Journal of Ecosystem & Ecography
ISSN: 2157-7625
Jacobs, J Ecosys Ecograph 2023, 13:1
Mini Review Open Access

The Study of the Changing Value of Alpine Ecosystem Services and the Path to Sustainable Development

Nisha Jacobs*

Department of Ecological science, University of Essex, United Kingdom

Abstract

Alpine ecosystems are critical for carbon sequestration, water balance, ecological security, biodiversity, and human well-being. However, climate change and high-intensity human activity continue to degrade vulnerable alpine ecosystems. Based on this, we reveal 40-year trends in ecosystem change in China's Qilian Mountains and identify the primary driving factors of change in alpine ecosystems from the perspective of ecosystem service value (ESV) change, providing a more comprehensive picture of the interactions between human society and natural ecosystems. From 1980 to 2018, more than 55% of ecosystem types changed, with forests, grasslands, glaciers, and bare land being the most vulnerable to disturbance, and forest and grassland ecosystems having significant ESV potential. Significant changes in land use and land cover (LULC) over the last decade, however, have resulted in a reduction in ESV stability in alpine ecosystems, where human activities have a greater impact on ESV of sparse woodland, shrubland, and grassland ecosystems at 2800-4000 m.

Keywords: Alpine ecosystem; Sustainable development; Carbon sequestration

Introduction

The United Nations Sustainable Development Goals (SDGs) aim to comprehensively solve development problems in three dimensions of society, economy, and environment from 2015 to 2030, and to steer the world toward sustainable development. Alpine ecosystems are one of the most difficult obstacles to achieving sustainable development. However, approximately 920 million people worldwide live in alpine ecosystems, with 560 million living in China's mountainous regions (Deng and Tang, 2013b, Deng and Tang, 2013a). Human material demand and the ability to transform nature increased dramatically in the twentieth century due to rapid population growth and leapfrog technological development. As a result, the achievement of the SDGs is linked to social, economic, and environmental development [1].

Materials and Method

The study area, with an altitude range of 1589-5583 plays a critical and irreplaceable role in maintaining ecological security, water source protection, and species diversity in western China, and, more importantly, it provides a variety of ecosystem services such as water regulation, soil erosion control, biodiversity conservation, and carbon sequestration. Three inland rivers (Shiyang River, Heihe River, and Shule River) originate here, irrigating over 700,000 ha of farmland in the Hexi Corridor and providing drinking water to over 0.68 million people [2].

The LULC data set was provided by the Chinese Academy of Sciences' Data Centre for Resource and Environment Science (RESDC), which used images from Landsat-TM/ETM and Landsat 8, and used the object-oriented multi-scale segmentation and change detection classification method at a 30 m 30 m resolution by integrating several existing data sets. The LULC data are first classified into six classes (forest lands, grasslands, croplands, wetlands, built-up lands, and other lands) and 25 sub-classes, which are then re-defined to be consistent with the ecosystem classification [3,4].

In 1980, the forest (27.94%) and grassland (38.53%) in the Qilian Mountains accounted for 66.47% of the total area, and the area of unused land and bare rock land accounted for 16.62% and 10.79%, respectively; dry land accounted for about 2.73%; water bodies, wetland and glacier accounted for less than 1% of the total area (water bodies 0.09%, wetland 0.26%, glacier and snow 0.37%); built up area accounted for 0.13%, the least common type of land use. During the period 1980-2018, the LULC in the Qilian Mountains changed dramatically (by 55%). The area of woodland, grassland, water bodies, bare rock land, glacier and snow, in particular, increased significantly at the expense of dry land, Gobi, and bare land and desert, while wetland decreased. The LULC demonstrated significant spatial heterogeneity. Woodlands and grasslands were common in the eastern and central areas, while glacial snow land, bare rock land, and unutilized land were mostly found in the west, and other LULC types were uncommon [5.6].

The findings indicated that ESV changes in the Qilian Mountains are region specific (Fig. 6, Appendix Table A.4). From 1980 to 2018, the total ESV ranged from 0.02 million $ to 3673 million $ in terms of spatial distribution. The eastern and western regions performed better than the central regions overall. The eastern counties' ESV accounted for approximately 35.3% of the total, primarily Sunan (L), Tianzhu, Yongchang, Wuwei, Gulang, Yongdeng, Huzhu, and Menyuan. Western counties' ESV accounted for approximately 36.2%, primarily Linze, Tianjun, Jiuquan, Yumen, Subei, Gaotai, Jiayuguan, and Sunan (H). The ESV of central counties, which included Shandan, Minle, Qilian, Zhangye, and Alashan youqi, accounted for approximately 28.5% [7, 8].

Conclusion

The study reveals the change characteristics of an alpine ecosystem over a short time scale, which aids in identifying the development trend

***Corresponding author:** Nisha Jacobs, Department of Ecological science, University of Essex, United Kingdom, E-mail: Nisha33@gmail.com

Received: 03-Jan-2023, Manuscript No: jee-23-87495; **Editor assigned:** 05-Jan-2023, Pre-QC No: jee-23-87495 (PQ); **Reviewed:** 19-Jan-2023, QC No: jee-23-87495; **Revised:** 21-Jan-2023, Manuscript No: jee-23-87495 (R); **Published:** 28-Jan-2023, DOI: 10.4172/2157-7625.1000374

Citation: Jacobs N (2023) The Study of the Changing Value of Alpine Ecosystem Services and the Path to Sustainable Development. J Ecosys Ecograph 13: 374.

of a typical ecosystem. In this paper, ESV is also assessed and quantified in order to determine the importance and scarcity of alpine ecosystem value. Furthermore, this study focuses on identifying and discussing the driving factors of the change in service value of alpine ecosystems, reflects the interaction between human society and natural ecosystems more comprehensively, and proposes mountainous ecosystem management and development strategies. According to the study, more than 55% of the Qilian Mountains' ecosystem types changed between 1980 and 2018. The most vulnerable ecosystems in the alpine ecosystem are forests, grasslands, glaciers, snow, and bare lands. The English Standard Version (ESV). The Qilian Mountains have an ESV of 11,302 million dollars, and the ESV potential of the forest and grassland ecosystems is enormous (43.99% and 29.57%, respectively). As a result, forest and grassland should be prioritised for ecological protection. In general, the stability of ESV in the Qilian Mountains is poor, particularly in the last ten years, and the change of LULC determines ESV stability. We used the coefficient of cross-sensitivity (CCS) method to conclude that high-intensity human activities are the primary cause of ESV changes in the Qilian Mountains in the short term. Human activities (destruction/restoration) have a greater impact on the ESV of the sparse woodland, shrub land, and grassland ecosystems, while temperature warming has a greater impact on the ESV of glaciers, snow, and ice. [9, 10].

Acknowledgement

The Second Tibetan Plateau Scientific Expedition and Research Program (STEP) (NO.2019QZKK0301), the National Key Research and Development Program of China (NO. 2019YFC0507401), and the National Natural Science Foundation of China funded this research (NO. 42071057). We thank the anonymous reviewers for devoting their time and providing constructive feedback on this manuscript.

Potential Conflicts of Interest

The author has no conflict of interest.

References

1. Bustreo C, Giuliani U, Maggio D, Zollino G (2019) How fusion power can contribute to a fully decarbonized European power mix after 2050. Fusion Eng Des 146: 2189-2193.
2. Goglio P, Williams AG, Balta-Ozkan N, Harris NR, Williamson P, et al. (2020) Advances and challenges of life cycle assessment (LCA) of greenhouse gas removal technologies to fight climate changes. J Clean Prod 244: 118896.
3. Khalidy R, Santos RM (2021) The fate of atmospheric carbon sequestrated through weathering in mine tailings. Miner Eng 163: 106767.
4. Lezaun J (2021) Hugging the shore: tackling marine carbon dioxide removal as a local governance problem. Front Climate 3: 684063.
5. Lockley A, Mi Z, Coffman DM (2019) Geoengineering and the blockchain: coordinating carbon dioxide removal and solar radiation management to tackle future emissions. Front Eng Manag 6: 38-51.
6. Osman AI, Hefny M, Maksoud MA, Elgarahy AM, Rooney DW (2020) Recent advances in carbon capture storage and utilisation technologies: a review. Environ Chem Lett 19: 797-849.
7. Liu C, X Li (2012) Carbon storage and sequestration by urban forests in Shenyang, China. Urban For Urban Green 11: 121-128.
8. Mc Carthy M, M Best, Betts R (2010) Climate change in cities due to global warming and urban effects. Geophys Res Lett 37.
9. Surya P (2020) Urban Forests and their Role in Carbon Sequestration: A Review. Int J For Res 16: 23-29.
10. Dubbale D, Tsutsumi J, Michael B (2010) Urban environmental challenges in developing cities: the case of Ethiopian capital Addis Ababa. Int J Environ Eng 4: 164-169.