etc. Tribune 2015 in Tribune 2016.

EXTENSION OF NH 1

The Indian private company in collaboration with Spanish company formerly known as Soma Isolux, that facilitating construction of Jalandhar Panipat express way which enclosed 291 km across the two prominent states as well Punjab and Haryana (Hindustan Times 2014).this contract was bond between Indian government and Soma Isolux on May 9 2008 with duration period of 30 months which will close end on November 2011 and also the company (Soma Isolux) abortive to meet up concluding point on November 2011,this lead to the extension of almost two and half years that is from November 2011 to March 2013.

In addition to that, the Soma Isolux Company has failed to complete the project on March 2013, which subsequently the Supreme Court on April 17 2013 extended the deadline from March 31 2013 to March 31 2015, even though in March 2015, Soma Isolux futile to ended the project due to the outstanding works of about 29%.After that, another additional three months was given in order to complete widening of national high way one (NH 1) (Tribune 2015).Despite the numerous extension granted by company (Soma Isolux) the failed to file it up- (Hindustan Times 2014).

OBJECTIVES OF THE STUDY

Is to assess the decreasing area of vegetation cover before and after the commencing of the elevation of National High way One.

Is to identify the changing intensity of vegetation cover along the Panipat Jalandhar express way.

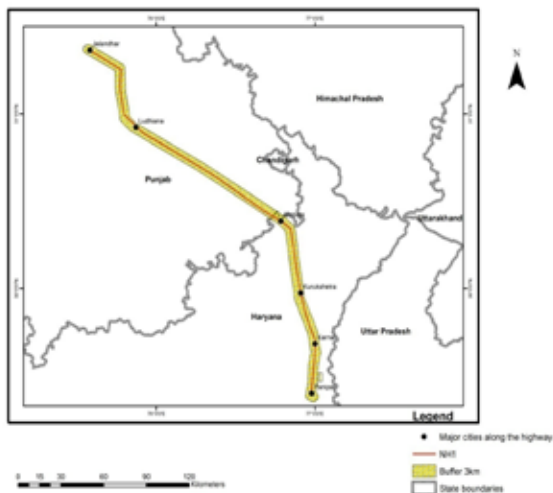
What is the possible environmental impact of widening of the NH 1?

ANALYSIS OF ENVIRONMENTAL EFFECTS

VEGETATION LOST

Vegetation is a hub centre of biodiversity and also a prominent tool of driving ecological balance as well as forest cover (Karpatnie 2012). Vegetation is an essential natural resource that immensely contributes in utilizing a series number of bioclimatic and geochemical processes. The anthropogenic factor particularly in relation to the human development project with respect of the widening of Jalandhar Panipat National Highway One (NH 1) into six lanes covered about 291 km and lead to the loss of 286.5 km of vegetation areas.

In this study, it covers three (3) km from both road sides which make the total of six (6) km and lead to the creation of buffer region in order to assess the change in vegetation cover as a consequence of six lanes expansion from Panipat to Jalandhar National Highway One. Below is the figure 2; shows the study area across the state of Punjab and Haryana.



ASSESSMENT OF THE DECREASING AREA UNDER VEGETATION COVER

The assessment of the decreasing area under vegetation covers before the commencement of the expansion of Jalandhar – Panipat express way in March 2008 and to the present day of 2016.It has been found out that, there was a decreased in terms of vegetation cover which is as at 2002 has about 1631.3 km, but now it has been reduced to 1344.8 km in reference of March 2016.

THE CHANGING INTENSITY OF VEGETATION COVER

The vegetation density along the newly emerged six lanes of the Panipat Jalandhar express way has hugely alter from 0.687 in 2002 to 0.5176 as at 2016,that yields to the surfaced of small trees and shrubs around the entire area.

PLAN OF RE-AFFORESTATION SUBMITTED BY THE SOMA- ISOLUX ON NH 1 TO THE FOREST DEPARTMENT

The Soma – Isolux company did not submitted any propose plan for re-planting of trees or re-a forestation either on the roads sides (left or right) or at middle portion of the road, due to temperament of the contract flanked by National Highway Authority of India (NHAI) on the opening out of Jalandhar Panipat express way from four lanes into six lanes (ADB Report 2008).

The National Highway Authority of India (NHAI) in collaboration of with Asian Development Bank (ADB) is liable to provide desirable process of protecting and nourishing all ecological issues (ADB Report 2008).The Asian Development Bank is given loan to National Highway of Authority of India with a purpose of re-planting trees and other vegetation lost due to the road construction Panipat Jalandhar expressway (ADB Report 2008).

STATUS OF WILDLIFE (REPTILE & BIRDS)

The destructions of forest due to the widening of National Highway One (Jalandhar – Panipat) it yields to the loss of wildlife such as birds as a result of cutting down of trees (Usman and Adefalu 2010) and gone astray of reptiles as consequence clearing of vegetation covers (Usman and Adefalu 2010).

Furthermore, the wildlife (Reptile and Birds) would be lost as a product of habitation lost, because of the road project (Binalli et al 2012). It also negatively affect plant and animals interdependence in terms of shelter and food which is exist for their life survival and becomes as an effect of converting forest areas into the road side of Panipat Jalandhar national highway one elevation (NZP 2013).

In addition to that, the widening of Jalandhar Panipat (NH 1) has a great impact on forest degradation and habitat lost by wildlife (Birds and Reptiles) and it continues endangered hot spot of biodiversity, which resulted into fragmented forest and in turn to reduce the number of birds and reptiles due to the environmental change (NZP 2013).

WHAT EFFECT WILL BE THERE ON ENVIRONMENT DUE TO CHANGE OF VEGETATION TYPE AND REDUCTION OF NUMBER OF TREES

One of the major effects of vegetation change and reduction of forest cover is the decreases of the soil fertility (Binalli et al 2012) and enhance roads sides developmental works such as light industries, shopping mall, and likes which can directly raise the rate of global warming (Binalli et al 2012).

The reduction of trees because of the surfacing of upgrading Jalandhar Panipat expressway, it has a direct negative on the grasses which would slowly substituted by shrubs (Binalli et al 2012).The decline of vegetation will raise the amount of carbon dioxides in the atmosphere as a consequence of the release of chlorofluoro carbon that can step up environmental temperature (FON 2014).

This project of construction of National Highway one (NH 1) is associated with environmental problems such as siltation, waste generation, spoil, noise, dust, hot mix plants, emission from asphalt that comes directly from vehicles and other construction equipment (ADB Report 2008).

IMPACT OF CUTTING DOWN OF TREES ON SOIL EROSION AND AIR POLLUTION

Scores of trees have been gun down as a result of elevation of Panipat Jalandhar express way, which yields into the escalating environmental degradation FAO 2000 in Usman and Adefalu 2010.As a consequence of this construction which may leads to the ecological succession and change ecosystem structure and it species composition that can be leisurely modified over a period of time.(Binalli et al 2012).

The removal of plant particularly trees, it may serve as driven factor of enhancing air pollution (FON et al 2014) and also to ignite soil erosion which can rout to excessive water runoff (Hattinger 1984 in Raffaele and Enrico 2000.In addition, The widening of Panipat Jalandhar national high way one is accelerating sediment in the both nearby and far away streams or rivers due the high intensity of soil erosion Reid 1987, Peace and Hudguiss 1987 in Raffaele and Enrico 2000.

Moreover, the cutting down of trees also decreases soil infiltration capacity and continues barricade natural drainage system King 1989, Tilley and Rice 1977, Wright et al 1990 in Raffaele and Enrico 2000.this cutting down of trees immensely increase the rate of sulphur dioxide emitted from vehicles and other automobiles hugely add the quantity of air pollution as a consequence of increase of the number of road users due to expansion of the way, that greatly improve the greenhouse gasses which contribute to global warming or abnormality of temperature(CEF 2009).

WHAT IS THE SOURCE OF THEIR MATERIALS?

The main source of construction materials of Soma Isolux for the elevation of Jalandhar Panipat express way is oblige from nearby or far away from the project site, these materials includes; sand, and rock pieces, that are very essential of the structure of road. The quarry sites and borrows pits which soma Isolux use to convey building resources is approved and identified by the state pollution control of the both state of Haryana and Punjab in order to eliminate negatives of environmental effects (ADB Report 2008).

As a consequence of exploitation of building resources such as sand and rock pieces from the quarry sites lead to the shaping of serious environmental problem which includes; vegetation lost, slope destabilization and its other associates problems. (ADB Report 2008).In order to mitigate the ecological difficulty state pollution control board has taken serious action to overcome negatives environmental effects (ADB Report 2008).

MATERIALS AND METHODS

Data: Satellite imageries of year 2002 and 2016 were used in this study. The remotely sensed images used were LANDSAT imagery which was acquired from the US Geological Survey website (<http://earthexplorer.usgs.gov/>). Considering quality of data, availability, and cloud cover, all the images used are for the month of March. The optical bands of TM images (bands 1–5 and 7) have spatial resolution of 30 m and the thermal band (band 6) has a spatial resolution of 120 m.

Image pre-processing: For image pre-processing, the images were atmospherically corrected using ENVI 4.7. The SLC (Scan Line Corrector) -off Images after 2003 were gap filled using image pre-processing tool in ENVI 4.7. However, imageries of 2016 had almost minimal cloud cover (less than 1 percent), which was masked out using ENVI 4.7 to eliminate any effect of cloud on derivation of the indices. The LANDSAT scenes covering the area of interest were mosaicked and subsetting using ENVI 4.7 and subsequently transferred to ArcGIS 10.1 for extraction of indices.

Digitization of the highway: The NH1 highway was digitized from the Google maps and transferred into the GIS environment for assessing the loss of vegetation in the area before starting of the project and after completion of the project. For assessing the loss of vegetation, a buffer zone of 3 km on either side of the road was taken as this is the region of major influence of the project.

Derivation of area under vegetation: Normalized Differential Vegetation Index is used for extracting the area under vegetation cover for two points of time. The raster calculator tool in the ArcGIS 10.1 is used for calculation of the index. The value of this index ranges from -1 to 1, with higher pixel values corresponding to healthier and greener vegetation. The VARI was calculated using following equation:

$$NDVI = \frac{NIR - Red}{NIR + Red}$$

After generation of NDVI for 2002 and 2016, the total area under vegetated and non-vegetated land is evaluated and the percent change in the area under vegetation is calculated.

DISCUSSION OF THE RESULT

The Table 1, below shows the non-vegetated area and vegetated areaboth in square kilometres and its percentage with respect of the year of 2002 and 2016 along their differences.

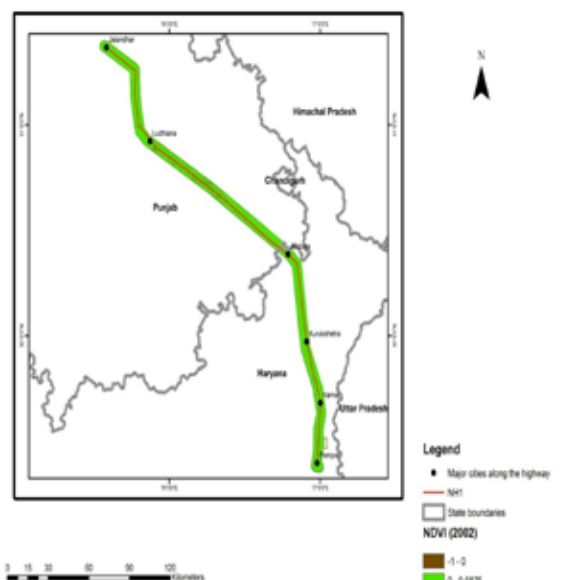
Table 1;showing the non-vegetated area, vegetated area, percentage and their difference.

| YEARS | Non-Vegetated Area | Vegetated Area | Percentage |
|------------|--------------------|----------------|------------|
| 2002 | 36.5 | 1631.3 | +784 |
| 2016 | 332.0 | 1344.8 | -17% |
| Difference | + 286.5 | -286.5 | |

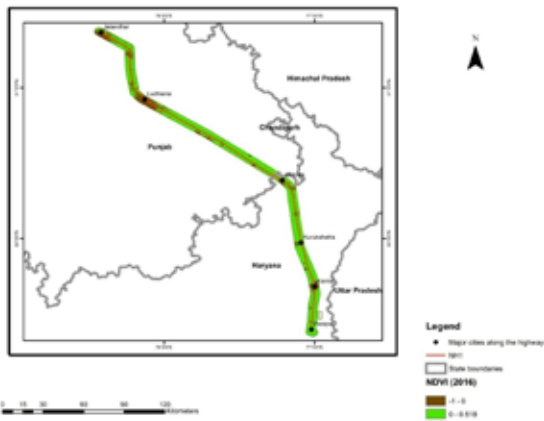
Source; NDVI 2016

The above table1 depicts the decreased in vegetation area of about 286.5 km2, which is equivalent to the 17% of the total vegetation cover from Panipat to Jalandhar National High way one.

The figure 1 and 2 viewing spatial changes in vegetation cover prior to 2008 and post commencement of the Panipat Jalandhar NH I expansion into the six lanes, That signifies more vegetation in 2002 before the republishing of the road and also indicating the significant vegetation deficient in 2016.The figures (Maps) was produced on the basis of Normalised Difference Vegetation Index (NDVI) has evaluated the range of selected buffer region from 0.2 to 0.6 represent shrubs and less vegetation cover, and above 0.6 represent dense vegetation cover. Figure (Map) 2 below shows value above 0.6.



The above map has the value of greater than 0.6 with reference of 2002, accentuated a dense vegetation unlike the figure (map 3) with regards of 2016 has the value below 0.6 which means only shrubs and minimal vegetation area (small trees).Below is the figure 3 (map) shows value less than 0.6.



The change in the intensity, that has been measured base on the Normalised Difference Index (NDVI) in order to analyse the vegetation cover along the National Highway One of the Jalandhar Panipat. Which was revealed a drastically changed in vegetation density between 2002 to 2016. The vegetation intensity during the 2002 was about 0-0.687 as compare with the value number of 0-0.5176 in 2016 after the shaping of Panipat Jalandhar express way. It also delineated the reduction of vegetation density of the area and also indicates that denser tree cover in the area is now occupied by shrubs.

The impact of the project, the elevation of the Panipat Jalandhar NH 1, has numerous negatives particularly with concern of environmental imbalance, that in turn to affects the whole ecosystem in respect of destruction of wildlife (Reptiles and Birds), in addition of vegetation change and reduction of great number of trees as a result of their gun down, which is escalating the rate of air pollution.

CONCLUSION

Conclusively, the extension of national highway one from Jalandhar to Panipat has so many positives in the realms of social and economic perspective as a consequence of boosting social wellbeing and cheering urbanisation within the entire region as well a nation in general. This project also associated with a series of negatives that directly affected the environment especially with regards of the change of vegetation intensity that has been reduced as a product of elevation of the express way taken by Soma- Isolux Company since from 2008 and to the present day of April 2016.

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