

Table S1. The calculation formulas and methods of ecosystem services

Formulas	The meaning of each alphabets
$W_i = P \cdot A$	W is the food production value of the wine industry (RMB·year ⁻¹). A is the winegrapes area (3.8×10 ⁸ m ² of winegrapes area in the Eastern Foot of Helan Mountain, Ningxia; 7.067×10 ⁷ m ² of winegrapes area in Hongsibu). P is the winegrapes profits (RMB·m ⁻² ·year ⁻¹), the winegrapes profits equal to 4.9 RMB·m ⁻² ·year ⁻¹ .
$CV = P_c \cdot N \cdot A \cdot a$ $OV = P_o \cdot N \cdot A \cdot b$	CV is the value of carbon sequestration (RMB·year ⁻¹). P _c is the carbon price (RMB/t). According to the Chinese afforestation cost method, the carbon price was equal to 273.3 RMB/t. N is the net exchange of CO ₂ in the vineyard ecosystem. According to the research results [28], the net CO ₂ exchange rate (NEE) of the vineyard ecosystem was equal to 887.59 g·m ⁻² ·year ⁻¹ in the arid region of northwestern China. A is the vineyard area (m ²). <i>a</i> represents the proportional coefficient of 0.2727. OV is the value of oxygen release (RMB·year ⁻¹). P _o is the oxygen release price. According to the Chinese afforestation cost method, the price of oxygen was equal to 369.7 (RMB·t ⁻¹). <i>b</i> represents the proportional coefficient of 0.73.
$U = K \cdot Q \cdot A$	U is the total value of absorbed gas and dust (RMB·year ⁻¹). K is the unit price of absorbed gas or dust (RMB·kg ⁻¹). Q is the amount of gas and dust absorbed by the vineyard per unit area (kg·m ⁻² ·year ⁻¹). A is the vineyard area (m ²). According to this research [30], the unit price of SO ₂ , NO _x , HF, and dust control was equal to 0.6, 0.9, 0.6, and 170 (RMB·kg ⁻¹), respectively. The amount of gas and dust absorbed by the vineyard per unit area was equal to 90.0, 8.0, 0.8 and 9.0 (kg·ha ⁻¹ ·year ⁻¹).
$W_s = (A-L) \cdot C \cdot P$	W is the value of soil conservation (RMB·year ⁻¹). A is the soil erosion modulus (t·m ⁻² ·year ⁻¹). L is the amount of soil loss (t·m ⁻² ·year ⁻¹). C is the vineyard area (m ²). P is the price of soil conservation (RMB·t ⁻¹). According to the statistics of the Ningxia Water Conservancy, the original landform soil erosion modulus of the winegrapes region was equal to 0.003 t·m ⁻² ·year ⁻¹ , and the soil loss was equal to 0.001 t·m ⁻² ·year ⁻¹ . The price of soil conservation was equal to 6.52 RMB·t ⁻¹ [30].
$W_w = (R-E) \cdot A \cdot P$	W is the value of water conservation (RMB·year ⁻¹). R is the annual average rainfall (mm·year ⁻¹). E is the annual average evapotranspiration (mm·year ⁻¹). A is the vineyard area (m ²). P is the unit water storage fee (RMB·m ⁻³). Statistics from the Ningxia Water Conservancy show that the average annual rainfall of the winegrapes region was equal to 200 mm·year ⁻¹ , the average evapotranspiration was equal to 184 mm·year ⁻¹ . The unit water storage cost was equal to 0.67 RMB·m ⁻³ .
$Q = (X-x) \cdot A \cdot P$	Q is the value of water-saving and efficiency-enhancing (RMB·year ⁻¹). X is the average water consumption of agricultural irrigation in Ningxia (m ³ ·m ⁻²). <i>x</i> is the average water consumption of the winegrapes industry (m ³ ·m ⁻²). A is the vineyard area (m ²). P is the price of water (RMB·m ⁻³ ·year ⁻¹). According to the statistics of Ningxia Water Conservancy, the agricultural irrigation water in Ningxia was equal to 0.954 m ³ ·m ⁻² , the irrigation water for winegrapes was equal to 0.8535 m ³ ·m ⁻² , the water price was equal to 0.22 RMB·m ⁻³ ·year ⁻¹ .

$$V = P \cdot N \cdot Y$$

V is the total ecotourism income (RMB·year⁻¹). P is per capita tourism consumption (RMB·year⁻¹). N is the total number of tourists (person). Y is time (year). The ecological tourism value of the wine industry was equal to 3.42×10⁸ RMB·year⁻¹ in the Eastern Foot of Helan Mountain [30], and the ecotourism value is estimated to 6.36 ×10⁷ RMB·year⁻¹ in Hongsibu.

$$PA = P \cdot N$$

PA is the total annual income of ecological poverty alleviation (RMB·year⁻¹). P is the per capita wage income (RMB·year⁻¹). N is the total number of eco-poverty alleviation (person). The total annual income of eco-poverty alleviation of the wine industry was equal to 9.00×10⁸ RMB·year⁻¹ in the Eastern Foot of Helan Mountain [30]. The total annual income of eco-poverty alleviation was estimated to 1.67×10⁸ RMB·year⁻¹ in Hongsibu.
