UNIVERSITY OF LEEDS

This is a repository copy of *A Preliminary Study on Mapping Wilderness in Mainland China*.

White Rose Research Online URL for this paper:
http://eprints.whiterose.ac.uk/129686/

Version: Accepted Version

Article:
Cao, Y, Yang, R, Long, Y et al. (1 more author) (2018) A Preliminary Study on Mapping Wilderness in Mainland China. International Journal of Wilderness, 24 (2). ISSN 1086-5519

This paper is protected by copyright. This is an author produced version of a paper published in International Journal of Wilderness.

Reuse
Items deposited in White Rose Research Online are protected by copyright, with all rights reserved unless indicated otherwise. They may be downloaded and/or printed for private study, or other acts as permitted by national copyright laws. The publisher or other rights holders may allow further reproduction and re-use of the full text version. This is indicated by the licence information on the White Rose Research Online record for the item.

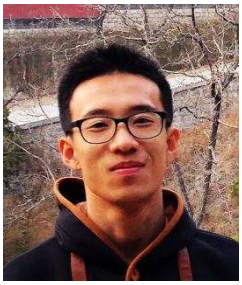
Takedown
If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.

White Rose university consortium
Universities of Leeds, Sheffield & York

eprints@whiterose.ac.uk
https://eprints.whiterose.ac.uk/

A Preliminary Study on Mapping Wilderness in Mainland China[1]

BY CAO Yue，YANG Rui，LONG Ying，STEVE CARVER




Background

Wilderness areas are, in the main, places that are ecologically intact, mostly free of industrial infrastructure, and without significant human interference. With a growing appreciation of the intrinsic value of wilderness, more attention is being paid to wilderness protection and management especially as threats increase and remaining wilderness areas shrink in size (Casson et al. 2016).

Practical experience in many countries has shown that maps depicting the spatial distribution of wilderness provide baseline information for the development and implementation of wilderness protection policies. Accurate and reliable wilderness inventories are an essential basis for robust designation of wilderness protected areas and the development of associated management policies.

Due to the lack of a wilderness inventory in China, the total area and the spatial distribution of wilderness are neither known nor fully understood. This places considerable restrictions on wilderness protection. This paper therefore focuses on identifying and understanding the spatial distribution of wilderness in mainland China, to provide a practical basis for the future development Chinese wilderness protection policies (Cao et al. 2017).

[1] The original paper was published in June of 2017 in *Chinese Landscape Architecture* (《中国园林》)(Cao, Y., Long, Y., Yang, R., 2017.Research on the Identification and Spatial Distribution of Wilderness Areas at the National Scale in Mainland China [J]. *Chinese Landscape Architecture*, 6, pp.26-33.). Invited by IJW, authorized by the authors and permitted by CLA, this paper appears as a translated summary of the original version.

The Concept of Wilderness Mapping

Different people often have different opinions on “how wild should wilderness be” which makes the concept of wilderness a complex one to implement. How to apply multiple and complex wilderness definitions into a meaningful wilderness map is the first question which needs to be answered.

The idea of defining the point at which wilderness begins and ends along the environmental modification spectrum was first proposed by Roderick Nash in his book “Wilderness and the American Mind” (Nash 2016). His approach was to emphasize the variations of intensity of human impact on landscapes and so define the wilderness continuum. This was further developed by Lesslie and Taylor, and applied to wilderness mapping in the early 1980s (Lesslie and Taylor 1985). The wilderness continuum emphasizes the transition from urban areas to pristine nature through varying levels of human modification as reflected in the intensity of human impacts on landscape. The basic attributes of the wilderness include measures of remoteness and naturalness such that wilderness quality increases with the increased remoteness and naturalness. In this manner, wilderness quality can be divided into high, relatively high, medium and low levels. Defining wilderness by these relativistic ideas helps us to understand the concept of wilderness from a spatial perspective.

Based on this concept of the wilderness continuum, GIS-based wilderness quality mapping is the most commonly applied method of identifying the spatial extent and quality of wilderness areas. While the first global mapping was carried out using manual techniques (McCloskey and Spalding 1989), wilderness mapping at various spatial scales developed rapidly with the development of satellite technology and GIS from the 1980s onwards. Over the past 30 years, several wilderness mapping projects have been carried out at global scale (Sanderson et al. 2002; See et al. 2016), continental scale (Fisher et al. 2010; Carver 2010), and in countries, regions and individual protected areas (Kliskey and Kearsley 1993; Carver et al. 2013; Orsi et al. 2013; Măntoiu et al.2016; Lin et al. 2016).

Several countries have conducted wilderness mapping studies including Australia (Lesslie and Maslen 1995), the United States (Aplet et al. 2010), the United Kingdom (Carver et al. 2002), Iceland (Ólafsdóttir et al. 2016), Denmark (Müller et al. 2015) and Austria (Plutzar et al. 2016), some of which have effectively supported wilderness protection policies. These currently provide inspiration and a technical lead for ongoing developments in China.

The Model of Wilderness Mapping for China

In developing a wilderness map for China, we address the principal questions: "Where are, how large and of what 'quality' are China's remaining wilderness areas?" Our objective is to map the spatial distribution of the remaining wilderness areas in China; thereby providing a practical base for the further development of Chinese wilderness protection policies. The study area is mainland China excluding Taiwan and marine areas.

The mapping model is shown in Figure 1. Four indicators reflecting the wilderness qualities or attributes are selected and mapped as follows:

1. Remoteness from the settlements (i.e. areas of permanent human occupation);
2. Remoteness from vehicular access;
3. Biophysical naturalness (i.e. the degree of biophysical disturbance by modern society); and
4. Apparent naturalness (the degree of involvement of modern artificial facilities).

These four indicators reflect two aspects of wilderness definition simultaneously: on one hand, from the "ecological" point of view, wilderness is natural areas with fewer human impacts and high naturalness; while on the other hand, from the "perceptive" point of view, wilderness is seen as remote with almost no manmade facilities or habitation.

To map these indices, national datasets including urban and rural construction land, road networks, land use and artificial facilities were selected and mapped using GIS methods according to the four indicators described above. The results of each individual indicators are overlaid with equal weights using a simple weighted linear summation Multi-Criteria Evaluation (MCE) approach so as to obtain the map of Chinese Wilderness Quality Index (WQI). This is then used to further identify wilderness areas with different values.

The resolution of is $1km^2$. Each $1km^2$ grid cell corresponds to a wilderness index ranging from 0 to 100. This resolution is deemed sufficient for mapping wilderness at national scale in China.

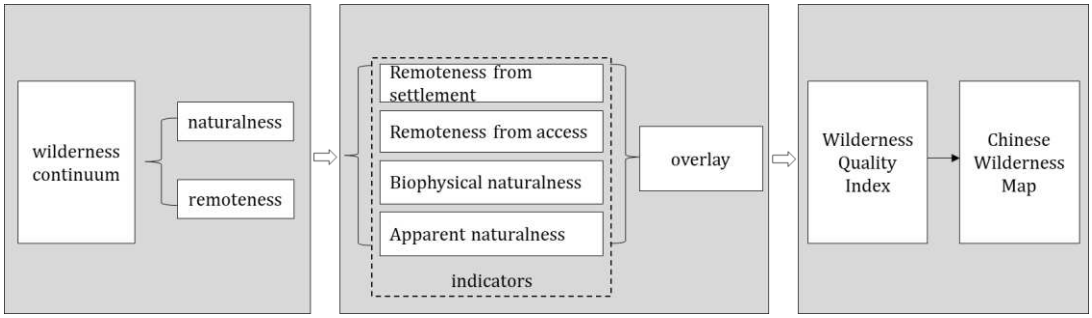


Fig. 1 Model of wilderness mapping for China

Mapping Wilderness Attributes

Remoteness from settlement reflects the distance to/from existing urban and rural habitation. Data on urban and rural construction land in China (Liu et al. 2014) are used as the source to calculate remoteness as Euclidean distances (see Figure 2). Remoteness from access reflects the distance from roads. "Roadless areas" are usually considered to be an important indicator of wilderness (Selva et al. 2010). Chinese traffic network data including railways, highways, national roads, provincial roads and urban roads are merged and used as inputs when calculating Euclidean distance from mechanized access (see Figure 3).

Biophysical naturalness reflects the degree of human modification of land cover based on a naturalness grading given to different types of land-use. The 2010 national land-use data is selected as the base data (Liu et al. 2014), which itself is based on classified remote sensing images. There are 6 principal types of land use including cultivated land, forest land, grassland, open water, residential land and "unused" land, and 25 secondary types in this classification. The land-use types corresponding to the land code (land resource classification system) are reclassified to reflect the likely degree of human modification of natural ecosystems (See Table 1 and Figure 4).

Table 1: the grading evaluation table of different land-use types corresponding to the natural degree

Land-use code	Land-use type	Grading of biophysical naturalness
11	Paddy field	2
12	Dry land	2
21	Woodland	5
22	Shrubbery	4

23	Open forest land	4
24	Other woodland	3
31	High coverage grassland	5
32	Medium coverage grassland	4
33	Low coverage grassland	4
41	River canal	4
42	Lake	5
43	Reservoir pond	3
44	Permanent glacier and snowfield	5
45	Intertidal zone	4
46	bottomland	4
51	Urban land	1
52	Rural settlement	1
53	Other construction land	1
61	Sand land	5
62	Gobi land	5
63	Saline land	5
64	wetland	5
65	Bare land	5
66	Bare gravelly land	5
67	Others	5

Note: The first two columns are from the National Land-use Data Classification System (Liu et al. 2014).

Apparent naturalness reflects the extent to which an area is affected by permanent modern human artifacts. Distribution of traffic network data and settlement data are selected as the input data because transportation infrastructures and buildings are two main kinds of artificial infrastructures seen in the landscape. The former data also includes artificial infrastructures near the road such as bridges, dams and power lines. A kernel density tool is used to calculate the density of artificial facilities which in turn is used to reflect the degree of apparent naturalness (see Figure 5).

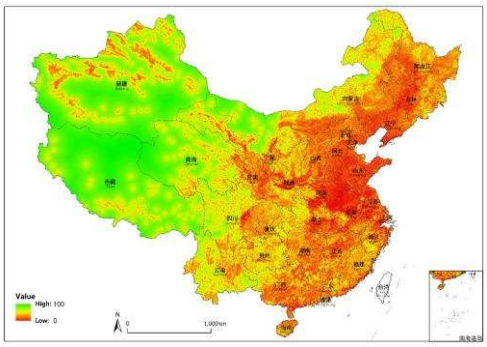


Fig. 2 Remoteness from settlements

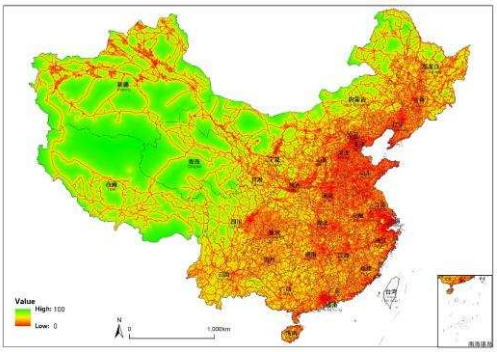


Fig. 3 Remoteness from access

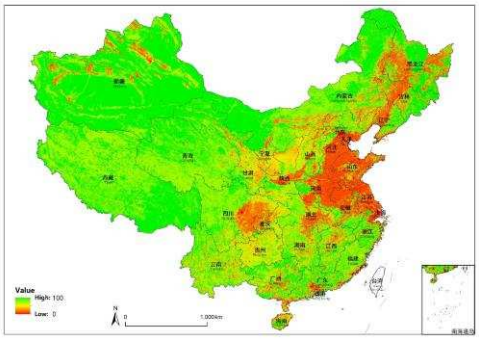


Fig. 4 Biophysical naturalness

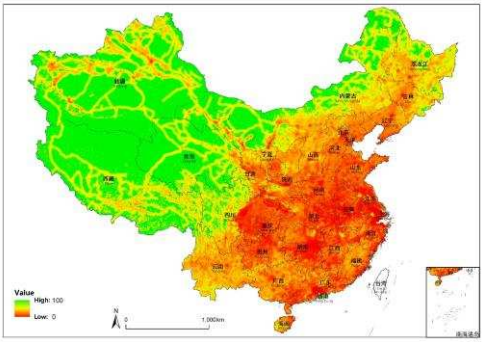


Fig. 5 Apparent naturalness

Results

Since the calculation of the four indicators involves different dimensions and units, the first step in calculating a wilderness quality map is to normalize each of the input layers so that all the scores range from 0 to 100. To derive the Chinese Wilderness Index, scores of four indicators are combined by weighted linear summation within MCE. The formula is as follows.

$$W_{QI} = \sum_{i=1}^{n} e_i$$

In this formula, W_{QI} was the wilderness index, the value of which represented the wilderness quality; e_i is the standard score after evaluation of individual indicator; n is the number of indicators. It should be noted that equal weight of the four indicators is used for simplicity and clarity, but alternative weighting schemes could be explored in future. The resulting map of the Chinese Wilderness Quality Index (WQI) is shown in Figure 6.

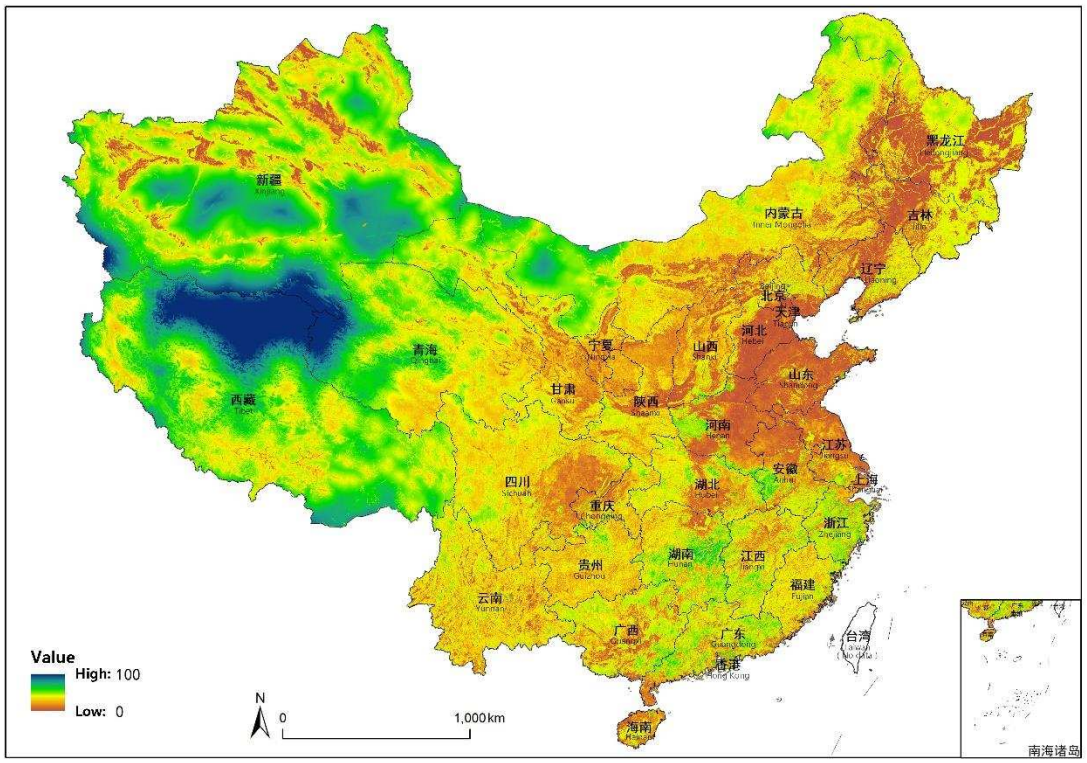


Fig. 6 Map of the Wilderness Quality Index (WQI)

The wilderness quality index is then classified to divide all lands into five types labelled as high-quality, relatively-high-quality, medium-quality, low-quality wilderness and other type of lands (i.e. developed) as shown in Table 2. The spatial distribution of wilderness areas falling within the different levels are shown in the Chinese Wilderness Map (see Figure 7). Four types of wilderness take up to half of the whole land area, which together constitute those landscapes with highest wilderness level in mainland China.

Table 2. Degrading of Chinese wilderness quality and its proportion of total land area

Type of landscape	**Proportion of total land area/%**	**Classification basis: Range of WQI value**
High-quality wilderness	4.3	60.1~100.0
Relatively-high-quality wilderness	12.4	45.1~60.0
Medium-quality wilderness	11.9	40.1~45.0
Low-quality wilderness	24.0	35.1~40.0
Other type of lands	47.4	0.258~35.0

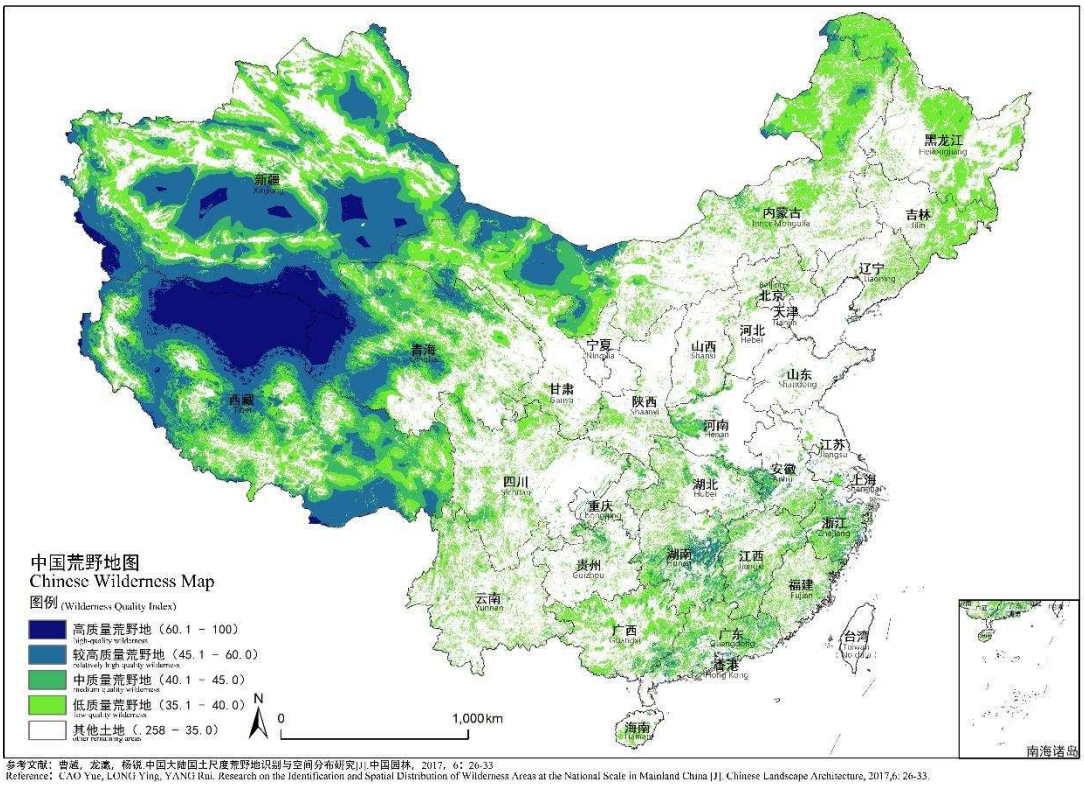


Fig. 7 Chinese Wilderness Map

High-quality wilderness accounts for 4.3% of total land area of mainland China, mainly distributed in Qiangtang, Altun Mountains, Hoh Xil, Taklamakan Desert, and Lop Nur. Relatively-high-quality wilderness accounts for 12.4% of total land area, mainly distributed in the northern Tibet Autonomous region, southern Xinjiang Autonomous region, Western Qinghai Province and Western Inner Mongolia Autonomous region. Together these high-quality and relatively-high-quality wilderness areas are mainly distributed in Western China. Policies restricting land-use alternations, construction of artificial infrastructures and human activities with negative effects on landscapes could be implemented in these regions so as to preserve the wilderness value and characteristics for future generations.

In addition, medium-quality wilderness accounts for 11.9% of total land area and low-quality wilderness accounts for 24.0%. This is distributed in provinces throughout western, central and eastern China. Although the wilderness quality of these two types are lower, there are still high conservation values to be found in these lands, some of which have already been designated as protected areas while many others have not. Wilderness areas in eastern and central China are highly fragmented, yet still provide important ecosystem services and recreational opportunities for nearby urban populations. These areas are perhaps more threatened than wilderness areas in

western China and so perhaps need closer attention and further research due to the country's large population and associated demand for economic development. Most importantly, the use of these areas should also be wisely and carefully managed to preserve the wilderness values as far as possible.

Existing wild areas can be divided into two types, those which already have been designated as protected areas and those which have not. For those already included in protected area networks, the wilderness area and its values should be emphasized in the management zoning, and more scientific and sophisticated management policies should be developed to enhance conservation practices and the permanence of these wilderness zones. For wilderness areas not included in existing protected areas, but with relatively high wilderness quality, the necessity and feasibility of further studies and practices should be explored. These include the designation of new protected wilderness areas and the delineation of ecological "red lines"[2] around biodiversity hotspots to bridge the gap between existing protected areas and wilderness. The establishment of ecological networks connecting wilderness areas will be necessary, especially to maintain and enhance the ecological integrity of smaller wild areas. Rewilding might be necessary to either restore and enhance existing wilderness areas or improve connectivity between protected areas.

Conclusion and Discussion

This research has identified existing wilderness areas in China from a spatial perspective and created the first national scale wilderness map in mainland China. Four levels of wilderness areas and other (developed) lands respectively accounted for 4.3%, 12.4%, 11.9%, 24.0% and 47.4% of the total land area in mainland China. This study is meaningful in both cognitive and practical aspects of wilderness protection in China. At the cognitive level, a new understanding of the national scale landscape is added from the perspective of wilderness, which is a basic requirement for the further analysis of spatial patterns of wilderness at multiple spatial scales. At the practical level, it is expected to guide policy-making about wilderness preservation and planning for a national Chinese Wilderness Preservation System. This will provide an essential reference for development and planning of various protected areas and for the

[2] Ecological "red lines" is one of the key polices in "China Eco-civilization" which would designate areas to be protected from further development, and mainly focuses on eco-functional areas, ecologically fragile areas and biodiversity hotspots.

delineation of ecological protection “red lines.”

This research develops the national scale wilderness mapping in mainland China and lays the foundations for further work including:

1) Improvements to the mapping work described here to better analyze spatial pattern of wilderness in China making use of big data and multi-sourced data.
2) Systematic assessment of the multiple values of wilderness in China, especially the biodiversity and ecosystem service values of wilderness areas.
3) Analysis of the conservation status of wilderness areas in China and identification of gaps in wilderness preservation to support proposals for more targeted wilderness preservation policies.
4) Multi-scale wilderness mapping to directly assist management of wilderness protected areas, designation of new wilderness areas, management zoning, and wilderness recreation planning.

In recognition of the importance and sensitivity of wilderness areas, preservation of wilderness qualities and values should be discussed in the context of the Chinese national park pilot program and ongoing reconstruction of the country’s protected areas system. Wilderness preservation and management in China could be greatly improved by policies such as ecological function zoning, national main functional area planning, delineation of biodiversity conservation priority regions, and delineation of ecological “red lines” so as to maintain harmonious landscapes between humans and nature and leave precious “Wild China” for both contemporary and future generations.

【Rejoinder】

This paper is a preliminary study focusing on wilderness mapping at a national scale. It creates the first wilderness map for China and could be taken as a starting point for further studies including regional and park-focused mappings. The following issues should be addressed carefully in the further studies.

☐ Wilderness definition and attributes

The wilderness concept has been introduced and discussed in China from multiple perspectives including environmental philosophy, environmental aesthetics, environmental history and nature writing. Scholars including HOU Wenhui(侯文蕙), CHENG Hong(程虹), LU Feng(卢风),YE Ping(叶平), CHEN Wangheng(陈望衡) have made great contribution to this process. The special issue on wilderness in *Chinese Landscape Architecture* in 2017 raised more discussions on wilderness concept in China (Carver 2017; Cao and Yang 2017; Martin 2017; Watson and Carver 2017).

Besides, scholars also started to explore the wilderness concept in Chinese mind from the perspective of perception and philosophy, which made the discussion go a step further (Tin and Yang 2016; Tin et al. 2016; Gao 2017).

However, there is no unified or official definition of wilderness in China at present, so we take the IUCN and other existing wilderness definitions as a reference. We think that defining wilderness in Chinese context is extremely important, however we could not give a precise Chinese wilderness definition at this stage. In this case, our mapping work is based on the wilderness continuum and internationally recognized attributes which most wilderness mapping studies so far have adopted.

China is a huge and geographically/culturally varied country making it hard to find an approach that works at all scales. We think using naturalness and remoteness as wilderness attributes at national scale is appropriate but acknowledge that these may need modifying to take social, cultural, political and historical factors into account at the local scale.

Remoteness is a good indicator at the national scale, because where there are no roads it is more remote from human influence and therefore more likely to be wild/natural. However, at local scales more indicators should be taken into consideration including solitude, lack of visible human artefacts, population density, terrain roughness and more complex models should be used to map these variables including visibility, walking time, etc.

Apparent naturalness in this paper refers to the absence of certain artificial infrastructures which is usually considered to be an important indicator of wilderness (Lesslie and Maslen 1995; Carver et al. 2002; Plutzar et al. 2016).

In Chinese, wilderness attribute(属性) has a similar meaning to wilderness indicator（指标）including naturalness, wildness and remoteness. Wilderness Quality Index is a term used in European wilderness mapping projects. This may cause confusion because “quality” (质量) in Chinese usually relates to both good or bad qualities. Although WQI is understandable, using 荒野等级/荒野度/荒野程度（wilderness levels/grades）maybe better as the classification of areas with different wilderness quality index.

- ☐ Revisiting the cultural relevance of wilderness in China and how to acknowledge it in the mapping procedure

We acknowledge that simply transposing Western methods to China may cause confusion in a cultural context. Further studies to address this problem may include the following points.

1) Conduct a series of wilderness perception surveys in China to see how this western term is interpreted in the minds of Chinese people. This research may include different levels of public participation and expert consultation to address the following questions: Is wilderness a meaningful and useful concept in nature conservation in China？ What are the attributes that best define an area as wilderness in China? Which attributes are most important to Chinese people?
2) Use MCE techniques to combine the indicators in different ways, orders and sets with variable weights which acknowledge the cultural understanding and local, regional, national and international differences.
3) The classification criterion of wilderness quality should be further improved using statistical and fuzzy methods to better interpret the resulting wilderness map in a cultural relevant way.

☐ Comments on data quality

There are some problems in terms of data quality in this research which need to be recognized when considering the results. These include the following:

1) Due to data or calculation methods, there may be overestimation or underestimation of the wilderness quality, which should be verified and improved in regional scale mapping work.
2) Overestimation of wilderness quality may exist in Chinese border regions due to edge effects arising from the absence of relevant data from neighboring countries.
3) Internal edge effects can also be seen due to variations in mapping standards between different provinces requiring careful calibration and checking using supplementary data.

Acknowledgments

We would like to thank: Vance G. Martin (President, the WILD Foundation and Wilderness Foundation Global, and Chairman, Wilderness Specialist Group (IUCN/WCPA) for his guidance and much advice; Li Jiajia for her assistance in the data processing; and Peng Qinyi for his assistance in the translation of the paper.

References

Aplet, G., Thomson, J. and Wilbert, M., 2000. Indicators of wildness: Using attributes of the land to assess the context of wilderness. In *Proceedings: Wilderness Science in a Time of Change. Ogden (UT): USDA Forest Service, Rocky Mountain Research Station. Proc. RMRS-P-15*.

Cao, Y. and Yang, R., 2017. The Research Framework and Key Issues of Chinese Wilderness Studies. *Chinese Landscape Architecture*, *6*, pp.10-15. [in Chinese]

Cao, Y., Long, Y., Yang, R., 2017.Research on the Identification and Spatial Distribution of Wilderness Areas at the National Scale in Mainland China [J]. *Chinese Landscape Architecture*, *6*, pp.26-33. [in Chinese]

Carver, S., Evans, A.J. and Fritz, S., 2002. Wilderness attribute mapping in the United Kingdom. *International Journal of Wilderness*, *8*(1), pp.24-29.

Carver, S., 2010. Mountains and wilderness. *European Environment Agency (2010) Europe's ecological backbone: recognising the true value of our mountains. European Environment Agency, Copenhagen*, pp.192-201.

Carver, S., Tricker, J. and Landres, P., 2013. Keeping it wild: Mapping wilderness character in the United States. *Journal of environmental management*, *131*, pp.239-255.

Carver, S., 2017. Lessons from the West: developing wilderness mapping techniques and their potential in China and SE Asia. *Chinese Landscape Architecture*, *6*, pp.20-25. [in Chinese, translated by Cao, Y.]

Casson, S.A., Martin, V.G., Watson, A., Stringer, A. and Kormos, C.F., 2016. Wilderness protected areas: Management guidelines for IUCN Category 1b protected areas.

Fisher, M., Carver, S., Kun, Z., McMorran, R., Arrell, K. and Mitchell, G., 2010. Review of status and conservation of wild land in Europe. *Report: The Wildland Research Institute, University of Leeds, UK*, *148*, p.p131.

Gao, S., 2017. Can Chinese Philosophy Embrace Wilderness?. *Environmental Ethics*.

Kliskey, A.D. and Kearsley, G.W., 1993. Mapping multiple perceptions of wilderness in southern New Zealand. *Applied Geography*, *13*(3), pp.203-223.

Lesslie, R.G. and Taylor, S.G., 1985. The wilderness continuum concept and its implications for Australian wilderness preservation policy. *Biological Conservation*, *32*(4), pp.309-333.

Lesslie, R. and Maslen, M., 1995. National Wilderness Inventory Handbook of

Procedures. *Content and Usage (Commonwealth Government Printer, Canberra, Australia),*.

Lin, S., Wu, R., Hua, C., Ma, J., Wang, W., Yang, F. and Wang, J., 2016. Identifying local-scale wilderness for on-ground conservation actions within a global biodiversity hotspot. *Scientific reports*, *6*, p.25898.

Liu, J., Kuang, W., Zhang, Z., Xu, X., Qin, Y., Ning, J., Zhou, W., Zhang, S., Li, R., Yan, C. and Wu, S., 2014. Spatiotemporal characteristics, patterns, and causes of land-use changes in China since the late 1980s. *Journal of Geographical Sciences*, *24*(2), pp.195-210. [in Chinese]

Măntoiu, D.Ş., Nistorescu, M.C., Şandric, I.C., Mirea, I.C., Hăgătiş, A. and Stanciu, E., 2016. Wilderness Areas in Romania: A Case Study on the South Western Carpathians. In *Mapping Wilderness* (pp. 145-156). Springer, Dordrecht.

Martin, V.G., 2017. Wilderness — International Perspectives and the China opportunity. *Chinese Landscape Architecture*, *6*, pp.5-9. [in Chinese, translated by Zhang, Q.]

McCloskey, J.M. and Spalding, H., 1989. A reconnaissance-level inventory of the amount of wilderness remaining in the world. *Ambio*, pp.221-227.

Müller, A., Bøcher, P.K. and Svenning, J.C., 2015. Where are the wilder parts of anthropogenic landscapes? A mapping case study for Denmark. *Landscape and Urban Planning*, *144*, pp.90-102.

Nash, R., 2014. *Wilderness and the American mind*. Yale University Press.

Ólafsdóttir, R., Sæþórsdóttir, A.D. and Runnström, M., 2016. Purism scale approach for wilderness mapping in Iceland. In *Mapping Wilderness* (pp. 157-176). Springer, Dordrecht.

Orsi, F., Geneletti, D. and Borsdorf, A., 2013. Mapping wildness for protected area management: A methodological approach and application to the Dolomites UNESCO World Heritage Site (Italy). *Landscape and Urban Planning*, *120*, pp.1-15.

Plutzar, C., Enzenhofer, K., Hoser, F., Zika, M. and Kohler, B., 2016. Is There Something Wild in Austria?. In *Mapping Wilderness* (pp. 177-189). Springer, Dordrecht.

Sanderson, E.W., Jaiteh, M., Levy, M.A., Redford, K.H., Wannebo, A.V. and Woolmer, G., 2002. The human footprint and the last of the wild. *BioScience*, *52*(10), pp.891-904.

See, L., Fritz, S., Perger, C., Schill, C., Albrecht, F., McCallum, I., Schepaschenko, D., Van der Velde, M., Kraxner, F., Baruah, U.D. and Saikia, A., 2016. Mapping human impact using crowdsourcing. In *Mapping Wilderness* (pp. 89-101). Springer, Dordrecht.

Selva, N., Kreft, S., Kati, V., Schluck, M., Jonsson, B.G., Mihok, B., Okarma, H. and

Ibisch, P.L., 2011. Roadless and low-traffic areas as conservation targets in Europe. *Environmental management*, *48*(5), p.865.

Tin, T., Summerson, R. and Yang, H.R., 2016. Wilderness or pure land: tourists' perceptions of Antarctica. *The Polar Journal*, *6*(2), pp.307-327.

Tin, T. and Yang, R., 2016. Tracing the contours of wilderness in the Chinese mind. *International Journal of Wilderness*, *22*(2), pp.35-40.

Watson, A.E., Carver, S., 2017. Wilderness, Rewilding and Free-willed Ecosystems: Evolving Concepts in Stewardship of IUCN Protected Category 1b Areas. *Chinese Landscape Architecture*, *6*, pp.34-38. [in Chinese, translated by Huang, C. and Yang, H.]

CAO Yue is a Ph.D. candidate in Department of Landscape Architecture at Tsinghua University. His research focus on national park and protected area, especially focusing on the Chinese wilderness protection, including wilderness mapping and the establishment of the Chinese Wilderness Preservation System(CWPS); email: 605260093@qq.com.

YANG Rui is the chair, professor in Department of Landscape Architecture at Tsinghua University. He has over 20 years' experience in the planning and management of national parks and world heritage sites in China. He is the Chief Expert of the Major Program of National Social Science Foundation of China: "Theoretical and Practical Research on the Construction and Development of Chinese National Park System"(No.14ZDB142). He is one of the Chinese senior advisor to the WILD11 process; email: yrui@mail.tsinghua.edu.cn.

LONG Ying, Ph.D. is now an associate professor in the School of Architecture, Tsinghua University. His research focuses on urban planning, quantitative urban studies and applied urban modeling. He is passionate about the wilderness; email: ylong@tsinghua.edu.cn.

Steve Carver is a Geographer and Senior Lecturer at the University of Leeds. He has over 25 years' experience in the field of GIS and multi-criteria evaluation with special interests in wild land, rewilding, landscape evaluation and public participation; email: s.j.carver@leeds.ac.uk.