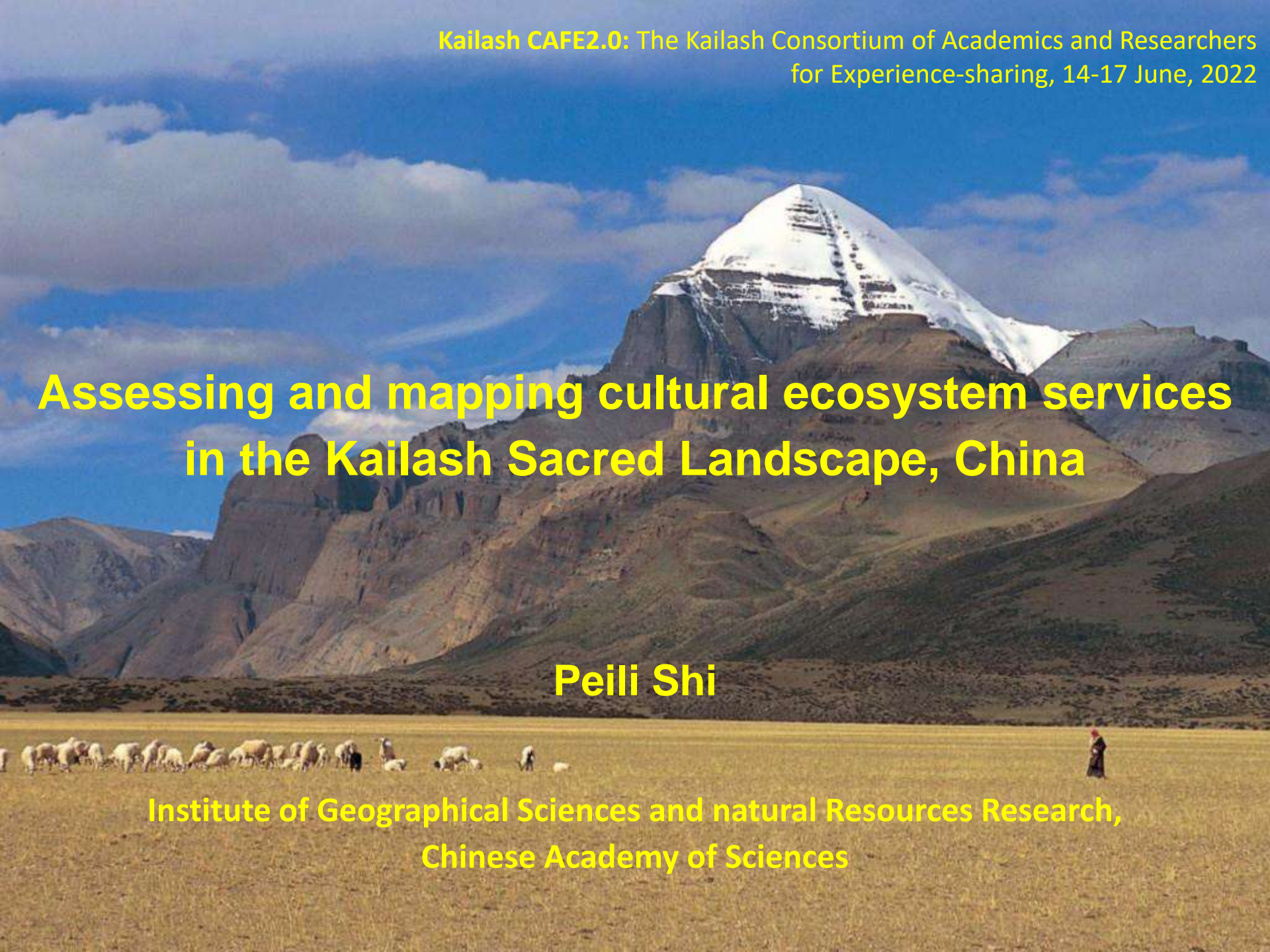


Assessing and mapping cultural ecosystem services in the Kailash Sacred Landscape, China

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Outline of presentation

- **Introduction of cultural ecosystem services (CES)**
- **Framework of CES and its indicators in KSL**
- **Data collection and methods for assessing CES**
- **Preference of CES by respondent and CES ranking**
- **Spatial distribution and Kernel density of CES**
- **Resilience of CES to climate change and its implication**
- **Conclusion**

1. Introduction

■ Cultural ecosystem services

- Cultural ecosystem services (CES) are the non-material benefits from ecosystems which are less directly linked to human well-being than other services.
- But tertiary industry, such as recreation and tourism related to aesthetic values, closely depends on CES

■ CES is one of the indispensable ecosystem services

■ With feature of intangible, non-material and invisible, CES is difficult to quantify, but it has many manifestations

■ CES are multi-facets, especially in the cultural landscapes with multifunctionality, a spatially explicit participatory mapping and assessing the full range of CES as perceived by different groups of people is needed.

1. Introduction

- Kailash Sacred Landscape is among the most bio-culturally diverse area in HKH, with CES diversifying livelihoods
- So far CES has been sporadically assessed and lacking in systematic conceptualization and application, weakening the significant role of CES in resources use, land planning and management for local sustainable development.
- Our assessing and mapping CES, with focuses on,
 - CES preferred by different respondents
 - CES ranking of different categories
 - Spatially distribution of CES
 - CES classes associated with landscape elements

1. Introduction

Pulan (Burang) County, Ali (Ngari) Prefecture, Tibetan Autonomous Region of China



1. Introduction

Kailash Sacred Landscape



Kailash Sacred Landscape





止热寺
5080M

天脚台
5370M

● 5648M

6X4E

宿营补给点
5233M

补给点
4895M

4075

补铅点
S057M

图 1

66354

~~尖峰户外~~

曲古寺
4860M

2002

短端广场
两翼铁塔

4740E

色龙寺
5030M

5020R

江扎寺
5060M

5000

祖茔寺
492811

45304

宿營补给点
480911

4006

塔钦
4675m

48.95

补船点
4678M

1994



Lake Manasarovar circumambulation



Mt Kailash and Lake Manasarovar



Mt Gurla Mandata and Manasarovar Ramsar Wetland



Mt Gurla Mandata and Manasarovar
—the mother of sacred mountain





Chiu gomp



Pulan (Takalakot)



Old Takalakot





Khorzhak gompa



2. Framework of CES and its indicators

Component	Definition (MA 2005)	Application in KSL	
		Indicator	Mapping type
	The diversity of ecosystems is one factor influencing the diversity of cultures	Types of cultural groups	Polygon
2) Spiritual and religious values	Many religions attach spiritual and religious values to ecosystems or their components	Places of worship (temple, monastery, church, other)	Point
		Sacred site or object (chhorten, stupa, sacred forest, sacred lake, sacred spring, sacred waterfall, sacred mountain, sacred cave)	Point Line Area
		Religious and cultural festival or event (festival, life events, pilgrimage route)	Point Line
	Ecosystems influence the types of knowledge systems developed by different cultures	Traditional knowledge systems (TK around biodiversity, TK around agriculture)	Point
4) Education values	Ecosystems and their components and processes provide the basis for both formal and informal education in many societies	Formal education (schools – primary, secondary, higher education)	Point
		Informal education (religious/traditional schools, training centres)	Point
5) Inspiration	Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture, and advertising	Folklore, meditation site, art, architecture	Point
6) Aesthetic values	Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks, scenic drives, and the selection of housing locations	Scenic awe-inspiring sites and view-points	Point
		Recreational park/site	Point
		Protected area	Polygon
7) Social relations	Ecosystems influence the types of social relations that are established in particular cultures	Traditional governance systems	Polygon
		Trade fairs	Point
	Many people value the 'sense of place' that is associated with recognized features of their environment, including aspects of the ecosystem	Overlap with #2 and #6)	

2. Framework of CES and indicators

9) Cultural heritage values	Many societies place high value on the maintenance of either historically important landscapes or culturally significant species	Culturally significant species	Polygon/Point
		Culturally significant landscape/site	Polygon/Point
		Historically important site	Point
		Dharamshala (resting houses/structures)	Point
10) Recreation and ecotourism	People often choose where to spend their leisure time based in part on the characteristics of the natural or cultivated landscapes in a particular area	Trekking route	Line
		Campsite	Point
		Hotel/lodge/teashop/homestay	Point
		Mountaineering peak	Point
		Biking route	Line
		Rafting/kayaking route	Line
		Recreational spring	Point
		Recreational lake	Polygon
		Recreational waterfall (for canyoning)	Point
		Adventure tourism	Point
		Information/visitor centre	Point
		Immigration post	Point
		Airport & helipad	Point

- The categories of CES are adopted from MEA and indicators referred to ICIMOD's working paper (Pandey et al., 2016)
- We assess and mapping seven categories of CES except **cultural diversity, knowledge system and sense of place**

3. Data collection and methods for assessing CES

Data collection

- Using media photo and questionnaire for data collection
- Interviewing with different respondents and surveying their preference to different categories of CES in KSL-China.
- ICIMOD's geospatial identification of cultural sites
- We identified and added cultural sites of **education value, social relation and recreation/tourism** (by manifestations of accommodation supply, hostels and hotels)

3. Data collection and methods for assessing CES

The preference analysis of respondents to CES

- Four relevant groups of respondents: **local residents** (20 persons), **entrepreneurs** (5 pers), **tourists** (20 pers) and **scholars of KSLCDI** (10 pers). In total 55 pers interviewed.
- We solicited their evaluation of the preferred cultural services and landscape elements.
- Based on their preferences, we aimed at identifying the **hotspots and distribution patterns** of the CES. At the same time, we mapped the **points of interesting (POI)** of the cultural sites and conducted a spatial analysis of CES.
- We ask:
 - ✓ Which places are the important sites of related CES components? and which one is the most important?
 - ✓ What do you most enjoy doing and where are these activities done?
 - ✓ Which landscape elements are linked with the CES you like?

3. Data collection and methods for assessing CES

Ranking different components of CES

- 10 experts to evaluate the score of each site of the studied seven categories of CES. This survey is scored in a graded and quantitative manner of 0 - 5 levels,
 - 0 = no value,
 - 1 = very low value,
 - 2 = low value,
 - 3 = medium value,
 - 4 = high value,
 - 5 = very high value.
- One place may have multiple services, so each site takes a **comprehensive score**. At the same time, all sites of each category of CES can get its average score so that we can **compare and rank corresponding component** of the CES in sequence.

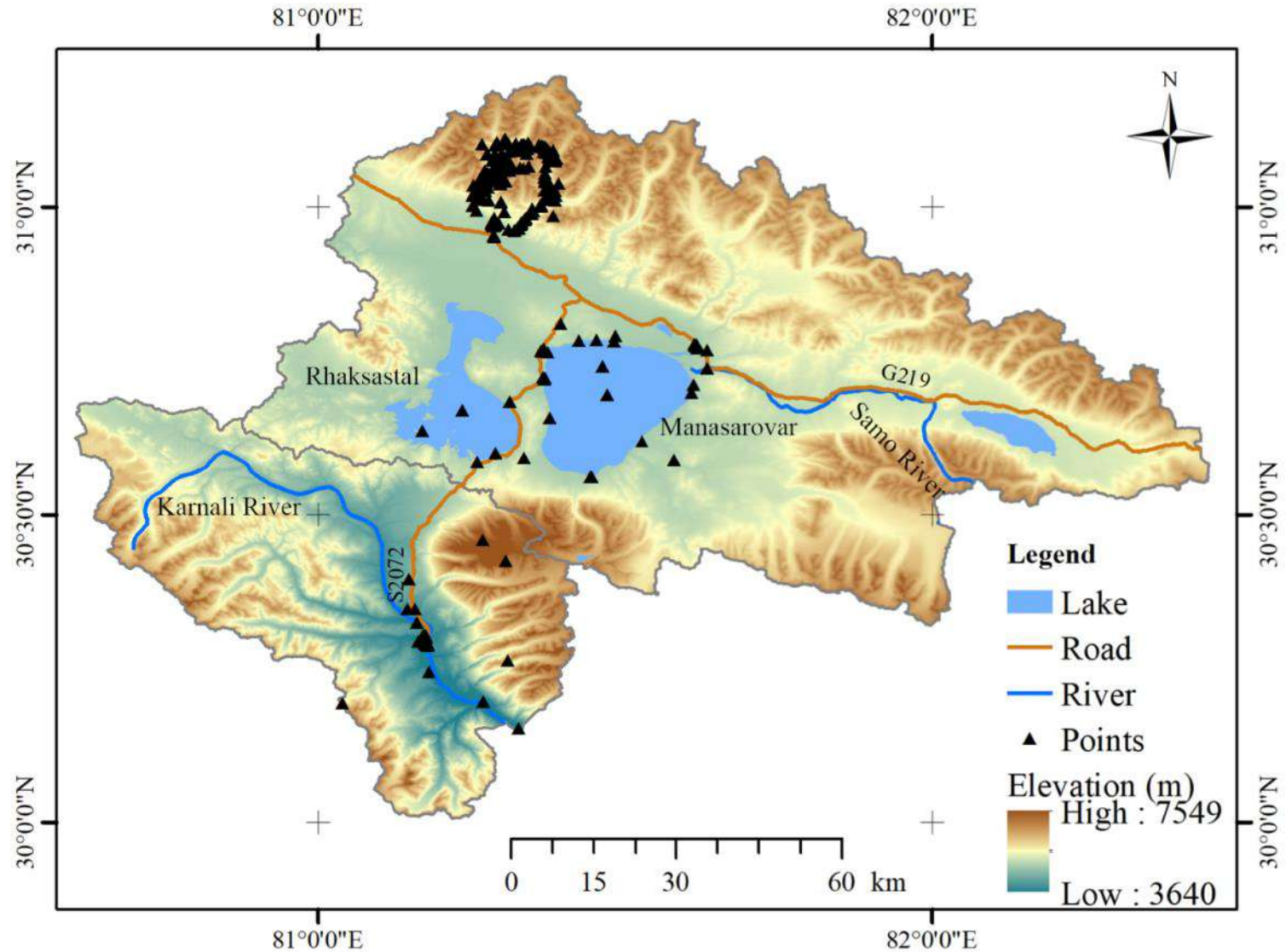
3. Data collection and methods for assessing CES

Spatial analysis and kernel density of CES

- Cultural sites were mapped and visualized in ArcGIS 10.2.
- Spatial analysis was conducted for **seven categories** of spiritual and religious values, education values, inspiration, aesthetics, social relation, cultural heritage and recreation/ tourism.
- **Kernel density analysis** for different categories of CES. The comprehensive scores of different sites were used as attributes for the density analysis.
- Kernel density produces a circular area based on the agglomeration of points inside a search radius 100 m

4. Preference of CES and CES ranking

Identifying cultural sites in KSL-China



4. Preference of CES and CES ranking

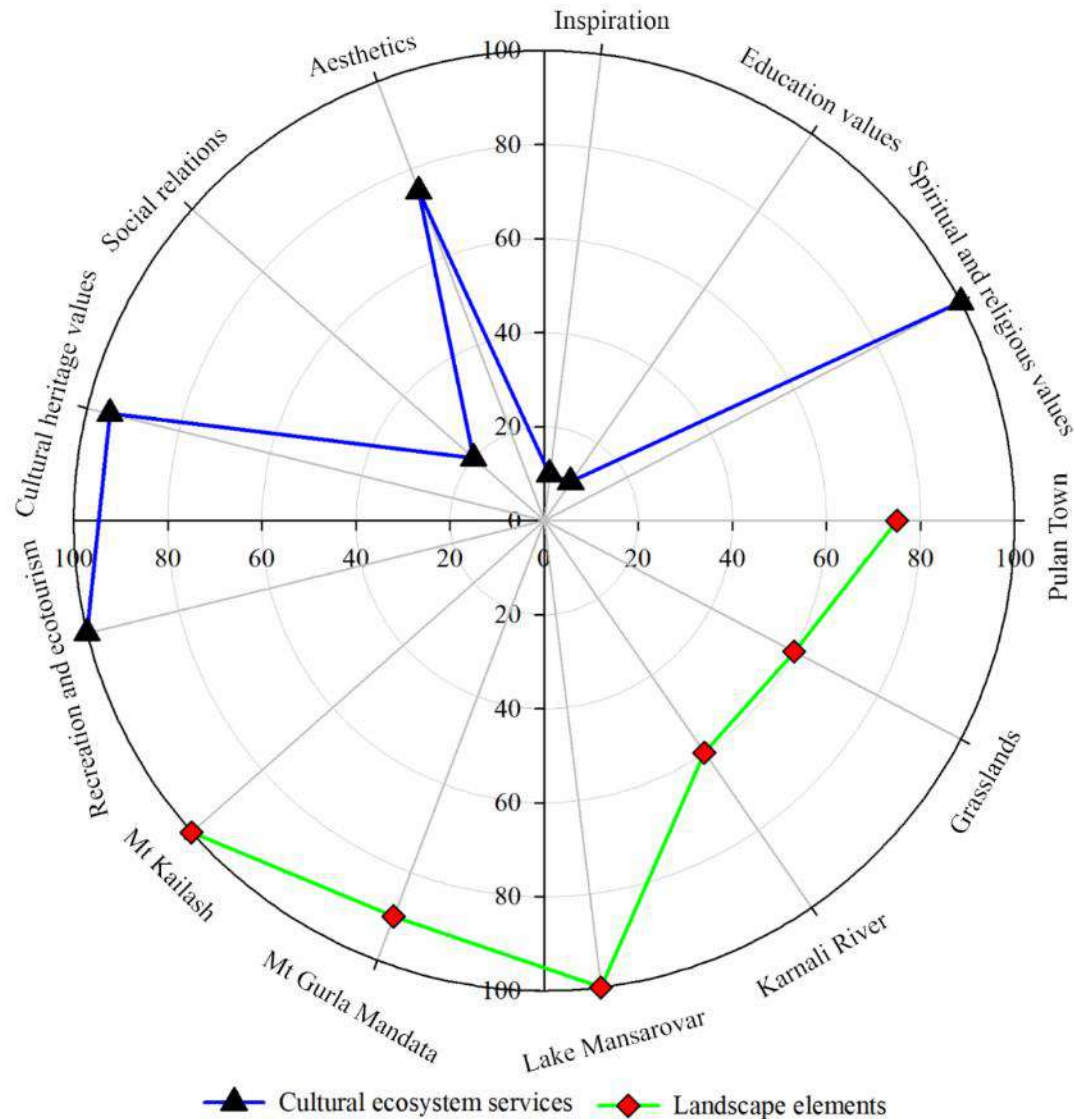
Preference of CES from different groups of respondents

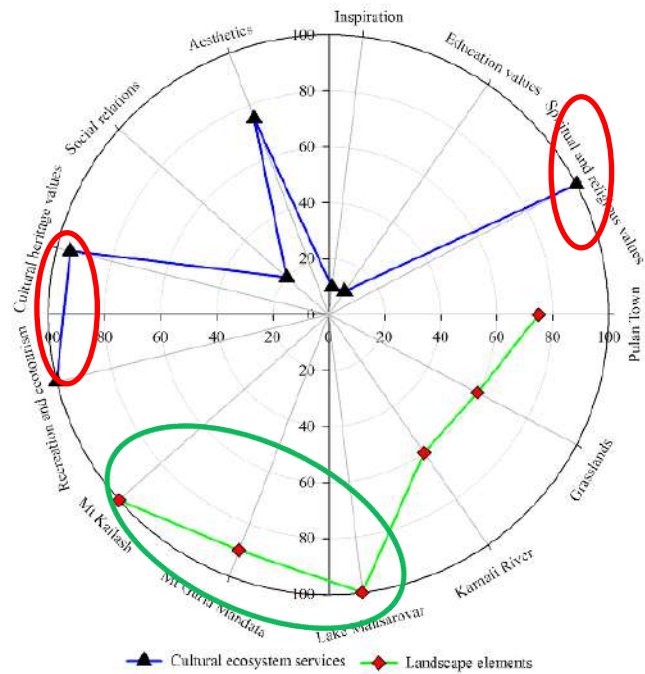
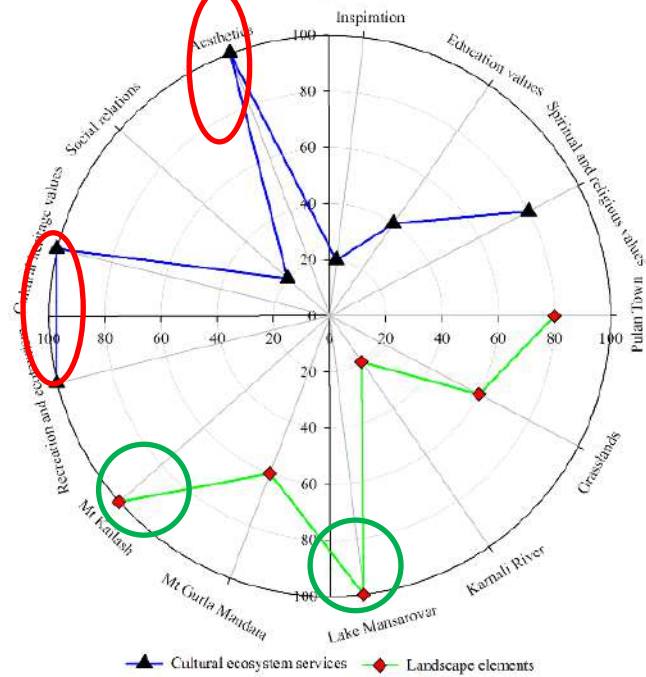
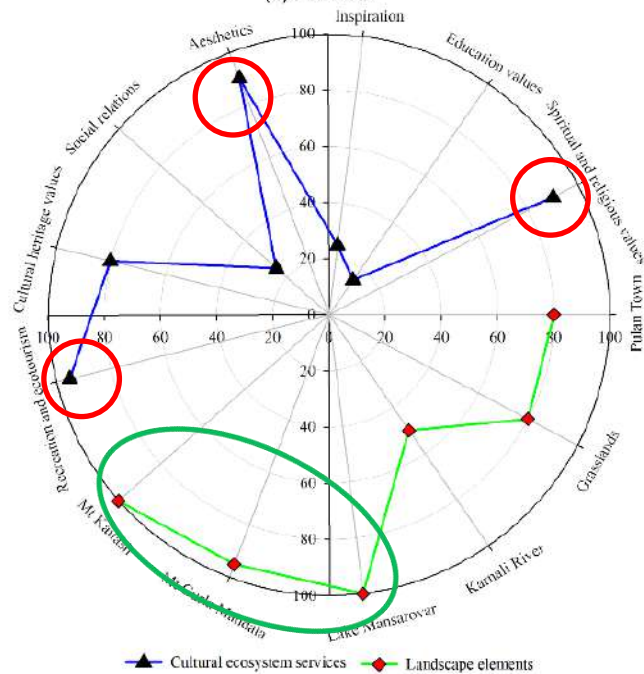
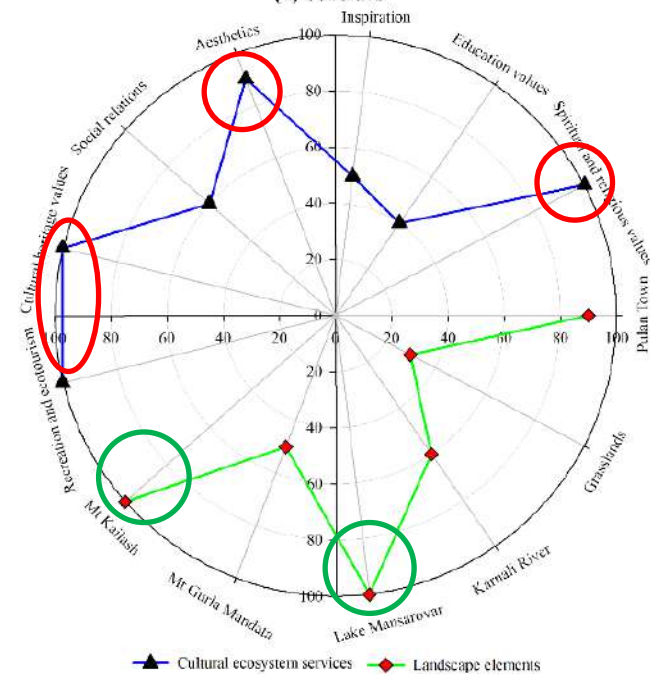
Table 4 Preference of CES components from different groups of respondents

	CES Categories	Local people 20 pers		Entrepreneurs 5 pers		Tourists 20 pers		Scholars 10 pers	
		n	%	n	%	n	%	n	%
Cultural ecosystem services	Spiritual and religious values	20	100	4	80	18	90	10	100
	Education values	2	10	2	40	3	15	4	40
	Inspiration	2	10	1	20	5	25	5	50
	Aesthetics	15	75	5	100	18	90	10	100
	Social relations	4	20	1	20	5	25	6	60
	Cultural heritage values	19	95	5	100	16	80	10	100
	Recreation and ecotourism	20	100	5	100	19	95	10	100
Landscape elements	Mt Kailash	20	100	5	100	20	100	10	100
	Mt Gurla Mandata	18	90	3	60	19	95	5	50
	Lake Mansarovar	20	100	5	100	20	100	10	100
	Karnali River	12	60	1	20	10	50	6	60
	Grasslands	12	60	3	60	16	80	3	30
	Pulan Town	15	75	4	80	16	80	9	90

4. Preference of CES and CES ranking

Preference of CES from different groups of respondents



(1) Local people**(2) Entrepreneurs****(3) Tourists****(4) Scholars**

4. Preference of CES and CES ranking

Identifying cultural sites in KSL-China

- A total of 319 POI sites of CES were mapped, being prominent the CES of cultural heritage (177), recreation/ecotourism (73) and spiritual and religious value (45), accounting for 55.9%, 22.9% and 14.1% of the total. Other CES take very small number of points of data

Table 3 POI sites of CES and CES ranking according to total score and mean score

	CES categories	POI sites	% of total sites	Total scores	Ranking of total scores	Mean scores	Ranking of mean scores
CES-2	Spiritual and religious values	45	14.11	746	1	1.34	3
CES-4	Education values	6	1.88	47	7	0.21	7
CES-5	Inspiration	6	1.88	128	4	0.48	6
CES-6	Aesthetics	8	2.51	114	5	0.98	4
CES-7	Social relations	4	1.25	66	6	0.76	5
CES-9	Cultural heritage values	177	55.49	697	2	1.93	1
CES-10	Recreation and ecotourism	73	22.88	342	3	1.67	2
total		319	100.00				

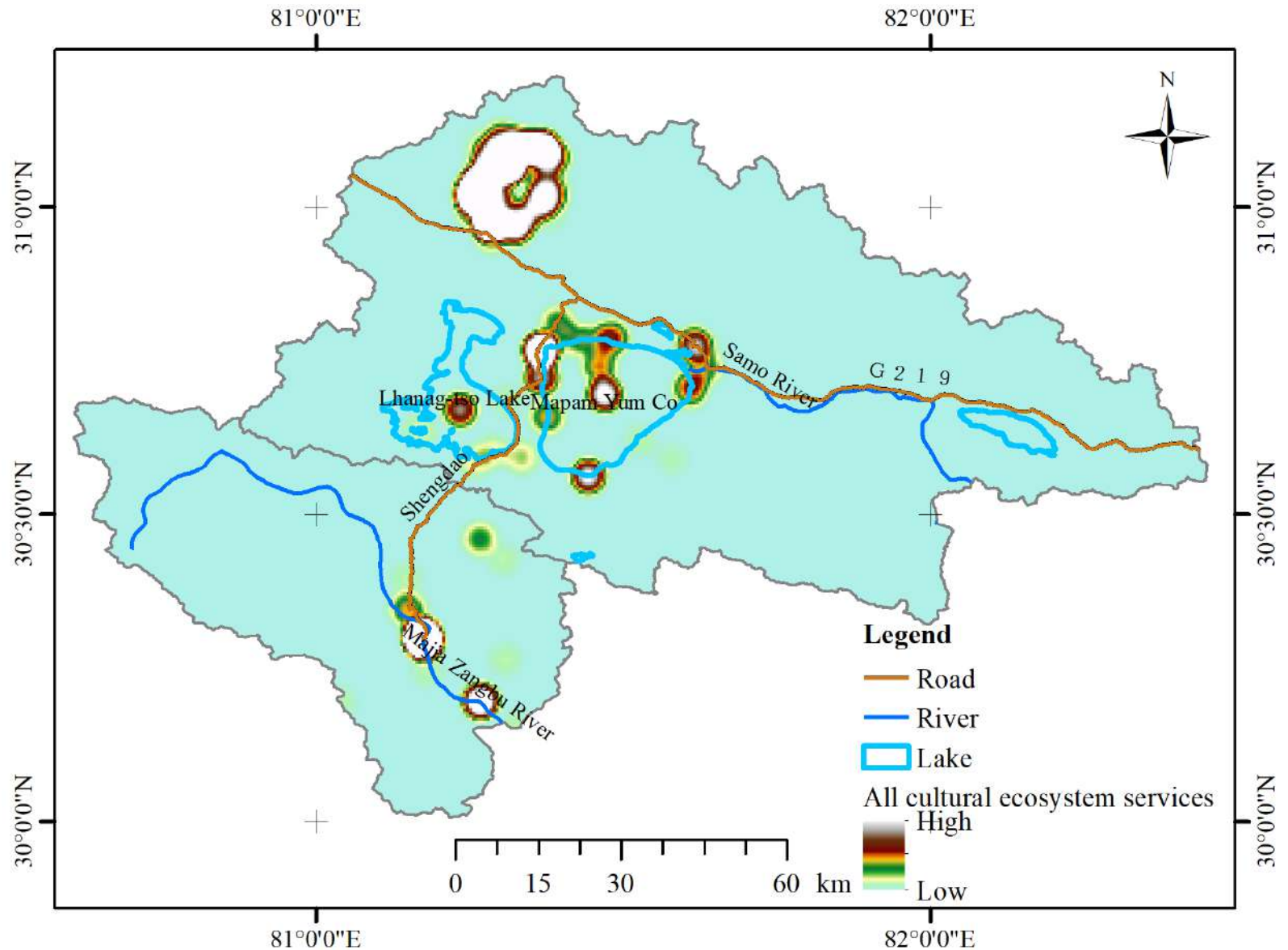
4. Preference of CES and CES ranking

Identifying cultural sites and CES ranking

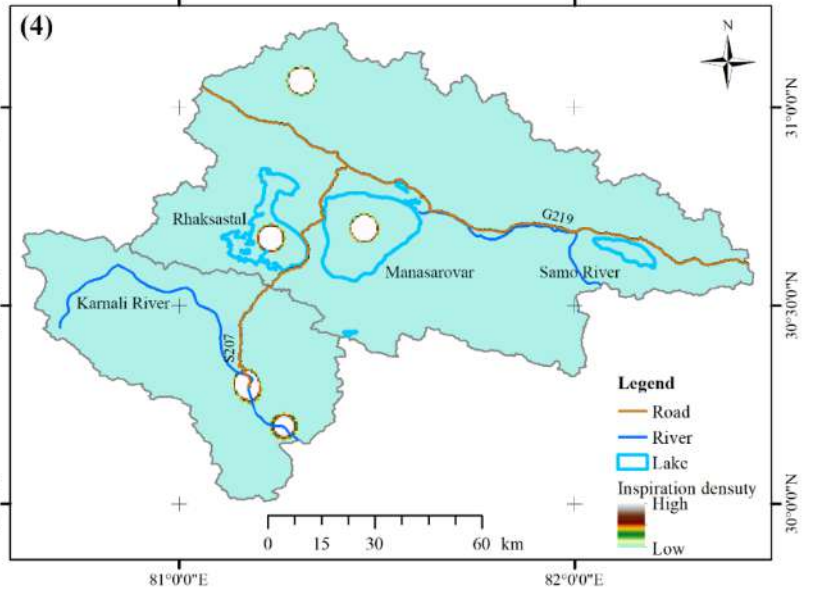
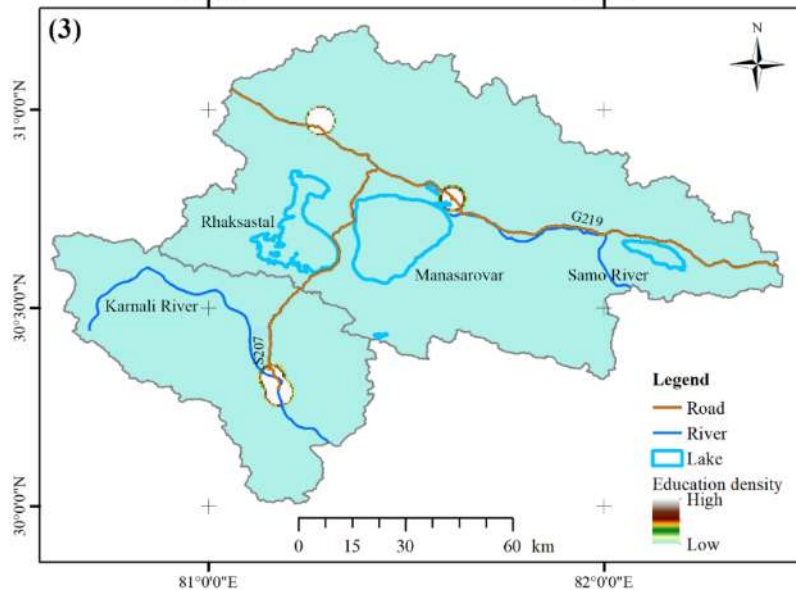
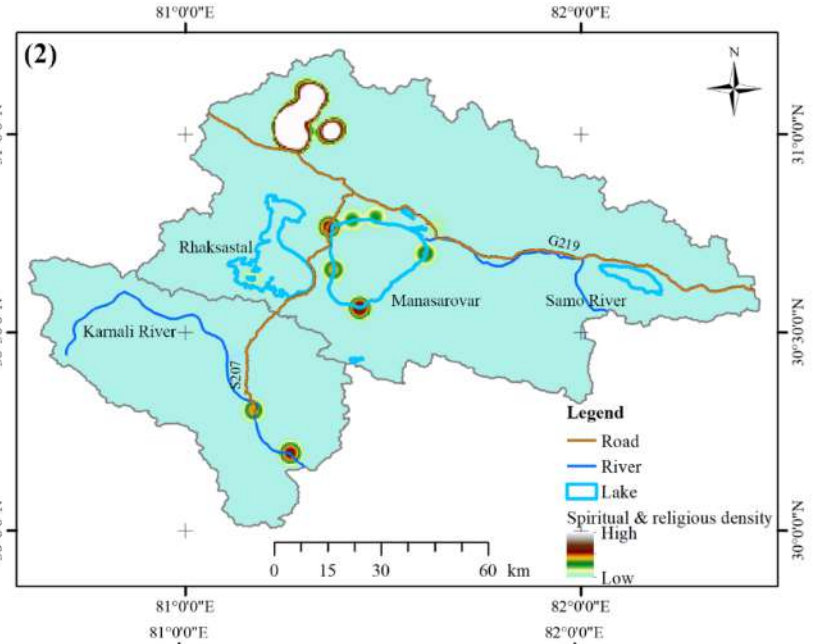
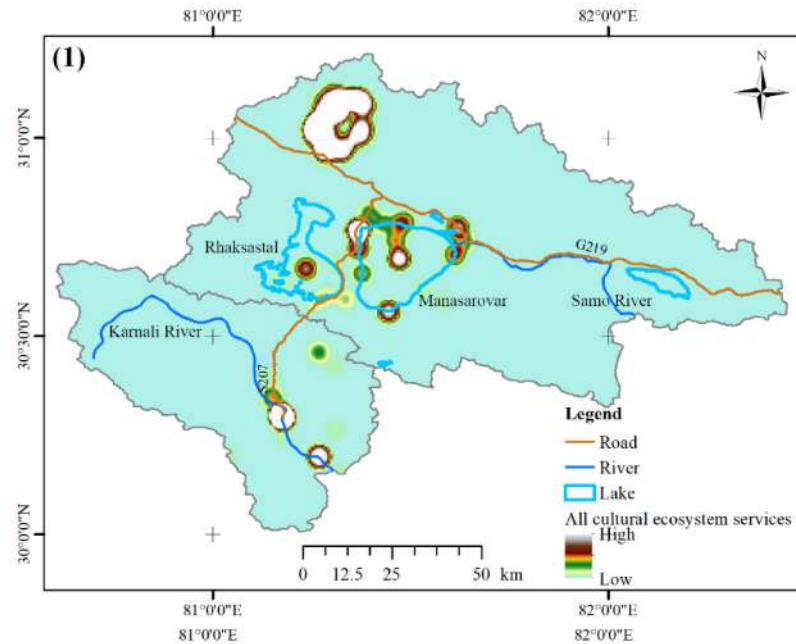
Location in Chinese	Location	Categories of CES	Latitude	longitude	altitude	total value	2 Spiritual and religious values	4 Education values	5 Inspiration	6 Aesthetic values	7 Social relations	9 Cultural heritage	10 Recreation and ecotourism
本日寺	Bon Ri Gompa	T2	30.76701	81.63423	4626	4	1	0	0	1	0	1	1
色热龙寺（色拉龙寺）	Seralung Gumba	T2	30.6981	81.60875	4601	14	3	0	1	3	0	3	4
聂果寺（聂过寺）	Yerngo Gompa	T2	30.56118	81.44375	4615	16	3	0	2	3	1	4	3
楚古寺（锤果寺）	Trugo Gompa	T2	30.56159	81.44325	4598	19	4	0	3	3	2	4	3
果初寺	Gossul Gompa	T2	30.65787	81.37749	4618	21	4	0	2	4	3	4	4
齐悟寺	Chiu Gompa	T2	30.765561	81.366798	4635	32	5	2	5	5	5	5	5
朗纳寺	Langboma Gompa	T2	30.79084	81.48339	4601	13	2	0	2	3	1	3	2
科迦寺	Khorzhak Gompa	T2	30.19569	81.26882	3716	30	5	1	5	5	5	5	4
曲古寺	Chhuku gumba	T2	31.033358	81.266521	4842	25	5	0	4	4	4	4	4
直热普寺(止热寺)5080	Diraphuk Gumba	T2	31.1040605476	31.1040605476	5051	23	5	0	4	4	2	4	4
尊追普寺（仲哲普寺）	Dzumchhug Gumba (aka Zuthu)	T2	31.0021592415	31.0021592415	4822	21	4	0	3	4	2	4	4
色龙寺	Serlung Gumba	T2	31.010372	81.278367	5020	17	4	0	3	3	1	3	3
江扎寺	Jyandra Gumba	T2	31.006863	81.29764	5069	17	4	0	3	3	1	3	3
贤柏林寺（达拉喀城堡）	Simbling Gompa	T2	30.30358	81.17438	3885	22	4	1	5	3	3	4	2
蔡切寺	Tsepgye Gompa	T2	30.63587	81.17018	4564	6	1	0	0	2	0	3	0
天葬台1	Dachung Napgya	T2	31.018841	81.264559	4809	20	5	0	4	2	4	4	1
印度公墓	Sewa Chechi Tuthrul	T2	31.100564	81.331929	5207	9	2	0	1	1	2	2	1
天葬台2	Shabkor Duthru	T2	31.003224	81.361747	4897	15	3	0	2	2	3	4	1
sacred cave 冥想	Langchen Biphu/ Padmasambh	T2	31.033	81.2667	4842	7	3	0	1	0	0	3	0
sacred cave 冥想	Maphum Yungdi Drukphu	T2	31.1064	81.305	5207	9	4	0	2	0	0	3	0
sacred cave 冥想	Milarepa drukphu	T2	31.0321	81.2653	4845	9	4	0	2	0	0	3	0
sacred cave 冥想	Naro bonchung drukphu	T2	31.0216	81.2641	4727	8	3	0	2	0	0	3	0
sacred cave 冥想	Sangna chiphu	T2	31.0268	81.2554	4930	7	3	0	1	0	0	3	0
sacred cave 冥想	Shabkor Drukphu	T2	31.0018	81.3633	4822	7	3	0	1	0	0	3	0
sacred Mountain 圣山	Chella Namsum/ Yangjema	T2	31.0447	81.2655	5406	16	4	0	3	2	3	3	1
sacred Mountain 圣山	Jamna potrang	T2	31.0189	81.2511	4831	17	4	0	3	3	3	3	1
sacred Mountain 圣山	Khandu-shinsa	T2	31.0228	81.2533	4900	18	4	0	3	3	3	4	1
sacred Mountain 圣山	Kailash (aka Khang Rinpo	T2	31.0666	81.3126	6621	34	5	4	5	5	5	5	5
sacred Mountain 圣山	Riksum Gompo: Chenrezig	T2	31.0905	81.3235	5647	16	4	0	3	3	3	2	1
sacred Mountain 圣山	Riksum Gompo: Chhadur	T2	31.0899	81.3105	5654	16	4	0	3	3	3	2	1
sacred Mountain 圣山	Riksum Gompo: Jambeyang	T2	31.0861	81.3396	5750	16	4	0	3	3	3	2	1
sacred Mountain 圣山	Sangji Tunku Photrang	T2	31.1111	81.3045	5513	18	4	0	3	3	3	2	3

5. Spatial distribution and Kernel density of CE

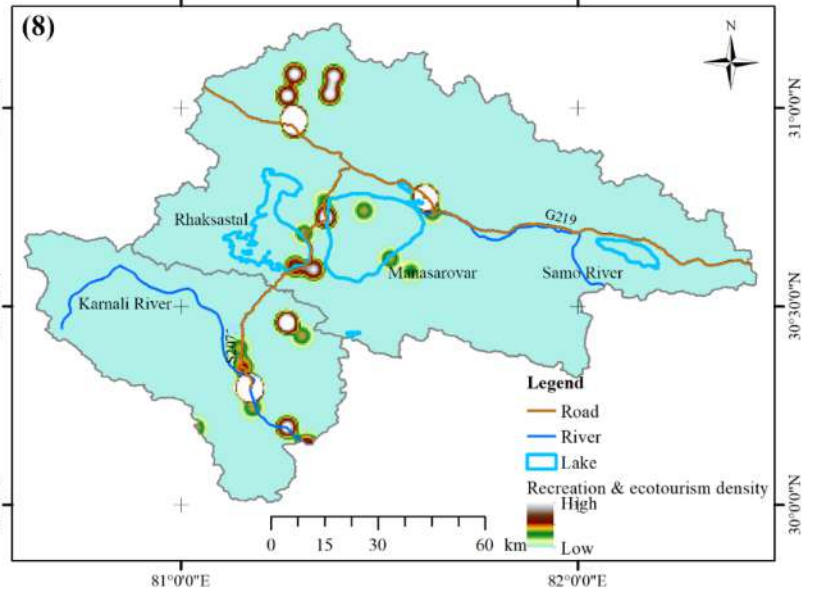
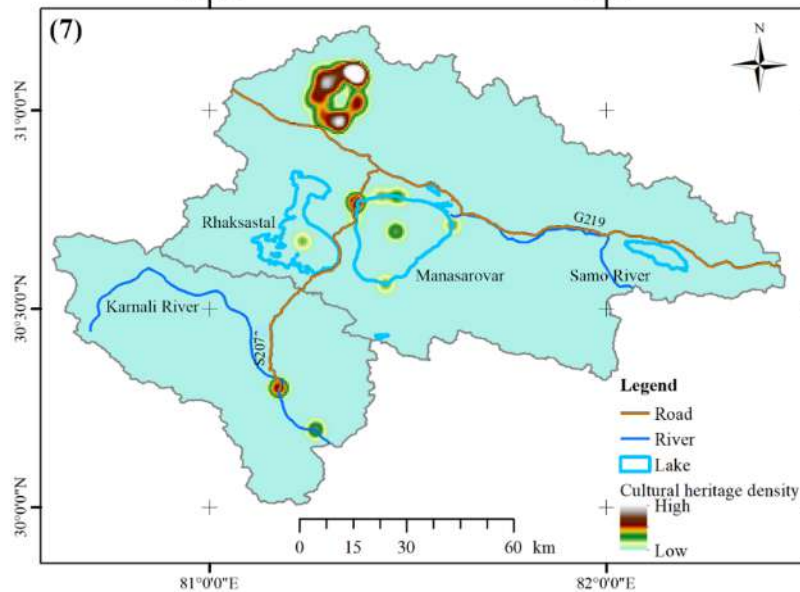
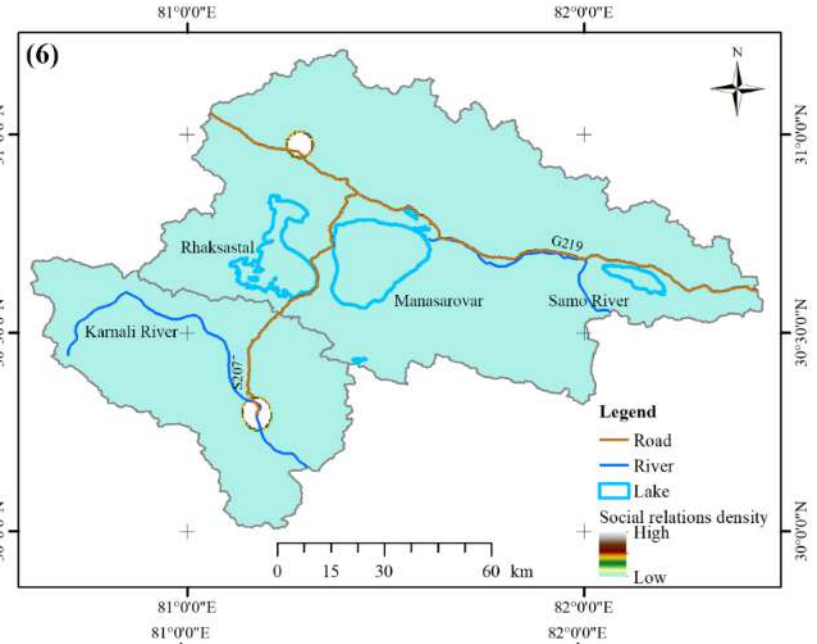
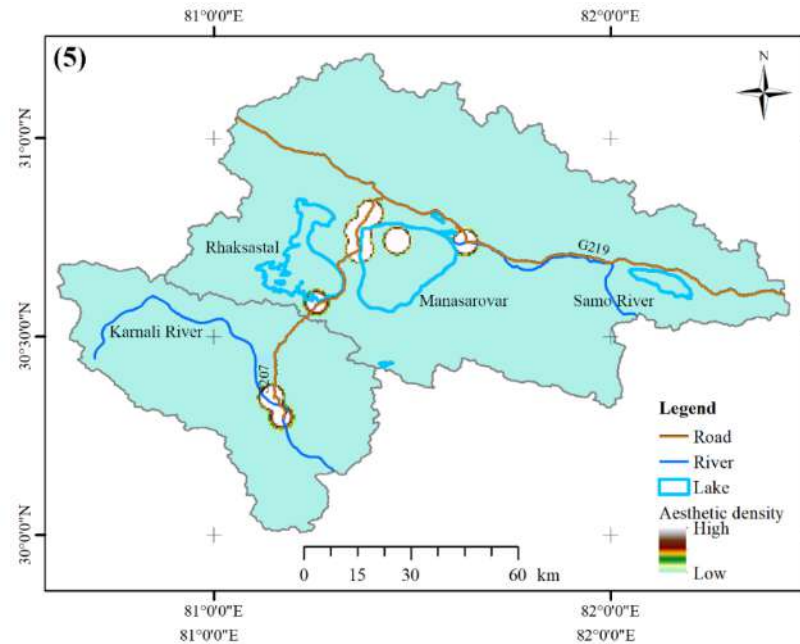
CES are concentrated in Mt Kailash, Manasarovar and Pulan



5. Spatial distribution and Kernel density of CE



5. Spatial distribution and Kenel density of CE



6. Resilience of CES to climate change and implication

- Ecosystem resilience is the capacity to rebound from climate change and disturbance. Resilience is a property of linked social-ecological systems (SES)
- The key to resilience in SES is diversity, including biodiversity and cultural diversity. Landscape heterogeneity and mountain vertical climate enrich the diversity of agriculture and pasture, which has bestowed the local people to resist the arid environment with crop-livestock integration and render comparative advantage.
- In addition, the rich resources of cultural heritage, spiritual and religious values and recreation/tourism values provide diverse CES and diversify livelihoods for local people.
- CES are link to the subjective belief and characterized by non-consumptive nature and are more resilient to climate change, which cannot be diminished. This add the resilience of SES and sustainable basis for local development.

6. Resilience of CES to climate change and implication

- Trademark using Kailash and Manasarovar
(Sacred Mountain and Holy lake)



神山冈仁波齐
Mt.Kailash



神山圣湖

冈仁波齐



普兰
PURANG



7. Conclusion

- The hotspots are closely related not only to the cultural heritage values, spiritual and religious values, but also to the aesthetics and recreation/tourism in the beautiful landscape.
- The values of cultural heritage, recreation/tourism and spirits and religions are ranked as the top three services, respectively.
- The multifunctionality of the sacred landscape provides the source of its attractiveness for pilgrims and tourists. Multiple cultural services provide a chance of diversifying livelihoods and poverty alleviation of local residents.
- Resilience feature of cultural services is beneficial to promote green development and rural vitalization. This study also provides important information for tourism spatial planning and management towards more sustainable development goals.



Thank You !