# INTRODUCTION

*The Little Ice Age (LIA)* was a period (1300-1850) of regional cooling, particularly pronounced in the North Atlantic region. (Wikipedia Contributors, 2019)

*Lucid waters and lush mountains are invaluable assets*, A good ecological environment is the fairest public product, and the most accessible welfare for the people. (www.chinadaily.com.cn, 2017)

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Lucid waters and lush mountains are invaluable assets

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*A good ecological environment is the fairest public product, and the most accessible welfare for the people.*

*— President Xi Jinping addressed during his inspection tour in Hainan in April 2013*

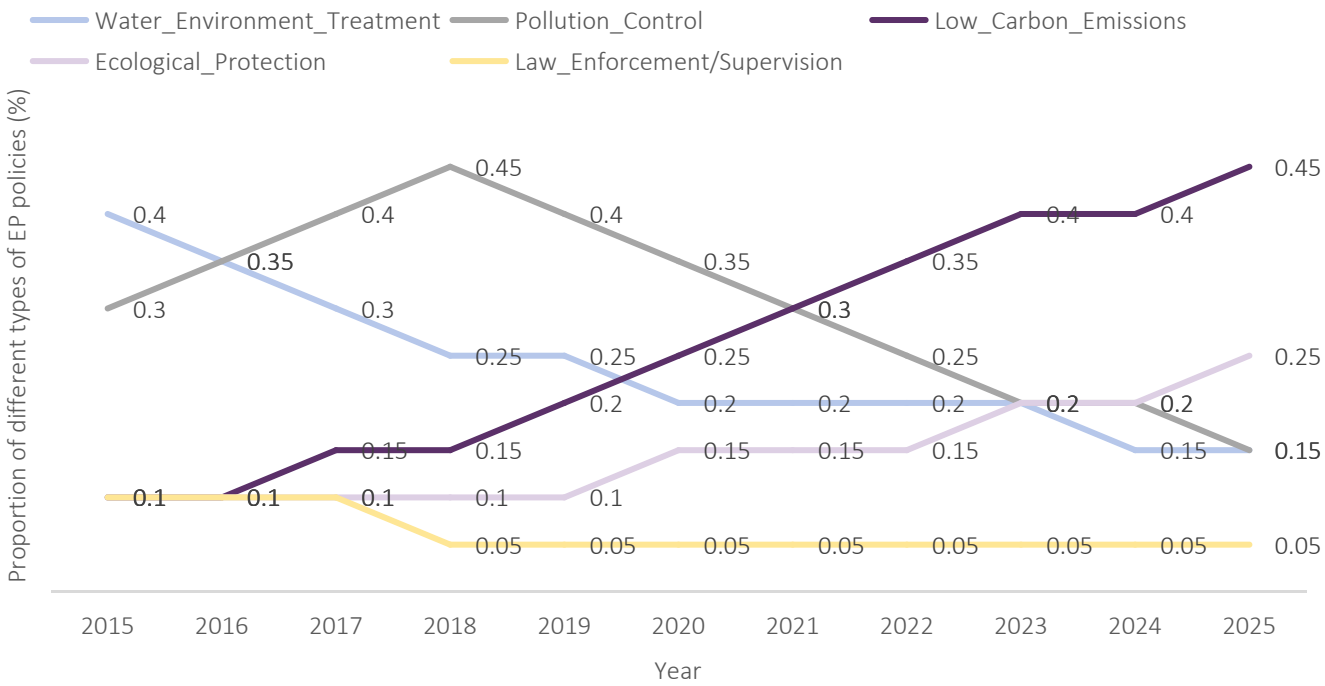
Photo taken on July 11, 2017 shows Saihanba National Forest Park, China's largest man-made woodland, in Weichang Manchu and Mongolian autonomous county in Chengde, Hebei province.[Photo/Xinhua]

*The Paris Climate Agreement* is an international treaty that commits most of the world's governments to addressing climate change. (Greenpeace UK, 2021)

*Carbon-neutral (or carbon neutrality)* is the balance between emitting carbon and absorbing carbon emissions from carbon sinks. (Bernoville, 2023)

# FINDING I

Figure-1 Proportion of different types of China's EP policies (2015-2025)




*$H_0$: China's policies to address global climate change* ***have not*** *shown* ***a positive trend***

*$H_1$: China's policies to address global climate change* ***have*** *shown* ***a positive trend***

**Hypothesis tests:** Mann-Kendall Trend Test

**Result generated by Python (PYTHON, 2025):**

Mann_Kendall_Test(trend='increasing', h=np.True_,

p=np.float64(6.151089035277835e-05), z=np.float64(4.006938426723769),

Tau=np.float64(0.9454545454545454), s=np.float64(52.0), var_s=np.float64(162.0),

slope=np.float64(0.03888888888888889),

intercept=np.float64(0.05555555555555555))

# The test results explained by Deepseek

(DeepSeek, 2025)

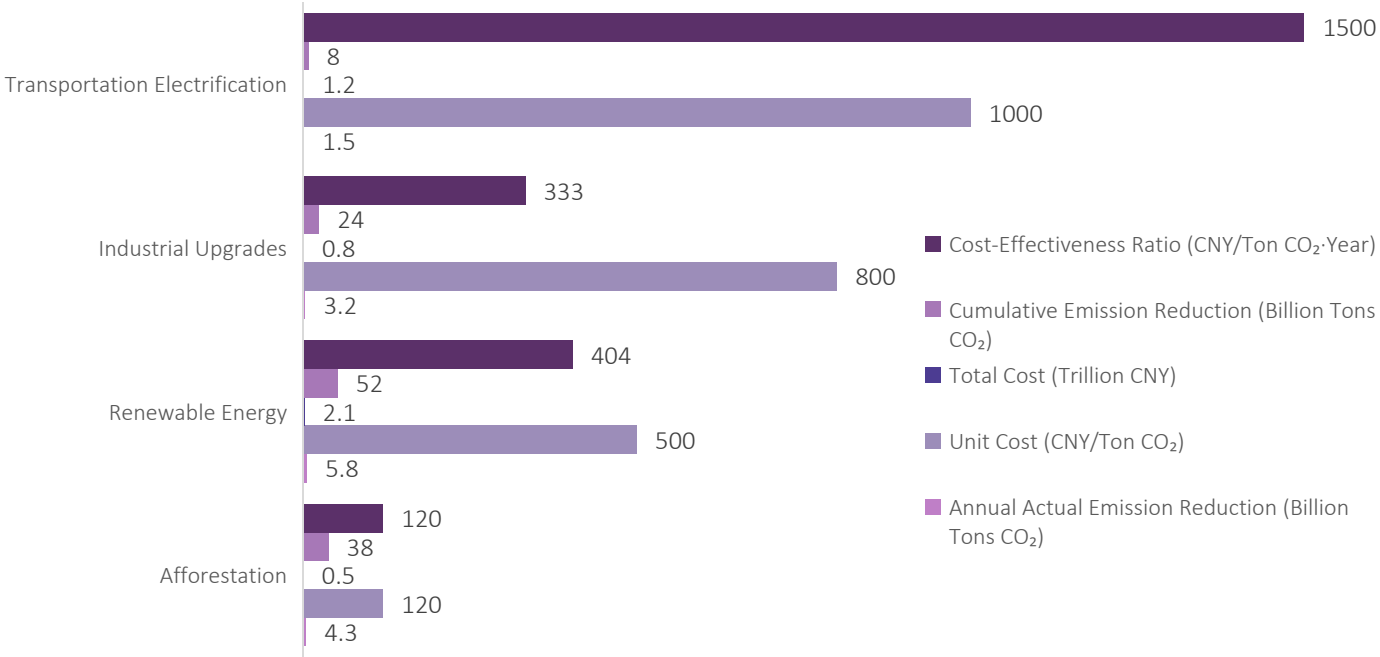
1. ** `trend='increasing'` **
   - Indicates the direction of the detected monotonic trend. In this case, the data shows a statistically significant **upward trend**.
2. ** `h=np.True_` **
   - Hypothesis test result:
     - `h=True` means the null hypothesis (no trend) is **rejected**.
     - There is significant evidence of a trend in the data.
3. ** `p=6.15e-05` **
   - **p-value** (extremely small: ~0.0000615).
   - Indicates strong statistical significance ($p < 0.05$ is typically considered significant). The probability of observing this trend by chance is nearly 0.
4. ** `z=4.007` **
   - **Z-score**, a measure of trend strength and direction.
   - A large positive value (4.007) confirms a strong upward trend. Negative values would indicate a downward trend.
5. ** `Tau=0.945` **
   - **Kendall's Tau coefficient** (ranges from -1 to 1).
   - Values close to **+1** indicate near-perfect agreement in upward trend (very strong monotonic relationship).



6. ** `s=52.0` **
   - **Test statistic S**. Positive values suggest increasing trends.
   - Represents the number of concordant pairs minus discordant pairs in the data.
7. ** `var_s=162.0` **
   - **Variance of S**, used to calculate the Z-score. Larger datasets or more variability may increase this value.
8. ** `slope=0.0389` **
   - **Sen's slope** (non-parametric estimate of trend magnitude).
   - Indicates the variable increases by ~0.0389 units per time step on average.
9. ** `intercept=0.0556` **
   - Intercept of the trend line (if modeled as a linear relationship: `y = slope * x + intercept`).
   - Represents the estimated baseline value at the start of the time series.

# FINDING II

Figure-2 Comparison Table of Emission Reduction Effects and Costs of China's Major Low Carbon Policy Measures (2013-2023)




## TOPSIS Test Result generated by Python (PYTHON, 2025)

| Measure | $D_{i+}$ | $D_{i-}$ | $C_i$ |
|---|---|---|---|
| Afforestation | 0.099 | 0.293 | 0.748 |
| Renewable Energy | 0.270 | 0.099 | 0.268 |
| Industrial Upgrades | 0.426 | 0.225 | 0.346 |
| Transportation Electrification | 0.426 | 0.000 | 0.000 |

*$H_0$: The effects of afforestation **does not differ significantly** from other measures.*
*$H_1$: The effects of afforestation **is significantly superior** to other measures.*

# The test results explained by Deepseek

(DeepSeek, 2025)

**Key Terms:**

- **D+ (Distance from Ideal Solution)**: Measures how far a solution is from the "best possible" scenario (lower = better).
- **D- (Distance from Non-Ideal Solution)**: Measures how far a solution is from the "worst possible" scenario (higher = better).
- **Ci (Closeness Index)**: Ranges from 0 (worst) to 1 (best). Calculated as **Ci = D- / (D+ + D-)**. Higher Ci values indicate better overall performance.

## Analysis of Each Measure:

1. **Afforestation**
   - **D+ = 0.099** (very close to the ideal solution).
   - **D- = 0.293** (relatively far from the non-ideal solution).
   - **Ci = 0.748** (highest among all measures).
   - **Conclusion**: **Best-performing option** (closest to ideal and farthest from non-ideal).
2. **Renewable Energy**
   - **D+ = 0.270** (farther from ideal than Afforestation).
   - **D- = 0.099** (very close to the non-ideal solution).
   - **Ci = 0.268** (lowest Ci value).
   - **Conclusion**: **Weakest performance** (poor balance between D+ and D-).
3. **Industrial Upgrades**
   - **D+ = 0.426** (farthest from ideal).
   - **D- = 0.225** (moderate distance from non-ideal).
   - **Ci = 0.346** (second-highest Ci).
   - **Conclusion**: Moderate performance, but significantly worse than Afforestation.
4. **Transportation Electrification**
   - **D+ = 0.426** (same as Industrial Upgrades).
   - **D- = 0.000** (directly overlaps with the non-ideal solution).
   - **Ci = 0.000** (lowest possible score).
   - **Conclusion**: **Worst-performing option** (identical to the non-ideal scenario).

## Ranking (Best to Worst):

1. **Afforestation** (Ci = 0.748)
2. **Industrial Upgrades** (Ci = 0.346)
3. **Renewable Energy** (Ci = 0.268)
4. **Transportation Electrification** (Ci = 0.000)

# FINDING III

## The Maowusu Desert in China has vanished from the map

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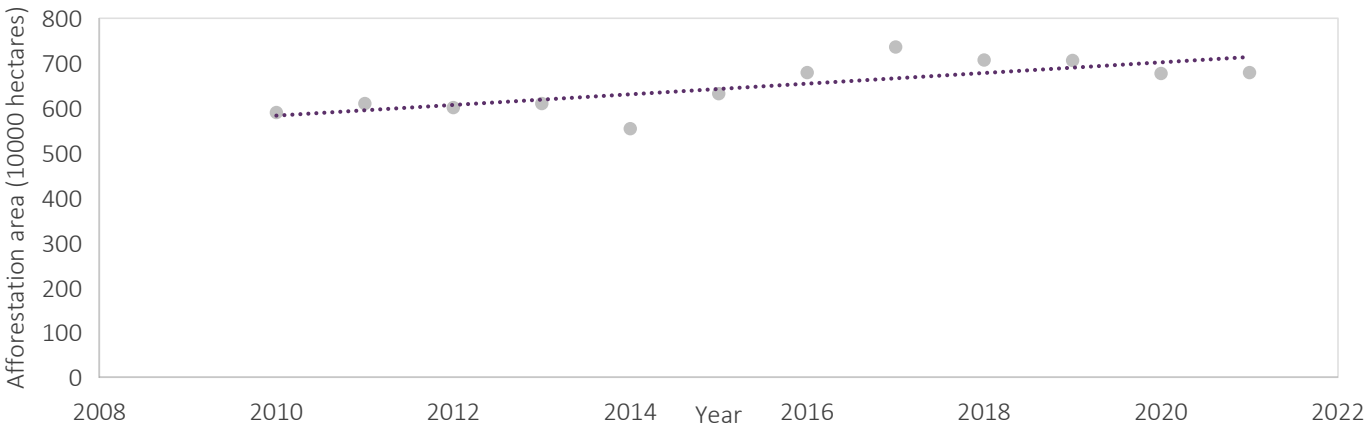
The Maowusu Desert, in northern China's Inner Mongolia Region, was one of four major deserts in the country, until it vanished from the map. Thanks to decades of work, **93.24 per cent** of the land has turned green. (Doloresz Katanich, 2020)

Figure-3 Changes in annual afforestation area in China (2010-2021)



| Country/Region | Project/Cooperation Content | Area (hectares) | Partners/Implementing Entities | Data Sources |
|---|---|---|---|---|
| Africa | China-Africa "Green Great Wall" Initiative | 1000000 | China and African Union | China National Forestry and Grassland Administration (2021), AU Green Wall Progress Report |
| Kazakhstan | China-Kazakhstan Border Afforestation | 2000 | Chinese Academy of Sciences and Kazakh institutions | Northwest Institute of Eco-Environment and Resources, CAS (2021) |
| Mongolia | China-Mongolia Desertification Control | 6600 | China Green Foundation and partners | China Green Foundation Annual Report (2023), Mongolia Ministry of Environment |
| UAE | Dubai Desert Greening Pilot Project | 1000 | Chinese firms and Dubai Government | The National (UAE, 2023), Qingdao Seawater Rice R&D Center Agreement |
| Southeast Asia | Laos/Cambodia Economic Forest Plantation | 300000 | Chinese agricultural enterprises | World Bank Report on SE Asia Forestry (2020), China Ministry of Commerce |
| Brazil | Eucalyptus Plantations by Chinese Firms | 200000 | Chinese paper companies | Brazilian Tree Industry Report (2020), APP Sustainability Report |

*$H_0$:China's afforestation area shows **no statistically significant change** over time.*

*$H_1$:China's afforestation area exhibits **a statistically significant change** over time.*

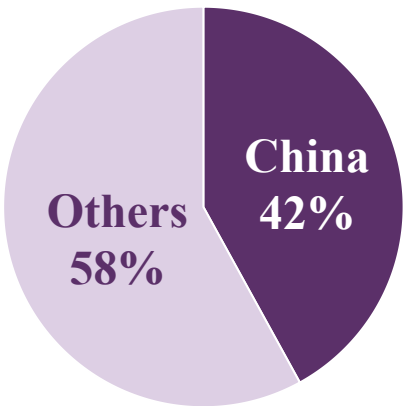
## Regression Analysis Result generated by SPSS (IBM SPSS statistics, 2024)

$\beta_1 = 11.87$ (million hectares/year)

$p = 0.0041$

$r = 0.76$

**Figure-4 Newly added Global Green Area Contributions (2019)**



# The test results explained by Deepseek

(DeepSeek, 2025)

### 1. Regression Coefficient ($\beta_1$ = 11.87 million hectares/year)

- **Interpretation**: For every 1-unit increase in the independent variable (e.g., time in years), the dependent variable (e.g., forest area, agricultural land, etc.) **increases by an average of 11.87 million hectares per year**.
- **Practical Implication**: This indicates a **strong positive relationship** between the variables. For example, if studying deforestation over time, $\beta_1$ = 11.87 might suggest a yearly loss of 11.87 million hectares of forest (context-dependent).

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### 2. p-value = 0.0041

- **Interpretation**: The p-value tests the statistical significance of the regression coefficient ($\beta_1$).
- **Conclusion**:
  - Since **p < 0.05** (a common significance threshold), the independent variable has a **statistically significant effect** on the dependent variable.
  - The extremely small p-value (0.0041) strongly rejects the null hypothesis (no relationship), meaning the observed trend is **highly unlikely to be due to random chance**.

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### 3. Correlation Coefficient (r = 0.76)

- **Interpretation**: Measures the strength and direction of the linear relationship between variables.
- **Conclusion**:
  - **r = 0.76** indicates a **strong positive correlation** (values range from -1 to +1).
  - The model explains **$r^2 = 0.76^2 \approx 57.8\%$** of the variance in the dependent variable, meaning the independent variable accounts for 57.8% of its variability.

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