Final Report

Working Partner Program
Impact Evaluation of Billion Tree Tsunami Afforestation Project in the Province Khyber Pakhtunkhwa, Pakistan

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SUMMARY

The Sustainable Development Goals (SDGs) developed by the United Nations (UN) in 2015 have brought increased awareness to critical issues such as the environment, employment, and health. These issues hold great significance, particularly for developing countries. Governments, organizations, institutions, and policymakers worldwide have prioritized the SDGs and are actively undertaking initiatives to support the UN's Social Progress Index (SPI). In Pakistan, while the other provinces participated in the afforestation project under the guidance of the Federal Government in 2019, the province of Khyber Pakhtunkhwa (KP) had already initiated the "Billion Tree Tsunami Afforestation Project (BTTAP)" in 2013. The KP government took this important step towards addressing climate change by focusing on enhancing forest cover, conserving biodiversity, and establishing protected areas within the province.

Under the KDIS Alumni Working Partner Program, we evaluated the short-term impact of BTTAP on relevant employment and awareness, as well as the long-term effects on health, environment, pollution, internal migration, and animal habitats. Our evaluation involved collecting data from the general public, project stakeholders, and government officials. Additionally, we leverage the Pakistan Social Living Standard Measurement (PSLM) data, which offers comprehensive modules related to health and employment, as a valuable panel dataset.

Although the evaluation of this project is in its early stages, we employ GIS mapping techniques to identify treatment areas. Moreover, we utilize the *difference-in-difference* and *instrumental variable* approaches with fixed effects using panel data to control for time and group-specific effects, ensuring a rigorous analysis of the project's impact. We aim to provide valuable insights into the effectiveness of the BTTAP in addressing environmental concerns, promoting employment, and improving the overall well-being of communities in Khyber Pakhtunkhwa province. The findings of our study contribute to the ongoing efforts towards achieving the SDGs and fostering sustainable development in the region.

1. INTRODUCTION

As a Party to the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC), the Government of Pakistan has played its part in assisting the international fight against climate change (NDC Pakistan, 2021). The "Billion Trees Tsunami Afforestation Project in Khyber Pakhtunkhwa," or BTTAP for short, aims to plan, create, launch, and apply the "Green Growth Initiative" in the Khyber Pakhtunkhwa Province's Forestry Sector. The Khyber Pakhtunkhwa Forest Department is carrying out the project across the whole province via its three forest areas, namely the Hazara Region, Malakand Region, and Southern & Central Region. Besides serving the purpose

of ecosystem restoration and enhancement, the BTTAP also aims at generation employment opportunities at the local level, especially for youth and women. A watcher guards a 20ha closure against unauthorized activity. 18,750 people will be gainfully employed as observers for the 375,000-hectare region that is being closed for four years. The BTTAP provided 320,500 man-days of employment to locals for the planting of 5,500 acres of MPFGTS. Employment options for people who have been assigned nursery growing responsibilities are also helping to support a variety of extra activities and job prospects as a result. It comprises those involved in different activities, service providing, etc. (WWF-Pakistan, 2016).

Climatic change is a danger multiplier, and it affects individuals unequally, with the poorest and those least suited to resist climate shocks and pressures suffering the brunt. Low-income nations suffer more when climate change isn't addressed. Pakistan, which contributes 0.9% of global greenhouse gas emissions, is susceptible to climate change. These repercussions include violent floods, abrupt changes in rainfall patterns, melting Himalayan glaciers, and a spike in vector-borne illnesses like dengue. Pakistan wants to switch to 60% renewable energy, and 30% electric cars, and eliminate coal imports by 2030. Pakistan wants to grow NBS via TBTTP, Recharge Pakistan, and PAI. Pakistan's 2018 emissions are 489.87 MtCO2e; BTAP and TBTTP would sequester 500 MtCO2e by 2040 if completely implemented. Pakistan must improve its scientific and technological capabilities to meet transition goals (NDC Pakistan, 2021).

Plantation crops and trees have enormous potential to store atmospheric carbon and slow down climate change. We need need to appropriately incorporate plantations and trees into our houses, buildings, marketplaces, parks, and other public spaces. The destructive consequences of climate change are mitigated by trees because they may survive in marginal areas (even without additional fertilizer application) and because they modify our environment. The production from farms would rise if trees or plantation crops were integrated, reducing food insecurity and poverty (Aba et al., 2017). Important crops for food security and alternative energy sources are grown in tropical and plantation environments. These mitigating measures may be divided into two categories: those that have an impact on current plantations and those that have an impact on future trends in afforestation and deforestation. Plantation forest managers should carefully evaluate the long-term impacts of adaptation or mitigation methods for climate change (Pawson et al., 2013).

The word "plantation" came into use when southern American towns, which were initially associated with colonial expansion, became centered on agricultural output. When British colonists landed in what would become known as Virginia and split the land into vast tracts ideal for cultivation, the plantation system emerged in the American South. The plantation system led to a society that was severely class-divided. Plantation owners were affluent aristocrats who set their own standards and customs. Because of this, the South had a wider disparity between the affluent and the poor than the North. Although affluent nobles controlled the farms, the workforce kept everything running. A

small number of affluent, white landowners controlled the majority of the land in the colonies south of Pennsylvania and east of the Delaware River, while the rest of the population consisted of subsistence farmers, indentured servants, and slaves. Virginia received its first shipment of African slaves in 1619 (Society, 2022).

Plantations were created to supply a range of ecosystem services, mostly timber and other wood products, and makeup close to 4% of the world's forests. In addition to these functions, plantation forests contribute to biodiversity directly and indirectly by providing habitat for a variety of species and by minimizing adverse effects on wild forests by balancing the demand for resource extraction. Changes in forest management practices that have been suggested to reduce the impacts of climate change on the productive potential of plantations would have significant indirect effects on biodiversity in plantation forests (Pawson et al., 2013).

Risks to New Zealand's plantation forests include future biosecurity threats and the effects of climate change. Due to shifting climatic circumstances, projected productivity improvements for radiata pine (Pinus radiata D. Don), the major commercial forest species in New Zealand, are minimal (Watt *et al.*, 2019). With regard to growing bioenergy crops, Eastern Germany has a distinct advantage since the previous "agricultural cooperatives" established sizable farms with, in comparison to Western Germany, comparably big fields. Therefore, a modeling investigation of the potential and effects of aspen SRC plants under the current environment and future climate forecasts was carried out in the five eastern federal states of Germany (Lasch *et al.*, 2010).

2. PROJECT DESCRIPTION

The Government of KP Province has launched a huge project to paint the economy green under the "Green Growth Initiative". A task force named "Tiger Force" has been set up, volunteer plus paid, for the plantation across the province and some permanent caretakers were hired for the taking care of plants. The Task Force on Green Growth has named six focus areas: Forestry, Protected Areas, Clean Energy, Climate Resilience, Water/Sanitation, and Waste Management for Khyber Pakhtunkhwa. The "Green Growth Initiative" of Khyber Pakhtunkhwa is a flag bearer of the clean and green revolution in Pakistan. It bears the promise that the Government will endeavor its best to provide a better quality of life to the citizens of Khyber Pakhtunkhwa, create decent and clean job opportunities for the youth, and also provide a means for social uplift and poverty eradication in the province.

It is an admitted fact that forests are vital to achieving global sustainable development. They provide solutions for addressing many development challenges including poverty eradication, environmental sustainability, support to the livelihoods, food security and agriculture, energy, clean water, and watershed protection, biodiversity conservation, mitigation and adaptation to climate change, combating desertification and land degradation, and disaster risk reduction. Hence forests are vital

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for creating green economies. Thus after expert deliberations Forestry was prioritized along with two other sectors and the following targets were announced during the launching ceremony of Green Growth Initiatives on February 9, 2014, at Pakistan Forest Institute, Peshawar:-

1. Increase the area of forests by two percent by converting 30,000 ha of additional land into forests annually.

2. Increase density (area of forests having canopy cover below 50%) of 7% of degraded forests by closure against grazing and fire.

3. Launch the "Billion Tree Afforestation" campaign to involve local communities in the sacred pursuit of greening Khyber Pakhtunkhwa.

4. Establish rules for REDD+ to assign Carbon value to forests and institute REDD+ as a tool to promote conservation.

5. Conserve Khyber Pakhtunkhwa Forests as a valued natural asset.

Billion Tree Tsunami Afforestation Project is aimed at planning, designing, commencing, and implementing the "Green Growth Initiative" in the Forestry Sector of Khyber Pakhtunkhwa Province. The project will thus support the Khyber Pakhtunkhwa Forest Department, as a catalyst, to plan, design, and launch sustainable development in the Forestry Sector (through active involvement of local communities) and promote green jobs. It will accordingly result in enhancement of forest resource base, rehabilitation, and improvement of existing forest ecosystems of the province, arresting environmental degradation, livelihood improvement, and job creation for rural youth at their doorstep. The project objectives are thus positively correlated with the sector objectives both at the federal and provincial levels.

Since, the project aims at improving the ecosystem of classified forests, as well as privately owned waste and farmlands, the project, therefore, entails working in close collaboration with concerned communities/stakeholders to ensure their meaningful participation through effectuating project promotion and extension services.

2.1. Progress

The Bonn Challenge is a global effort to restore 150 million hectares of the world's deforested and degraded lands by 2020 and 350 hectares by 2030. On December 15, 2015, at the UN climate change conference in Paris, KPK government representatives announced the restoration of 30,000 hectares and pledged to the Bonn Challenge. Till 20 April 2017, there has been almost 70 percent of the work is completed or under process, and at the end of 2018, authorities will complete their pledge (Kharl, 2017).

The project extends over the entire area of Khyber Pakhtunkhwa, comprising three Forest Regions

i.e. Central Southern Region-1 Peshawar, Northern Forest Region –II Hazara, and Northern Forest Region-III Malakand. Administratively the project will be implemented in all the three regions comprising 28 Forest and Watershed Divisions. The Integrated Specialized Units of Planning & Monitoring (FP&M), Community Development, Extension & Gender & Development (CDE&GAD), Non-Timber Forest Products (NTFP), Research and Development (R&D), and Institutional and Human Resource Development (I&HRD) will provide support to territorial units and PMU for effective management of the project (PC-I of Project).

The Billion Tree Tsunami Afforestation Project gained momentum after March 2015 when the provincial government put its efforts into establishing a healthy environment for people. BTTAP is based on three steps, first to grow saplings; second how to ensure their safe transformation and nourishment and last the protection of forests (Ashraf, 2017). The project was split into two phases, with a total cost of 1.912 million first phase was implemented during 2014-15, while with a total cost of $12.4 million phase two were implemented during 2015-2017 (Kharl, 2017).

The project is designed to pave the way for the smooth transformation of the current economic growth model to the green economy. It has now been realized that the existing global growth model has failed to alleviate poverty and resulted in natural resource stripping. Thus, in order to deliver socially inclusive, environmentally sustainable and climate-resilient, a new economic growth model called "Green Economy" is being promoted worldwide.
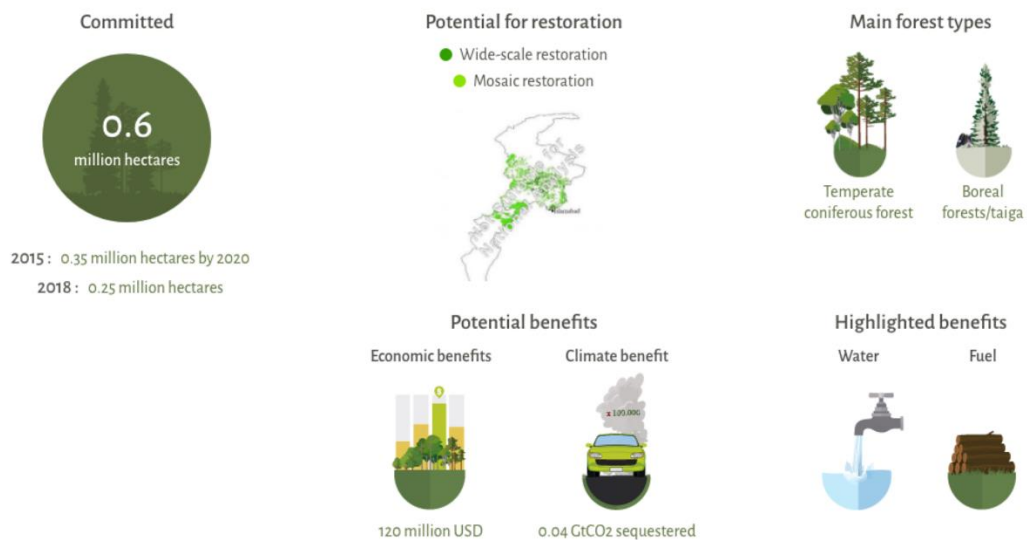
Source: World Economic Forum (WEF)

Khyber Pakhtunkhwa has its 20.3% area under forests, as assessed by Pakistan Forest Institute (PFI, 2012). It accounts for over 40% of national forest wealth. As per working plans data, Khyber Pakhtunkhwa forests have 48.84 million trees and have 2322.88 million cubic feet 5 volume. The Khyber Pakhtunkhwa Forests put on 12.511 million cubic feet of growth annually. Thus, roughly

Khyber Pakhtunkhwa forests annually sequests 140.327 million tons of Carbon. Part of this Carbon can be marketed to fetch carbon credits. Similarly due to extensive planting carried out under the project potential for earning from Clean Development Mechanism (CDM) will also increase. The land use analysis of the Khyber Pakhtunkhwa is given below:

Table 1: Breakdown of Land Use

S No	Land use	Area (million hectares)	Percentage
1	Forest	1.510	20.30
2	Alpine zone	0.660	8.70
3	Rangelands / Bushes/ barren	1.980	26.60
4	Agriculture	2.200	29.8
5	Others	1.100	14.60
	Total	7.450	100.00

Source: PC-I of Project

2.2.   Computer Simulation Model and Workflow for Afforestation

To develop a system dynamic model for afforestation classes, a conceptual diagram was developed with the help of Stella 10.1. The flows in Figure 2 show that five major sub-activities of afforestation have been included in the BTTA project, thus reinforcing growth in the forest area.

Figure 1: Simulation Model
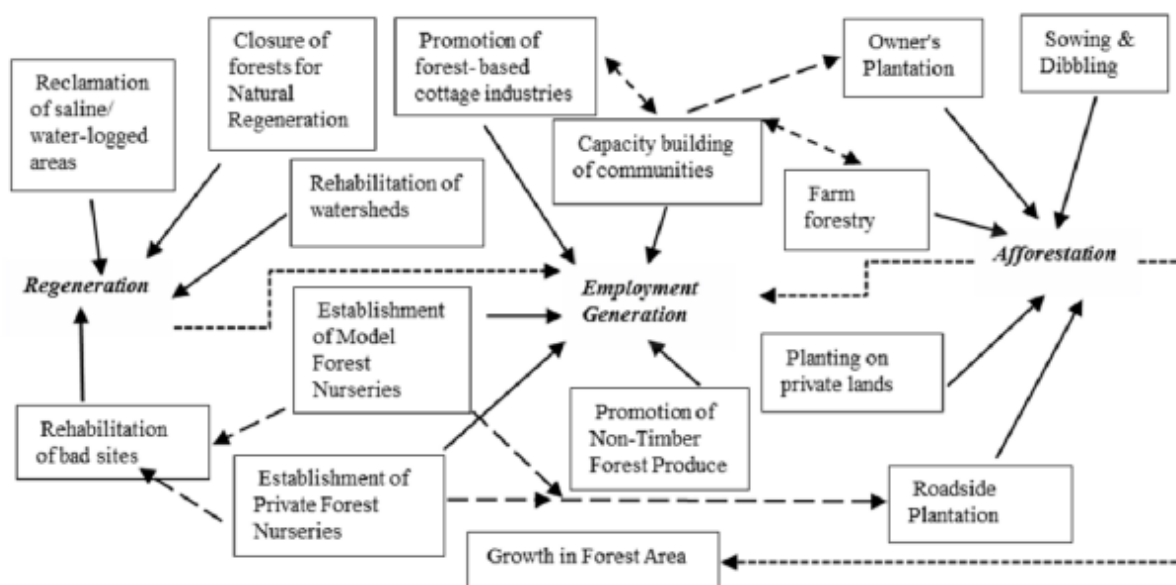
2.3. Treatment and Control Group

Figure 2: Area of Study
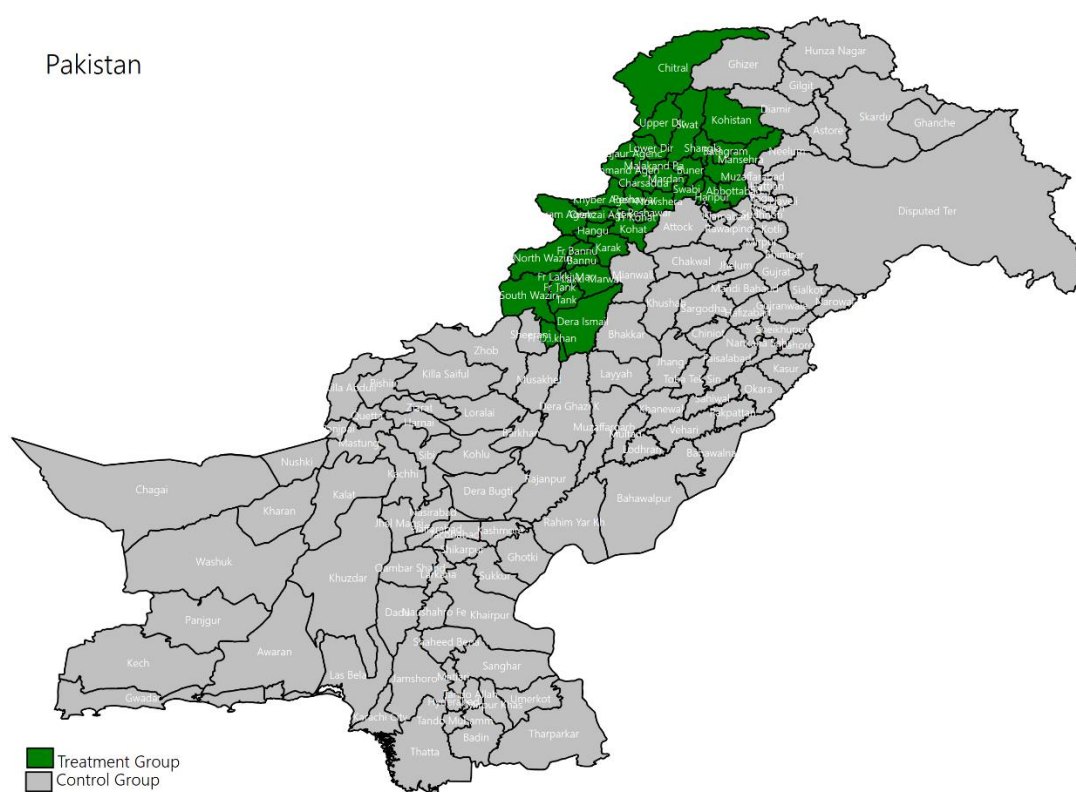
Source: Researchers Own Work

2.4. Result Chain Analysis

Figure 3: Result-Chain Analysis

INPUTS	ACTIVITIES	OUTPUTS	OUTCOMES	IMPACT
National and Internation Funding; Budget; UN agenda	Afforestation; Conservation; Protection	Plantation; Awareness	Job and Business Opportunities; Temperature	Stability of Temperature; Employment; Health
Establishment of Special Deaprtment and Policies; Project Ideas and Proposals	Plantation Drive; Awareness Campaigns; Project Initiations	Protection of Plnatation; Short Term Employment	Improved Temperature over the Province; Biodiversity Conservation	Observed Heal Improvements; Increase in Forest Coverage

Source: Researchers Own Work

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3. EVALUATION QUESTIONS

- To what extent the Billion Tree Tsunami Project has improved the short-term relevant employment?

- Does BTTP have contributed to the stability of temperature?

- Has BTTP improved the health of people?

- Did the BTTP have improved awareness of climate change?

4. RESEARCH METHOD

4.1. GIS

The research team will use GIS mapping to visualize the treatment and program variables. For instance, the treatment variable, plantation, will be visualized before and after the program using the data of satellites. In addition to that, the research team will show the visualization of outcome variables on the maps using GIS such as temperature, health, etc. Before and after the figure in section 1.4. has been created using GIS mapping to show the forest density before and after the program implementation. The figures have been adapted from the project website.

4.2. Mean Comparison

The project team will compare the mean values of treatment and outcome variables at the baseline of the project as well as at the current time. The comparison will be conducted before-after the program and between the treatment and control groups. It is the simplest method to see if there is any variation occurring because of the program. The mean comparison is the best method in the RCTs, but the quasi-experimental approach has many concerns, research also plots the data over the years in graphs. These graphs can be used to visualize the mean difference between the treatment and control groups over the years. T-test has been conducted under the shadow of mean comparison analysis which is significant after the treatment and insignificant before the implementation of the program across the province.

4.3. Difference-in-Difference (Fixed Effect)

Specification of fixed effect model is given below.

Estimation of Program Effect:

$$Y_{it} = \beta_o + \beta_1 DID_{itj} + B_2 X_{itj} + \gamma_i + \tau_t + \varepsilon_{itj} \quad (1)$$

Where

Y_{it} *Outcome variable i.e., temperature in year t, province i and district j.*

DID_{itj} = 1   *If province i is KP and District from KP where the program was implemented when year t is 2013 and afterwards.*

DID_{itj} = 0   *If province i is not Punjab or year t is before 2013*

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X_{itj}	Control Variables (Rainfall, Air Quality, Health Facilities, Injuries/Accidents)
γ_i (i=1...n)	Province fixed effect.
τ_t (t=1...n)	Year fixed effect.

5. FINDINGS SO FAR

Since we were worried about the treatment. However, using GIS mapping we have found a potential increase in forest density which evident that evaluation studies can be conducted to see whether the changes have occurred from this huge move by the government of Pakistan. In addition to that, a huge project of ten billion trees was initiated by the Government of Pakistan in 2020 for the whole of Pakistan. Through this evaluation, we can give our suggestions to the government for improvements.

5.1. Visual Representation

Initially we have added some of the visuals that clear the impact of large-scale afforestation projec t in Pakistan. The below figures have been taken from the World Economics Forum which provides key insights of the project. In these graphics (Figure 4 and Figure 5), one can observe the key insi ghts of project.

Figure 4: Photos from the World Economic Forum
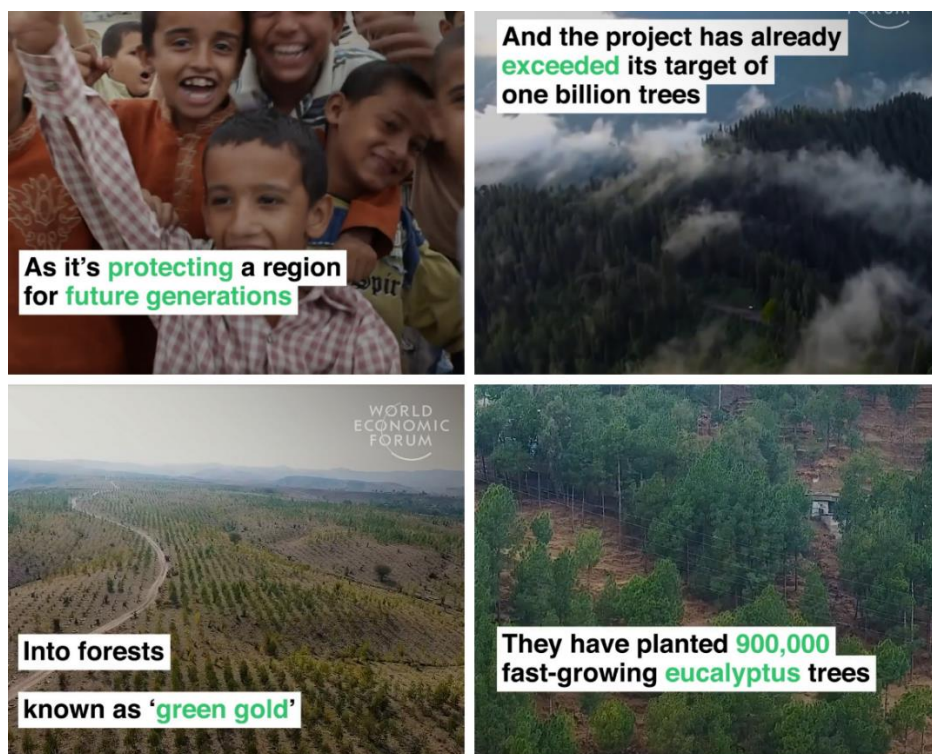
Secondly, a mean comparison analysis has been conducted on the mean temperature of the provinces of Pakistan. Figure 7 represents the difference between treatment and control group. In addition to that we can observe the effect of treatment after 2012 that the mean temperature of the treated groups goes down. Further this impact will be shown in our Difference-in-Difference (Fixed Effect) approach. Furthermore, Figure 6 also satisfy the assumption of parallel trend.

Figure 6: Mean Comparison & Parallel Trend
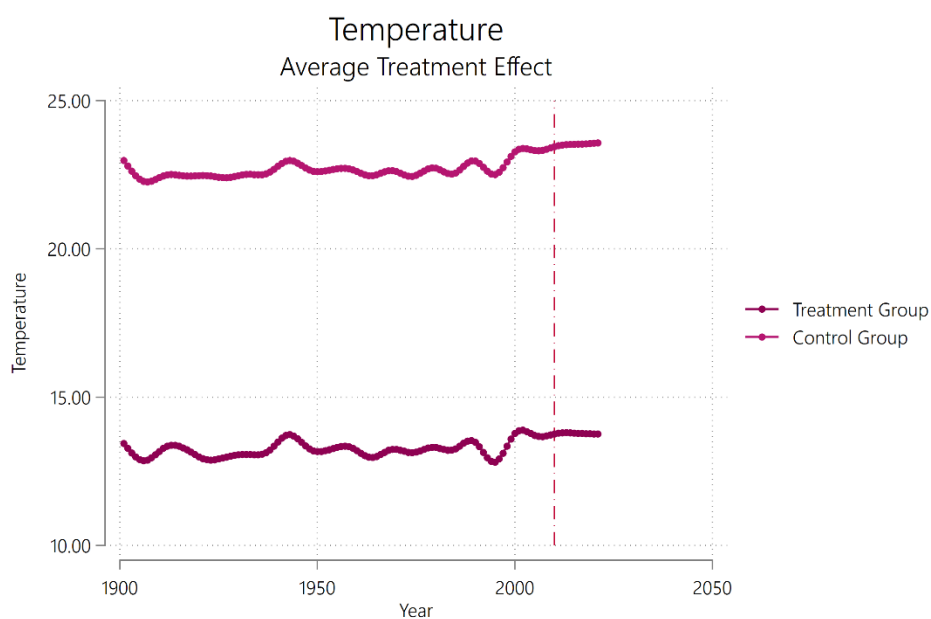
Third, GIS maps have been gathered to see if there is any treatment effect in increasing green cover, forest density and forest coverage. Figure 7 shows impact of treatment in treated sites.

Figure 7: GIS Maps
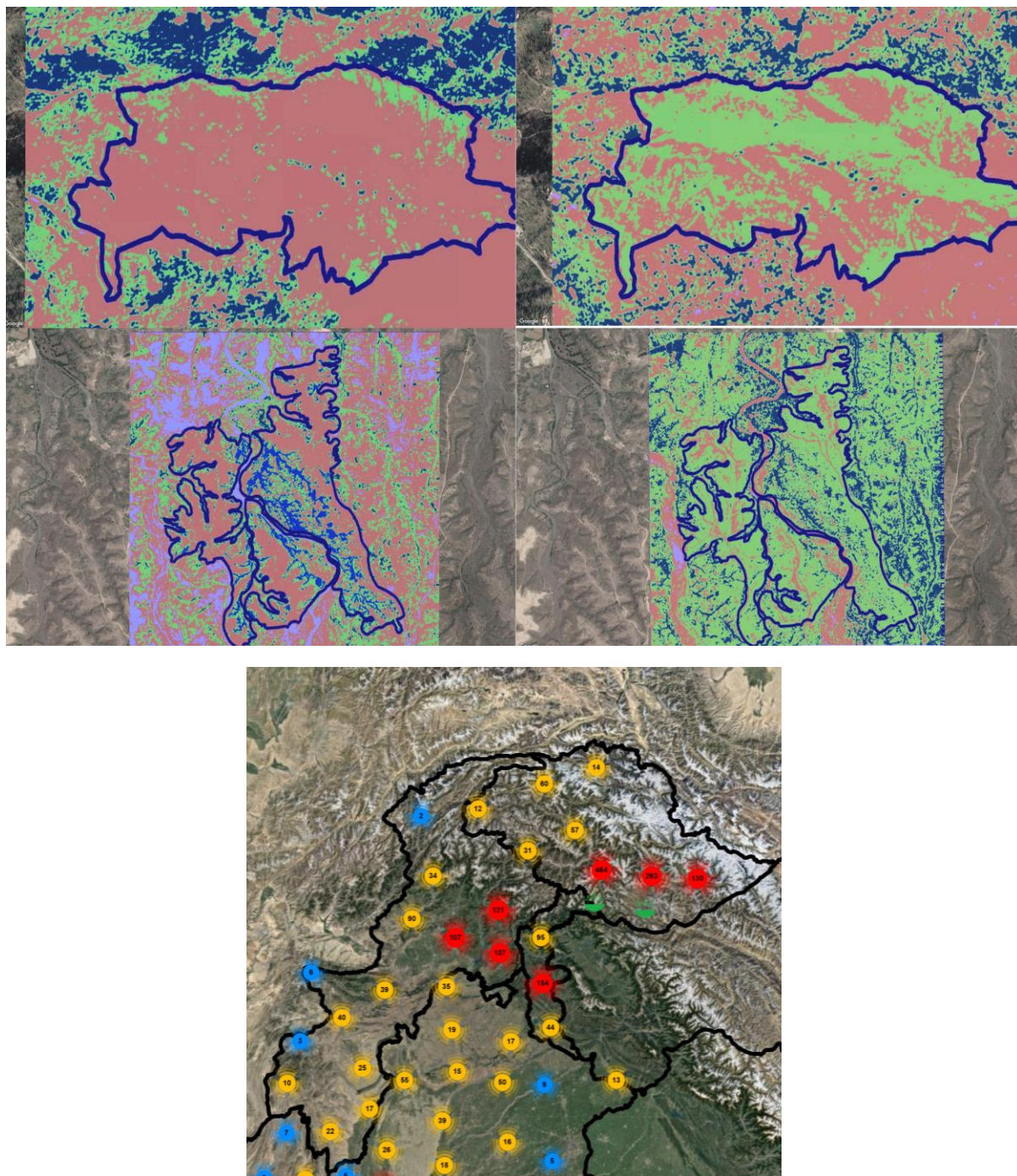
Finally in the visual representation of impact, average temperate data from Meteorological Department has been collected and presented in the graph. The graphs shows the temperature data of major cities and sites where the plantation has been done. This graphs shows a regular increase in temperature until 2013 and after the plantation program the temperature goes down slightly. In t

he current era, stabilizing temperature is also a great accomplishment, in fact, the KP plantation pr oject have decreased it on average which will further be explained in econometric data analysis.

Figure 8: Major Treatment Areas

Mean Maximum Temperature °C - (Main)
(Abbottabad,Bannu,D.I.Khan,Kohat,Kurram,Lower Chitral,Mansehra,Peshawar,Swat,Upper Dir)

-●- Bannu   -●- D.I.Khan   -●- Abbottabad   -●- Balakot   -●- Chitral   -●- Drosh   -●- Dir   -●- Swat

Source: Meteorological Department Govt: of Pakistan, Lahore
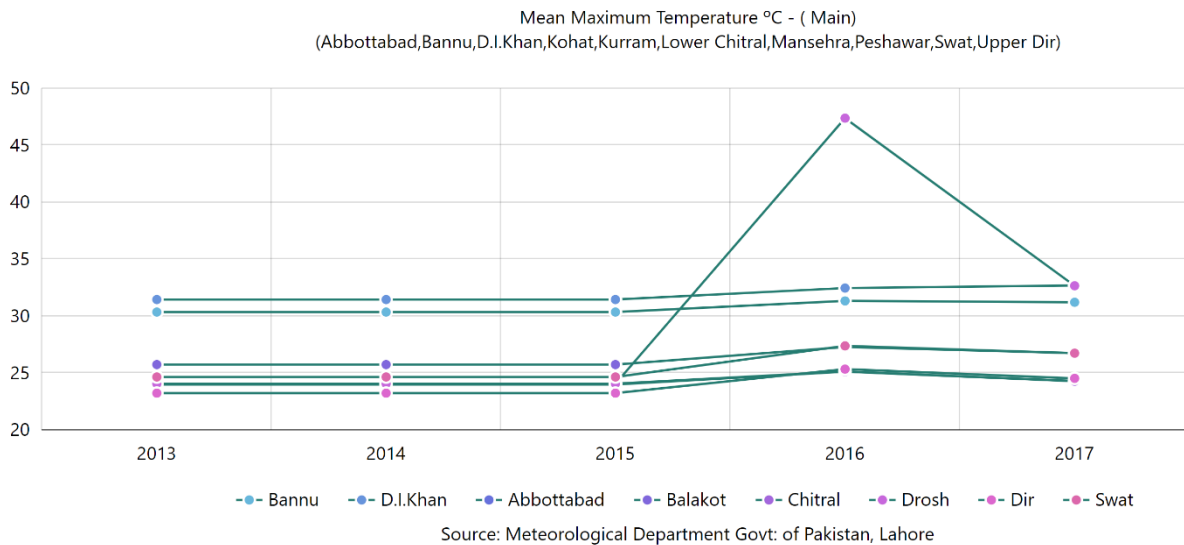
5.2. Quantitative Analysis

At first in the quantitative analysis, we provide summary statistics of our outcome variables and tre atment variables in Table 2.

Table 2: Descriptive Statistics

Variable	Observations	Mean	SD	Min	Max
ID	605	3	1.42	1	5
Year	605	1961	34.96	1901	2021
Annual Mean	605	20.86	4.80	12.21	28.09
Year Smooth	605	20.86	4.78	12.81	27.75

Using the data from Climate Knowledge Portal of the World Bank we have calculated and provide d the district wise summary statistics. In this table we shown average annual temperature of provi nces and smooth temperatures of 5 years curve. In our next analysis of difference-in-difference we have used the data of five provinces from 1901 to 2021. The provinces consisted on the Khyber P akhtunkhwa (our treatment province), Punjab, Sindh, Baluchistan and Federally Administered Tribal Areas (our control provinces).

On the next pages Table 3, Table 4, Table 5 and Table 6, we provide the number of trees planted w ith their categories in all three phases, region and site wise. The data have been acquired from the project progress reports.

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Table 3: Phase I

Forest Divisions	Block Plantation (ha)			Saline & Waterlogged/Badland (ha)			Roads & Canals (ha)			Outsource Plantation (ha)			Farm Forestry (million)		Total No. of Plants
	Target	Achieved	No. of Plants	Target	Achieved	No. of Plants	Target	Achieved	No. of Plants	Target	Achieved	No. of Plants	Target	Achieved	
Forest Region I															
1 Peshawar	370.00	370.00	397,750.00	25.00	25.00	107,500.00	20.00	23.83	25,617.00	30.00	30.00	32,250.00	0.45	0.54	563,117.25
2 Mardan	250.00	179.00	192,425.00	25.00	25.00	107,500.00	20.00	77.00	82,775.00	50.00	125.00	134,375.00	0.30	0.33	517,075.00
3 Kohat	416.00	416.00	447,200.00	25.00	25.00	107,500.00	20.00	20.00	21,500.00	-	-	-	0.30	0.32	576,200.00
4 Bannu	416.00	416.00	447,200.00	40.00	40.00	172,000.00	20.00	20.00	21,500.00	-	-	-	0.20	0.20	640,700.00
5 DI Khan	416.00	416.00	447,200.00	30.00	30.00	129,000.00	27.00	27.00	29,025.00	95.00	70.00	75,250.00	0.25	0.25	680,475.00
Sub.Total	**1,868.00**	**1,797.00**	**1,931,775.00**	**145.00**	**145.00**	**623,500.00**	**107.00**	**167.83**	**180,417.00**	**175.00**	**225.00**	**241,875.00**	**1.50**	**1.64**	**2,977,567.25**
Forest Region II															
1 Haripur	135.00	469.00	504,175.00	-	-	-	10.00	10.00	10,750.00	50.00	50.00	53,750.00	0.10	0.15	568,675.00
2 Gallics	135.00	185.00	198,875.00	20.00	20.00	86,000.00	20.00	20.00	21,500.00	-	-	-	0.06	0.06	306,375.00
3 Siran	135.00	278.00	298,850.00	30.00	30.00	129,000.00	20.00	20.00	21,500.00	-	-	-	0.08	0.09	449,350.00
4 Kaghan	135.00	223.00	239,725.00	-	-	-	10.00	10.00	10,750.00	-	-	-	0.08	0.08	250,475.00
5 AgrorTanawal	108.00	421.00	452,575.00	-	-	-	20.00	20.00	21,500.00	-	-	-	0.06	0.06	474,075.00
6 Torghar	108.00	232.00	249,400.00	-	-	-	10.00	10.00	10,750.00	-	-	-	0.06	0.06	260,150.00
7 H.Tribal	108.00	236.00	253,700.00	-	-	-	10.00	10.00	10,750.00	-	-	-	0.06	0.06	264,450.00
8 L.Kohistan	108.00	26.00	27,950.00	-	-	-	-	-	-	-	-	-	0.04	0.01	27,950.00
9 U.Kohistan	208.00	96.00	103,200.00	-	-	-	-	-	-	-	-	-	0.04	0.01	103,200.00
10 Daur W/Shed	144.00	444.00	477,300.00	-	-	-	-	-	-	-	-	-	0.08	0.08	477,300.00
11 Kunhar W/Shed	144.00	399.00	428,925.00	50.00	35.00	150,500.00	-	-	-	-	-	-	0.08	0.08	579,425.00
12 Unhar W/Shed	144.00	449.00	482,675.00	-	-	-	-	-	-	-	-	-	0.08	0.08	482,675.00
13 Buncr W/Shed	144.00	433.00	465,475.00	-	-	-	-	-	-	40.00	40.00	43,000.00	0.11	0.19	508,475.00
14 Kohistan W/Shed	144.00	307.00	330,025.00	-	-	-	-	-	-	40.00	40.00	43,000.00	0.07	0.07	373,025.00
Sub.Total	**1,900.00**	**4,198.00**	**4,512,850.00**	**100.00**	**85.00**	**365,500.00**	**100.00**	**100.00**	**107,500.00**	**130.00**	**130.00**	**139,750.00**	**1.00**	**1.07**	**5,125,600.00**
Forest Region III															
1 Swat	277.00	381.00	409,575.00	20.00	20.00	86,000.00	20.00	20.00	21,500.00	-	-	-	0.10	0.10	517,075.00
2 Kalam	130.00	234.00	251,550.00	-	-	-	10.00	10.00	10,750.00	-	-	-	0.06	0.06	262,300.00
3 Alpuri	138.00	138.00	148,350.00	-	-	-	-	-	-	30.00	50.00	53,750.00	0.10	0.10	202,100.00
4 Buner	185.00	185.00	198,875.00	-	-	-	10.00	10.00	10,750.00	30.00	40.00	43,000.00	0.13	0.13	252,625.00
5 Malakand	185.00	185.00	198,875.00	-	-	-	10.00	28.30	30,466.00	30.00	36.00	38,700.00	0.10	0.10	268,041.00
6 Lower Dir	277.00	327.00	351,525.00	-	-	-	20.00	25.00	26,875.00	30.00	50.00	53,750.00	0.14	0.14	432,150.00
7 Upper Dir	277.00	277.00	297,775.00	40.00	40.00	172,000.00	10.00	10.00	10,750.00	30.00	50.00	53,750.00	0.15	0.15	534,275.00
8 Dir Kohistan	231.00	307.00	330,025.00	-	-	-	-	-	*	-	-	-	0.11	0.11	330,025.00
9 Chitral	150.00	175.00	188,125.00	-	-	-	20.00	15.00	16,125.00	-	-	-	0.10	0.10	204,250.00
Sub. Total	**1,850.00**	**2,209.00**	**2,374,675.00**	**60.00**	**60.00**	**258,000.00**	**100.00**	**118.30**	**127,216.00**	**150.00**	**226.00**	**242,950.00**	**0.99**	**0.99**	**3,002,841.00**
Grand Total	**5,618.00**	**8,204.00**	**8,819,300.00**	**305.00**	**290.00**	**1,247,000.00**	**307.00**	**386.13**	**415,133.00**	**455.00**	**581.00**	**624,575.00**	**3.49**	**3.69**	**11,106,008.25**

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Table 4: Phase II

Forest Divisions	Block Plantation (ha)			Saline & Waterlogged/Badland (ha)			Roads & Canals (ha)			Woodlots (ha)			Sowing & Dibbling (ha)			Farm Forestry (mn)		Total No of Plants
	Target	Achv	No. of Plants	Target	Achv	No. of Plants	Target	Achieved	No. of Plants	Target	Achieved	No. of Plants	Target	Achieved	No. of Plants	Target	Achieved	Plants
Forest Region I																		
1 Peshawar	4,000.00	3,690.50	3,967,309.00	500.00	332.59	1,430,137.00	200.00	200.00	215,000.00	1,000.00	1,002.00	1,076,699.00	1,000.00	1,000.00	1,473,000.00	9.00	11.22	8,162,145.00
2 Mardan	3,500.00	3,534.00	3,799,050.00	500.00	630.00	2,709,000.00	200.00	287.00	308,977.00	1,000.00	1,117.91	1,201,753.00	1,000.00	1,057.00	1,556,961.00	6.00	11.44	9,575,741.00
3 Kohat	6,000.00	5,838.00	6,275,817.75	200.00	282.00	1,212,600.00	100.00	57.00	61,275.00	1,000.00	1,000.00	1,075,000.00	1,500.00	1,727.00	2,543,871.00	5.00	4.17	11,168,564.00
4 Bannu	4,500.00	3,862.00	4,151,650.00	4,500.00	4,547.00	19,552,100.00	100.00	45.00	48,375.00	1,000.00	212.00	227,900.00	-	-	-	4.50	4.78	23,980,025.00
5 DI Khan	4,500.00	3,380.00	3,633,500.00	6,800.00	6,486.00	27,889,800.00	1,500.00	1,812.00	1,947,900.00	1,000.00	1,000.00	1,075,000.00	1,500.00	1,500.00	2,209,500.00	5.50	3.63	36,755,700.00
Sub.Total	22,500.00	20,304.50	21,827,326.75	12,500.00	12,277.59	52,793,637.00	2,100.00	2,401.00	2,581,527.00	5,000.00	4,331.91	4,656,352.00	5,000.00	5,284.00	7,783,332.00	30.00	35.24	89,642,175.00
Forest Region II																		
1 Haripur	4,500.00	4,600.00	4,945,000.00	-	-	-	100.00	-	-	500.00	400.00	430,000.00	100.00	904.00	1,331,592.00	3.20	3.20	6,706,592.00
2 Gallics	2,500.00	2,986.00	3,209,950.00	100.00	30.00	129,000.00	30.00	19.00	20,425.00	35.00	35.00	37,625.00	450.00	168.00	247,464.00	3.20	1.46	3,644,464.00
3 Siran	2,500.00	3,100.00	3,332,500.00	50.00 5u		215,000.00	50.00	51.00	54,825.00	500.00	200.00	215,000.00	350.00	392.00	577,416.00	3.10	2.96	4,394,741.00
4 Kaghan	2,500.00	3,015.00	3,241,071.00	100.00	90.00	387,000.00	50.00	50.00	53,750.00	500.00	122.00	131,150.00	450.00	995.00	1,465,635.00	3.23	1.95	5,278,606.00
5 Agror Tanawal	2,000.00	2,958.00	3,179,850.00	-	-	-	75.00	75.00	80,625.00	1,000.00	1,000.00	1,075,000.00	150.00	614.00	904,422.00	3.10	3.13	5,239,897.00
6 Torghar	2,000.00	2,824.00	3,035,800.00	-	-	-	75.00	75.00	80,625.00	500.00	500.00	537,500.00	300.00	200.00	294,600.00	3.10	1.80	3,948,525.00
7 H.Tribal	2,000.00	3,360.00	3,612,000.00	50.00	50.00	215,000.00	50.00	50.00	53,750.00	500.00	500.00	537,500.00	350.00	450.00	662,850.00	3.10	3.10	5,081,100.00
8 L.Kohistan	-	-	-	-	-	-	35.00	35.00	37,625.00	-	-	-	250.00	250.00	368,250.00	3.10	0.94	405,875.00
9 U.Kohistan	-	-	-	-	-	-	35.00	35.00	37,625.00	-	-	-	250.00	250.00	368,250.00	3.10	0.86	405,875.00
10 Daur W/Shed	5,000.00	5,790.00	6,224,250.00	50.00	170.00	731,000.00	-	-	-	466.00	466.00	500,950.00	600.00	609.00	897,057.00	3.10	3.05	8,353,257.00
11 Kunhar W/Shed	5,000.00	6,589.00	7,083,175.00	50.00	257.75	1,108,325.00	-	-	-	570.00	570.00	612,750.00	600.00	679.00	1,000,167.00	11.00	3.68	9,804,417.00
12 Unhar W/Shed	5,000.00	6,535.00	7,025,125.00	50.00	50.00	215,000.00	-	-	-	1,000.00	1,000.00	1,075,000.00	600.00	600.00	883,800.00	3.10	2.22	9,198,925.00
13 Buncr W/Shed	5,000.00	6,819.00	7,330,425.00	50.00	35.00	150,500.00	-	-	-	1,000.00	1,000.00	1,075,000.00	600.00	810.00	1,193,130.00	3.10	5.40	9,749,055.00
14 Kohistan W/Shed	5,000.00	6,300.00	6,772,500.00	50.00	50.00	215,000.00	-	-	-	300.00	300.00	322,500.00	600.00	600.00	883,800.00	3.10	3.10	8,193,800.00
Sub.Total	43,000.00	54,876.00	58,991,646.00	550.00	732.75	3,365,825.00	500.00	390.00	419,250.00	6,871.00	6,093.00	6,549,975.00	5,650.00	7,521.00	11,078,433.00	51.63	36.85	80,405,129.00
Forest Region III																		
1 Swat	5,500.00	5,800.00	6,235,000.00	-	-	-	70.00	70.00	75,250.00	1,000.00	1,000.00	1,075,000.00	2,648.00	1,700.00	2,504,100.00	3.10	3.89	9,889,350.00
2 Kalam	1,500.00	1,698.00	1,825,350.00	100.00	75.00	322,500.00	30.00	30.00	32,250.00	500.00	500.00	537,500.00	700.00	850.00	1,252,050.00	3.10	3.10	3,969,650.00
3 Alpuri	2,500.00	2,758.00	2,964,850.00	200.00	200.00	860,000.00	50.00	50.00	53,750.00	1,000.00	1,000.00	1,075,000.00	650.00	650.00	957,450.00	3.10	5.54	5,911,050.00
4 Buner	2,500.00	3,185.00	3,423,875.00	-	-	-	100.00	47.00	50,525.00	1,000.00	252.00	270,900.00	300.00	1,000.00	1,473,000.00	3.10	5.42	5,218,300.00
5 Malakand	6,000.00	6,000.00	6,450,000.00	-	-	-	100.00	100.00	107,500.00	3,000.00	3,100.00	3,332,500.00	252.00	252.00	371,196.00	3.10	13.84	10,261,196.00
6 Lower Dir	4,000.00	4,220.00	4,536,500.00	-	-	-	50.00	30.00	32,250.00	1,500.00	1,500.00	1,612,500.00	350.00	500.00	736,500.00	3.10	14.74	6,917,750.00
7 Upper Dir	4,000.00	3,129.00	3,363,675.00	50.00	44.00	189,200.00	50.00	35.00	37,625.00	1,000.00	765.00	822,375.00	500.00	500.00	736,500.00	3.10	9.55	5,149,375.00
8 Dir Kohistan	1,000.00	1,670.00	1,795,250.00	-	-	-	20.00	70.00	75,250.00	500.00	975.00	1,048,125.00	400.00	420.00	618,660.00	3.10	1.72	3,537,285.00
9 Chitral	2,500.00	2,500.00	2,687,500.00	50.00	56.00	240,800.00	30.00	30.00	32,250.00	500.00	500.00	537,500.00	350.00	350.00	515,550.00	3.10	3.33	4,013,600.00
Sub. Total	29,500.00	30,960.00	33,282,000.00	400.00	375.00	1,612,500.00	500.00	462.00	496,650.00	10,000.00	9,592.00	10,311,400.00	6,150.00	6,222.00	9,165,006.00	27.90	61.14	54,867,556.00
Grand Total	95,000.00	106,140.50	114,100,972.75	13,450.00	13,385.34	57,771,962.00	3,100.00	3,253.00	3,497,427.00	21,871.00	20,016.91	21,517,727.00	16,800.00	19,027.00	28,026,771.00	109.53	133.24	224,914,860.00

Table 5: Phase III

Forest Divisions	Block Plantation (ha)			Reclamation of Saline & Waterlogged Areas (ha)			Farm Forestry (mn)		Total No of Plants
	Target	Achv	No. of Plants	Target	Achv	No. of Plants	Target	Achieved	
Forest Region I									
1 Peshawar	1,500.00	1,500.00	1,612,500.00	-	-	-	3.00	0.90	1,612,500.00
2 Mardan	1,030.00	1,030.27	1,107,540.25	435.00	435.00	1,870,500.00	3.00	0.20	2,978,040.00
3 Kohat	2,100.00	2,100.00	2,257,500.00	400.00	400.00	1,720,000.00	1.50	0.80	3,977,500.00
4 Bannu	2,500.00	800.00	860,000.00	1,000.00	2,700.00	11,610,000.00	-	0.09	12,470,000.00
5 DI Khan	181.00	270.00	290,250.00	3,319.00	3,475.00	14,942,500.00	3.00	1.00	15,232,750.00
Sub.Total	**7,311.00**	**5,700.27**	**6,127,790.25**	**5,154.00**	**7,010.00**	**30,143,000.00**	**10.50**	**2.99**	**36,270,790.00**
Forest Region II									
1 Haripur	1,300.00	1,300.00	1,397,500.00	-	-	-	0.50	0.90	1,397,500.00
2 Gallies	1,000.00	1,000.00	1,075,000.00	-	-	-	0.50	-	1,075,000.00
3 Siran	1,000.00	1,000.00	1,075,000.00	-	-	-	0.50	1.60	1,075,000.00
4 Kaghan	1,300.00	1,300.00	1,397,500.00	-	-	-	0.50	0.40	1,397,500.00
5 AgrorTanawal	1,200.00	1,200.00	1,290,000.00	-	-	-	0.50	0.90	1,290,000.00
6 Torghar	1,200.00	1,200.00	1,290,000.00	-	-	-	0.50	0.01	1,290,000.00
7 H.Tribal	100.00	1,000.00	1,075,000.00	-	-	-	0.50	0.90	1,075,000.00
8 L.Kohistan	-	-	-	-	-	-	-	0.00	-
9 U.Kohistan	-	-	-	-	-	-	-	0.01	-
10 Daur W/Shed	3,000.00	3,100.00	3,332,500.00	-	-	-	0.50	0.40	3,332,500.00
11 Kunhar W/Shed	3,100.00	3,100.00	3,332,500.00	-	-	-	0.50	1.20	3,332,500.00
12 Unhar W/Shed	3,000.00	3,168.00	3,405,600.00	-	-	-	0.50	1.60	3,405,600.00
13 Buncr W/Shed	3,000.00	3,500.00	3,762,500.00	-	-	-	0.50	0.70	3,762,500.00
14 Kohistan W/Shed	3,000.00	2,800.00	3,010,000.00	-	-	-	0.50	1.20	3,010,000.00
Sub.Total	**22,200.00**	**23,668.00**	**25,443,100.00**	**-**	**-**	**-**	**6.00**	**9.82**	**25,443,100.00**
Forest Region III									
1 Swat	2,700.00	2,700.00	2,902,500.00	-	-	-	1.00	5.30	2,902,500.00
2 Kalam	250.00	200.00	215,000.00	-	-	-	0.50	2.10	215,000.00
3 Alpuri	1,200.00	1,200.00	1,290,000.00	-	-	-	0.50	0.70	1,290,000.00
4 Buner	2,000.00	2,100.00	2,257,500.00	-	-	-	1.00	0.27	2,257,500.00
5 Malakand	1,600.00	1,600.00	1,720,000.00	-	-	-	-	0.10	1,720,000.00
6 Lower Dir	2,600.00	2,600.00	2,795,000.00	-	-	-	1.00	0.03	2,795,000.00
7 Upper Dir	1,430.00	1,430.00	1,537,250.00	-	-	-	0.50	0.44	1,537,250.00
8 Dir Kohistan	1,200.00	1,200.00	1,290,000.00	-	-	-	0.50	0.60	1,290,000.00
9 Chitral	1,500.00	1,500.00	1,612,500.00	-	-	-	1.00	1.00	1,612,500.00
Sub. Total	**14,480.00**	**14,530.00**	**15,619,750.00**	**-**	**-**	**-**	**6.00**	**10.54**	**15,619,750.00**
Grand Total	**43,991.00**	**43,898.27**	**47,190,640.25**	**5,154.00**	**7,010.00**	**30,143,000.00**	**22.50**	**23.35**	**77,333,640.00**

Table 6: Enclosure

Forest Divisions	Enclosure		
	No. of Enclosures	Area (Ha)	No. of Plants(Million)
Forest Region I			
1 Peshawar	68.00	5,714.00	13.88
2 Mardan	118.00	6,254.00	26.38
3 Kohat	231.00	12,925.00	22.84
4 Bannu	70.00	5,911.00	12.13
5 DI Khan	166.00	6,350.00	8.45
Sub.Total	**653.00**	**37,154.00**	**83.68**
Forest Region II			
1 Haripur	192.00	9,545.00	33.76
2 Gallics	154.00	9,309.00	22.83
3 Siran	156.00	12,946.00	36.47
4 Kaghan	138.00	6,227.00	13.73
5 AgrorTanawal	167.00	6,576.00	20.92
6 Torghar	119.00	5,129.00	12.70
7 H.Tribal	356.00	18,861.00	49.05
8 L.Kohistan	83.00	5,371.00	9.84
9 U.Kohistan	78.00	4,095.00	7.04
10 Daur W/Shed	69.00	2,610.00	8.60
11 Kunhar W/Shed	40.00	1,722.00	2.49
12 Unhar W/Shed	40.00	1,600.00	3.06
13 Buncr W/Shed	80.00	3,612.00	8.82
14 Kohistan W/Shed	73.00	3,085.00	5.61
Sub.Total	**1,745.00**	**90,688.00**	**234.92**
Forest Region III			
1 Swat	215.00	40,912.00	100.42
2 Kalam	83.00	9,338.00	29.57
3 Alpuri	270.00	10,800.00	24.52
4 Buner	210.00	29,265.00	75.63
5 Malakand	190.00	8,888.00	17.10
6 Lower Dir	189.00	9,051.00	33.69
7 Upper Dir	204.00	15,830.00	33.66
8 Dir Kohistan	218.00	9,897.00	16.95
9 Chitral	532.00	45,160.00	82.12
Sub. Total	**2,111.00**	**179,141.00**	**413.66**
Grand Total	**4,509.00**	**306,983.00**	**732.26**

5.3. Difference-in-Difference [Fixed Effect]

Since we fulfill the assumptions and requirements of DID, we exploit it in our research to find out the causal impact of BTTAP on the temperature. When data is contaminated with outliers or influential observations, FE regression is an alternative to least squares regression. It can also be used to detect influencing observations.

The strict exogeneity of the explanatory variables is a well-known requirement for consistency in the context of panel data models. In this research, the purpose of DID Fixed Effect is too partial out the unobserved factors by using time and group fixed effect. There is no similar program other than in the treatment group and also there is no similar program in control group, however, there are some other national/federal level programs but all that programs also available in our treatment group.

For the second main assumption "common trend" the graph has been presented in Figure 6. Common trend assumption in the graphs suffice the requirement of DID. In addition, the fixed effect regression model also remedial for weak common trend assumption.

Our result from FE DID has been presented in Table 7.

Table 7: FE DID Result

| BTTAP	Smooth Temperature	Annual Mean Temperature
DID	-0.333***	-0.316***
	(0.000)	(0.000)
Year FE	YES	YES
Province FE	YES	YES
Constant	20.87***	20.87***
	(0.00664)	(0.00845)
Observations	605	605

Standard Errors in Parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The results show that by using fixed effect, the impact of treatment/program on Smooth 5 Years temperature is negative and highly significant by 0.333 and p-value less than 0.001. In addition to that the impact of treatment on annual mean temperature is also negatively significant by 0.316 with p-value 0.001. Though the decrease in temperature is small but it has high importance in stabilizing the temperature and to improve the climate.

The effect can be imagine from the Figure 9 given below which explain the effect of increasing temperature by 1° centigrade or by half.

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Figure 9: Effect of Increasing Temperature
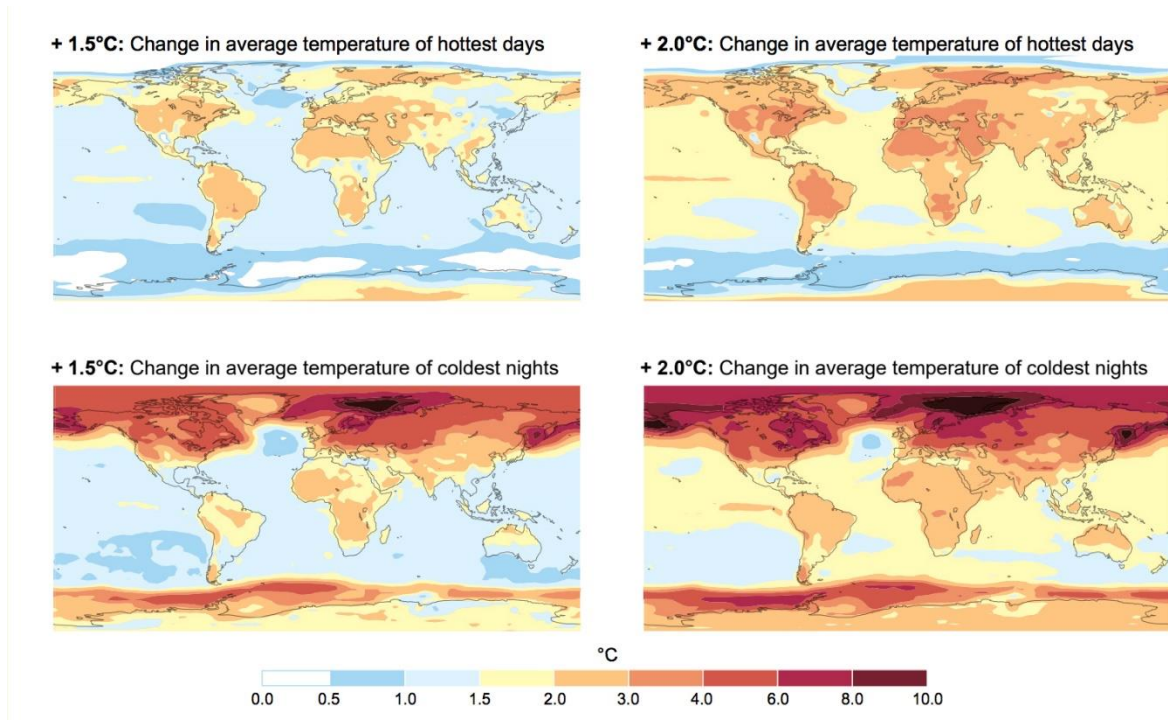
Source: NASA

6. CONCLUSION

After conducting a comprehensive literature review, field visits, data collection and data analysis, we found that the BTTAP is one of a largest program in Asia in which a billion plants have been planted coupled with opening nurseries and increasing forest coverage. This project also incudes the preservation of existing plants and trees. Another major component of this project was the planting olive which will be converted into olive oil and can contribute in the exports. However, the program was highly effective in terms of our outcome variables. Since we have done a number of analyses including GIS mapping, descriptive analysis, econometric analysis to see and to explore the impact of the program, we have found a significant decrease in the mean temperature of the province using difference in difference with fixed effect which is a causal model and have no question on its internal and external validity. Since the program was launched by the provincial government, we found an ideal condition for implementing DID.

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