MAPPING AND MANAGING NATURAL AND CULTURAL ASSETS

Sustainable Heritage Areas: Partnerships for Ecotourism
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Authors: Laura Ferguson

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Background

This report presents the findings of a review of literature on mapping and integrated management of assets that took place from May 2017 to September 2017. This literature review is intended to guide decisions on asset mapping approaches and applications, presenting a range of current knowledge and experience on a breadth of topics concerning mapping and managing natural and cultural assets. SHAPE proposes integrated management of natural and cultural assets that is based on the management of natural areas together with visitor management. It is a holistic approach that combines social development and conservation goals. The aim is to preserve natural and cultural assets, along with local values and authenticity, while developing tourism in the area.

The academic literature review was conducted online through the search engines Google and Bing, as well as using two databases – the Web of Science database and the University of the Highlands and Islands electronic journal database. In addition, printed literature was sourced from collections in the University of the Highlands and Islands Library and the Centre for Mountain Studies.

The initial academic literature search focused on searches for documents containing the keywords 'asset mapping,' 'tourism mapping,' 'asset mapping community development,' 'natural and cultural heritage,' and 'participatory mapping.' As individual mapping methods and approaches were discovered, further searches were conducted specifically for these. Later searches with a management focus included the search terms 'mapping areas at threat of climate change,' 'managing protected areas conservation,' 'integrated managing nature culture heritage,' 'management ecotourism' and 'integrated management protected areas.'

The Google electronic search focused on searches for non-academic literature containing the same keywords, but also including 'case studies' and 'project' to help find applied cases of mapping and integrated management. In addition to the literature case studies, SHAPE partners were invited to contribute their knowledge and experiences of mapping natural and cultural assets. The following questions were circulated to all partners:

1. Which methods and approaches have you used to gather information about points above in your sustainable heritage areas? Please consider spatial mapping methods but also other ways of recording assets in an area e.g. descriptive/narrative methods, other visual methods? The latter may be used more often to capture less tangible assets (e.g. history, local stories).
2. Please tell us about your experience/ views of these methods including some of the following points:
   How effective or ineffective are the methods/approaches you have used?
   How could the methods be improved?
   To what extent are the methods able to include stakeholder views?
3. Are you aware of examples of methods/approaches used in other places that we may also be able to learn from? If so please provide some information about them

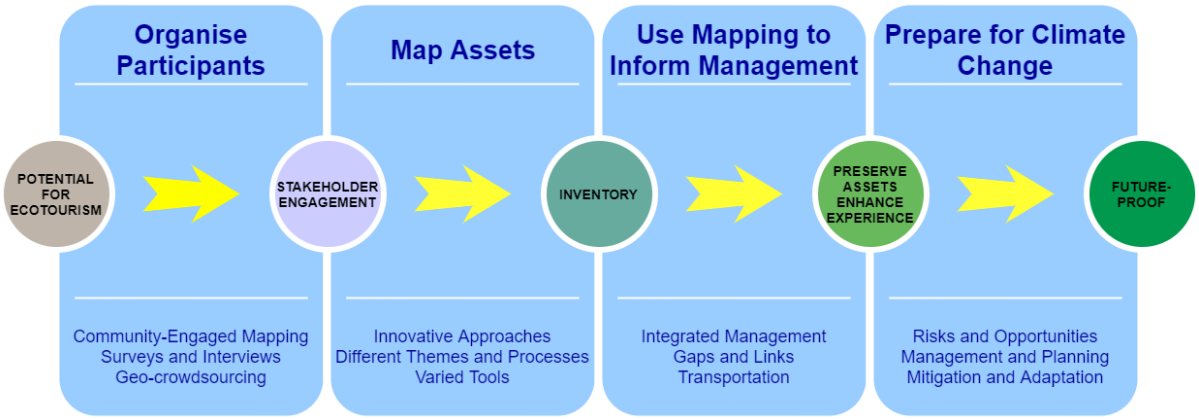
4. Are there any sources of further information you can send us to inform the review e.g. reports, papers, pictures, meeting minutes, websites, etc.? Please give details and send attachments or links as appropriate
5. Can you send examples of any maps of cultural and natural assets that have been produced in your area?

The responses to these questions were typically accompanied by supplementary material, including reports, toolkits and web links to projects to direct further investigation.

The findings of this review suggest that there were many articles analysing asset mapping and integrated management in theory, but less information regarding practical examples. The broad range of concepts had several recurring themes, most notably public participation, Geographical Information Systems (GIS), visitor management for sustainable tourism and climate change. The volume of literature on climate change in particular is large, and it was not attempted to review all aspects of it. The focus was maintained on impacts on ecotourism areas and managing the mapped assets for climate change resilience.

How to Use this Report

The report is structured to inform and guide the methodology of producing and using an assets map for ecotourism development. The process is illustrated in the flow diagram below, and the structure of the literature review is modelled on this.



The report begins with a brief introduction to assets and asset mapping. Section 2 analyses the theme of participatory mapping and how this might be achieved. Section 3 discusses approaches to asset mapping. These are methods that might be taken singly or combined. Section 4 then proceeds to outline tools for mapping, from pen on paper to GIS analysis, that can be used to document the output. Section 5 introduces the management element and the application of asset mapping in integrated management of natural and cultural resources. Finally, Section 6 tackles management of assets in the uncertainty of the changing climate.

1. Introduction to Asset Mapping

1.1 What is Asset Mapping?

Asset mapping is an inventory of features of an area that have value, alongside their networks, links and patterns of usage (Creative City Network of Canada, 2010). These assets are systematically identified, recorded, classified and analysed in a place-based approach. The results might then be used for planning activities, to decide which assets to develop or those which need management to sustain.

1.2 What Are Considered Natural and Cultural Assets?

Assets can be diverse. Natural assets and cultural assets are different but interrelated types of feature with value. The Organisation for Economic Co-operation and Development (OECD) defines natural assets as **assets of the natural environment**, consisting of "biological assets (produced or wild), land and water areas with their ecosystems, subsoil assets and air" (OECD, 2005). The City of Austin undertook a cultural asset mapping project in 2016, and their Economic Development Department defines a cultural asset as "**something that has value because of its contribution to a community's creativity, knowledge, traditions, culture, meaning, and vitality**" (City of Austin Economic Development Department, 2017). While these definitions provide a distinction between natural assets and cultural assets, the concepts are often blurred (Speed et al., 2012) and it is together that they contribute to a sense of place (Convery et al., 2012). Lockwood et al. (2006) further argue that natural and cultural heritage are so closely linked that they could be considered inseparable. Managing them in an integrated manner, therefore, is more representative of this dynamic, and also increases the chance of development initiatives being successful (Chauhan, 2006).

Focus has traditionally been upon mapping tangible, locatable assets, but it is important to also include those intangible features that hold value. There is much greater depth and variability in mapping nature and culture than identifying only the physical items (Miller, 1994). **Intangible assets do not have a physical character and their value is often much harder to determine.** McKercher (2002) provides a compact definition of the difference between tangible and intangible assets:

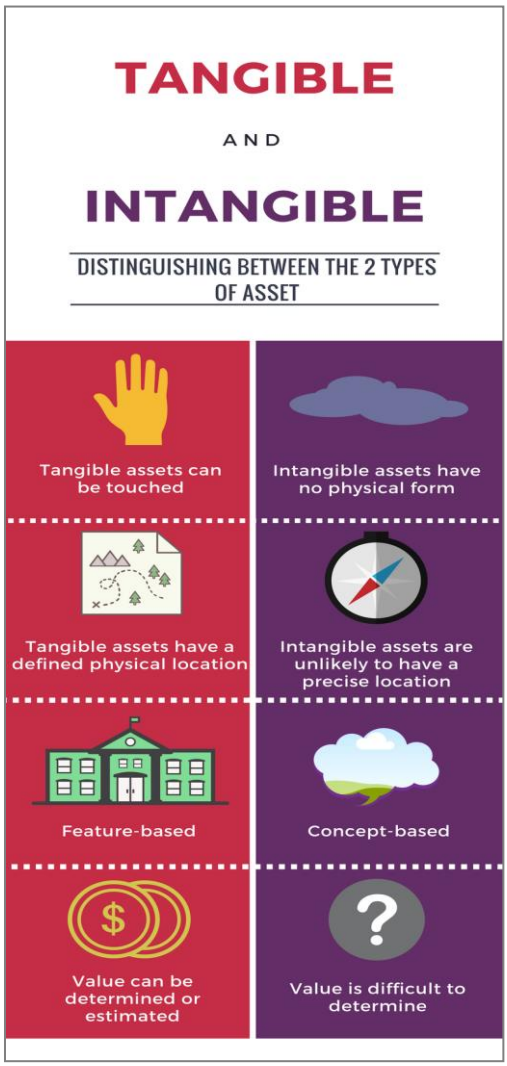
"if tangible heritage assets represent the hard culture of a community, its places, and things, then intangible heritage assets represent its soft culture, the people, their traditions, and what they know" (p.83).

Tangible assets, therefore, directly relate to a physical feature – they can be touched. Tangible assets include buildings, structures or mountains. Intangible assets have no physical form – they cannot be touched but still exist and can be experienced. Intangible assets include cultural or spiritual value, sense of place, and wildness. Worboys et al. (2005) also refer to instrumental and intrinsic values. Instrumental values are anthropocentric and extractive, either through direct use or ecosystem services. Intrinsic values are ecocentric and exist irrespective of human use or perception. Described as a "widely shared intuition" (Callicott, 1986, p.140), there is a strong ethical element to this kind of value and it is highly intangible. These type of values are difficult to interpret and represent because they are largely subjective.

Some examples of tangible assets might include historic buildings, monuments, walking or cycle paths and shops or markets. Intangible assets, meanwhile, might be stories, scenery, sense of tranquillity and cultural associations.

The infographic shown opposite helps clarify the distinction between tangible and intangible assets and explain why intangible assets are so difficult to determine. With so many vague qualities and values, intangible assets are easily overlooked, yet they can add significant value and appeal to an area.

There has been a period of growth in interest in nature, culture and heritage, due both to increased demand and to the efforts of conservationists and ecotourism developers in increasing the promotion of assets and availability of access and supply of facilities. Management of intangible assets however, is in its relatively early stages, compared to management of tangible assets, most likely due to the difficulty in defining and quantifying them. Brown (2005) criticises the planning emphasis on mapping physical landscape features over perceptual attributes, yet sense of place and other diffuse attributes are difficult concepts to integrate into management.



1.3 Why Map Assets?

Asset mapping is useful in planning and managing resources, as well as community development and improvement in community quality of life. It is a crucial step in any sustainable tourism development strategy. Asset mapping identifies which natural and cultural assets are present in an area and are important to the communities living there. The process might uncover previously unknown assets, particularly intangible ones. **Once assets are identified it is easier to plan for development and identify where assets may be linked to enrich experiences.**

The review of the literature suggests the main benefits of asset mapping are that it helps managers to:

1) identify assets
2) identify gaps and opportunities for development or linking of assets
3) plan to preserve assets from damage and enhance them
4) empower communities and create partnerships under a common cause

5) plan to sustainably use the resources for community development in areas such as ecotourism and local business development
6) produce maps that can be used for promotional purposes or to guide visitors

2. Participatory Asset Mapping

2.1 What is Participatory Mapping?

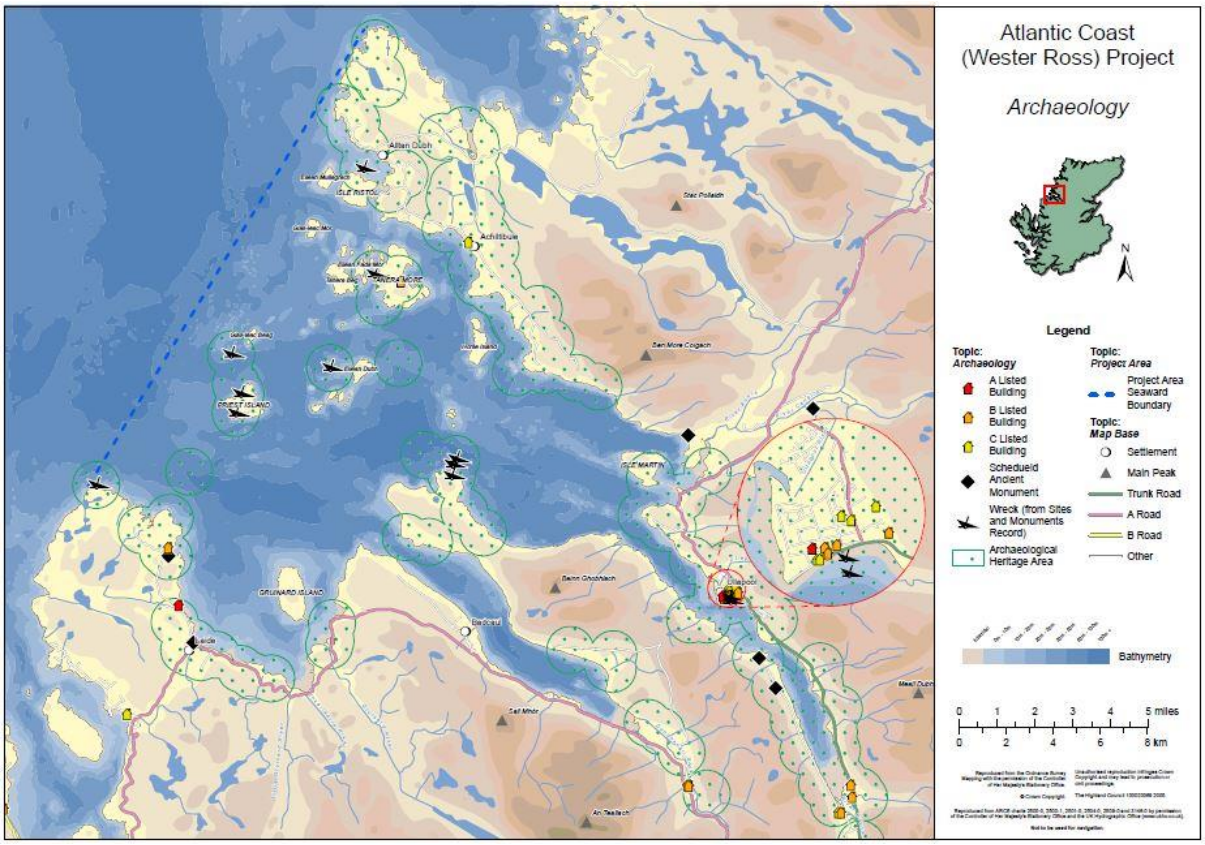
Participatory asset mapping is the collective gathering of information from community members to compile a map of local assets. It is a holistic method of mapping because it is consultative and can be considered a process of collective learning (Stoll-Kleemann and Welp, 2008) that is informative to both the community and area managers. Participatory approaches are increasingly being recognised as an important element of planning in biosphere reserves (Stoll-Kleemann and Welp, 2008). While there are many resources for locating assets, including existing maps, internet resources and satellite images, one of the best options is to ask those who know the area very well. **By consulting residents, a wealth of information on known and previously unknown assets can be gathered, including personal experiences and values attached to them.** It is useful to understand the reasons why these assets are important to people. As well as identifying local assets that are perceived as strengths, the process can highlight gaps in resources or missing connections between assets. It also has important social functions in that it promotes community cohesion and local involvement in development:

"It is vital to take account of their interests and knowledge and to involve them in managing and protecting the environment. It is better to discuss an issue without reaching a decision than to reach a decision without discussion" (Chalker, 1994, p.92).

The practice of asset management planning has become increasingly participatory. Decisions and management plans are more likely to be implemented (Renn et al., 1995), and **the sense of shared ownership that participatory methods generate can increase the chance of this implementation being successful** (Thomas and Middleton, 2003). The Atlantic Coast Project used participatory mapping successfully in their coastal zone planning, described below.

SHAPE Case Study: Atlantic Coast Project's Participatory Asset Mapping, Wester Ross, Scotland

The Atlantic Coast project was an INTERREG 3B project that aimed to design and prepare an integrated coastal zone plan to guide future development and use. The project worked with stakeholders from diverse backgrounds to establish policy advice for the management of the coastal zone. Papers were prepared on the Key Issues identified as part of the project - Tourism, Historic Environment, Shore Access, Nature Conservation, Aquaculture, Sport Fishing and Commercial Fisheries. Data to describe the assets pertaining to each aspect was collected from published documents, agency records, and local individuals and organisations. This included the formation of a Steering Group and Community Liaison Group which held stakeholder meetings. The resulting map for the historic environment is shown below.



Historic environment map produced for the Atlantic Coast Project. Image: The Highland Council.

Not all public participatory processes are successful. This is not necessarily the result of failure of method, but failure of implementation of it, or to secure the commitment of the community (Songorwa, 1999), or the influence of external factors (Berkes, 2004). Wester Ross Biosphere cite volunteer fatigue as the main issue in failing to gather public participation for their survey. As Miller and Twining-Ward (2005) explain, "the reality is that many stakeholders, in both the developed and the developing world, are busy, professional people who have little time to attend stakeholder workshops and meetings" (Miller and Twining-Ward, 2005).

SHAPE Case Study: Volunteer Fatigue in Wester Ross Biosphere Reserve, Scotland

Image: Wester Ross Biosphere Reserve.

Wester Ross Biosphere was formally recognised as a UNESCO World Biosphere Reserve in April 2016. The biosphere covers the area in the north west of Scotland from the peninsula of Knoydart northwards to Achiltibuie and the Summer Isles and inland eastwards to Garve. Wester Ross Biosphere experienced some failures in the public participatory elements of their asset mapping. Their methods had included a desk-based survey carried out by expert agency or NGO staff, interview of stakeholders with expert local knowledge, community survey, and stakeholder workshops and events. Here, the Wester Ross Biosphere team share their experience:

"In our region volunteer fatigue is chronic. Communities are increasingly being put under pressure to give more and more volunteer time to projects traditionally agency or local authority led. The recent increase of tourism has compounded this issue within one of the most sparsely populated areas in Europe (8,136 in 5300km² or 1 person per 0.65km²).

A year-long consultation was carried out prior to formulation of the application dossier, although there was only three months for completion of the dossier itself. There was perhaps an assumption on behalf of the consulting company that various stakeholders would provide information for each section, however volunteer fatigue meant the project officer did the bulk of the desk-based survey work to gather information.

In our experience these methods are extremely effective only when applied holistically. Desk-based survey cannot take into account local knowledge or community/stakeholder views. Expert local

knowledge is more likely to take into account local views but cannot be wholly representative. Community survey must be rigorously carried out so not to be self-selecting (all the usual difficulties with survey) and stakeholder workshops/events may not take into account the full range of knowledge available 'out-there' which targeted desk-based survey might find" (Wester Ross Biosphere, 2017).

There are valuable lessons to be learned from analysing and sharing experiences with public participation such as these. It may be best to consider volunteers a valuable resource base whose expectations and roles should be carefully managed and communicated alongside good understanding of their motivations to take part. Taking such measures increases the likelihood of maintaining a sustainable volunteer base.

Despite the obvious benefit of being able to incorporate public opinion, the subjectivity of opinions has been cited as a limitation of the method (Bunruamkaew and Murayama, 2011). Shin and Jaakson (1997) randomly surveyed 540 wilderness campers from three provincial parks in Ontario, Canada, on wilderness values and compared the results with the evaluation given by wilderness managers. They found there to be no association between the wilderness values of the two groups. They even discovered some respondents had failed to notice weak or damaged wilderness conditions. They concluded from this study that **while it is important to consider users' perceptions alongside biological and physical conditions, these subjective perceptions should not overrule the objective factors and scientific criteria ought to be maintained also**. Furthermore, communities are complex entities (Berkes, 2004). Gray (2003) criticises the homogenization of the public which "conceals the uneven distribution of power and benefits among social groups that usually occurs in practice" (p.117). Not all participants will have the same values, norms or stake in the project or area in question (Cooke and Kothari, 2001; Gray, 2003), and these disparities are not reflected in the combined common view of the output of the mapping exercise. Unequal accessibility to participatory methods, for example through living in a remote area, not being available at meeting times or not having adequate internet access, could also relate to this (Burns, 2012).

Agrawal and Gibson (1999) analysed three aspects of community that typically form the basis of ideas in community involvement in resource management – community as a spatial unit, community as a homogeneous structure and community as shared norms. They argue that none of these approaches maximise the benefits of community-based natural resources management because they misinterpret communities as fixed, small and homogeneous entities that produce a single set of shared understandings. Instead, Agrawal and Gibson propose that an alternative three aspects form the foci of community-based conservation – viewing communities as multiple actors with multiple interests, the processes through which they interrelate, and their institutional structure. Carlsson (2000) agrees that the multidimensional, cross-scale approach is more representative of communities in reality, but that characterising this is a challenging task. Three methods of incorporating public participation into asset mapping are described below, with reference to their potential for representing multiple interests.

2.2 Community-Engaged Mapping (Focus Group)

Described by Burns et al. (2012), Community-Engaged Mapping (CEM) is a focus group with maps. Groups of community members discuss and plot assets on maps of the area. In order to incorporate multiple interests, these groups should be diverse and representative of all sections of local society. This makes it more likely the group will identify a richer set of assets, some of which may not be obvious to everyone (Burns et al., 2012). CEM exercises can include all the multiple actors of a community, such as business owners, conservation groups, youth groups, societies, cultural centres, community action groups and anybody else who has a stake in the local area. A large-scale CEM exercise conducted in Cordillera National Park, Peru, is described below.

Case Study: Mapeo de Usos y Fortalezas Community-engaged Mapping, Peru (Del Campo and Wali, 2007)

Cordillera National Park is a protected area in the Ucayali moist forests ecoregion of Peru. A major participatory mapping activity was conducted with 53 communities in Cordillera National Park to inform a five-year management plan. Local facilitators, elected by their communities were trained to collect the data over a two-month process of community assemblies, focus groups and household interviews. The extensive data collection covered themes of community identity, migration, visions for the future, local myths and legends, and economic and subsistence resource use. The assets database was subsequently updated by community leaders, to map how assets had changed. This project was comprehensive and multidimensional, so was considered a great success but was also costly in both time and expense, as Community-Engaged Mapping often is.

While the collaborative nature of this method can promote active discussion, it can also contribute to concealing the heterogeneity of the community. It is beneficial to provide participants in advance with descriptions of or examples of the asset mapping approaches being taken, to allow them to prepare their own responses and come to the meeting with original ideas (Burns et al., 2012). It can also be helpful to split large groups into smaller breakout groups to give all participants a chance to speak and fully elaborate on their ideas.

2.3 Surveys and Interviews

Surveys can be cheaply distributed to a large number of participants, making them potentially more representative of the multiplicity of views in a community. They may be distributed in printed form or, increasingly, circulated in digital format via online survey tools. Survey content can be closed content, where respondents select from a range of provided answers, or open content where respondents volunteer qualitative information that may otherwise go uncommunicated.

Clement and Cheng (2011) used a mail survey to acquire data for their statistical analysis of public values, attitudes and planning preferences for three national forests in Colorado and Wyoming, USA. They described social surveys as an efficient and effective means of gathering information from what they refer to as the "silent majority" (Clement and Cheng, 2011, p.393). Surveys can therefore be viewed positively in terms of gathering multiple interests in a participatory exercise.

The main problem with surveys is that response rates are often low, and many views can thus be missed. Responses can be improved to a certain extent by a second mailing or re-advertising, otherwise apathy is difficult to overcome.

Interviews may follow a similar format to surveys but are typically conducted in-person. They may be fully or semi-structured; the latter encourages the interviewee to have more control over the direction and content of the interview. The main benefits of interviews are the level of detail that can be gathered, which is normally greater than in focus groups or surveys; the greatest potential is to acquire new information or develop lines of enquiry that the interviewer may not have previously considered. Individual stories will also be uncovered. Interviews therefore promote a more intimate and multidimensional understanding of community values.

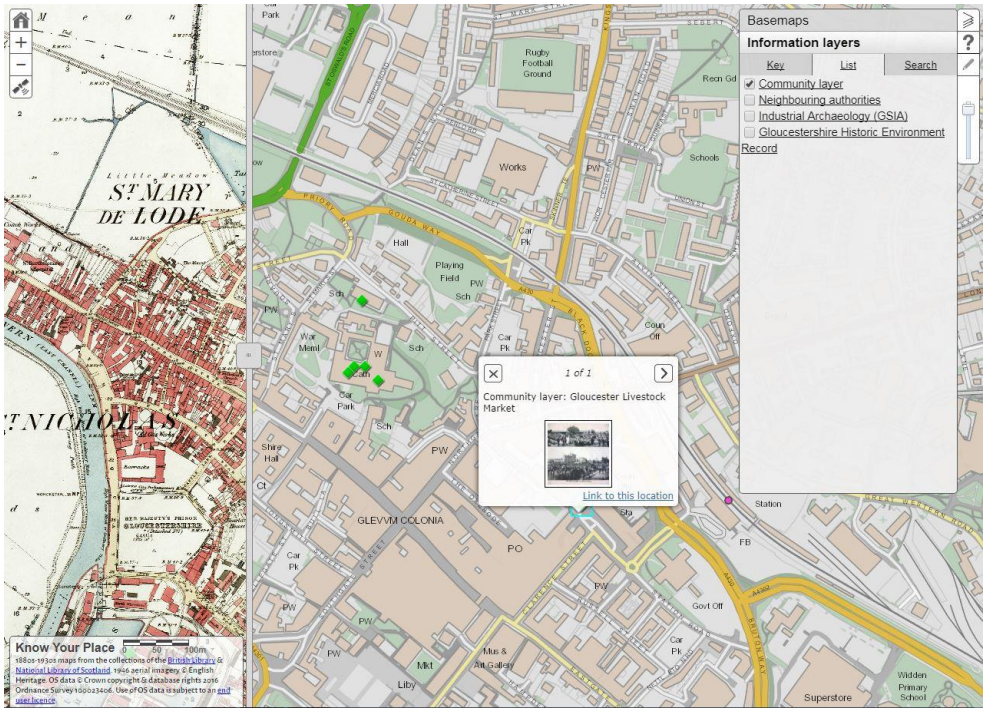
2.4 Geo-Crowdsourcing

Geo-crowdsourcing takes advantage of the Internet to recruit "citizens as voluntary sensors" (Goodchild, 2007, p.24). This can be done with primary data through recruiting members of the public specifically for the analysis being performed (e.g. del Campo and Wali, 2007; Idris et al., 2017; Carver et al., 2000) or by data mining secondary online geographic data (e.g. Mummidi and Krumm, 2008).

There is great potential for geo-crowdsourcing to gather multiple viewpoints. Web-based gathering of information can remove the barriers of distance or conflicting time schedules from public involvement. The anonymity and privacy of the Internet can also remove any psychological barriers that may discourage people from active participation in a physical group setting (Carver et al., 2000; Heywood et al., 2001). User-friendly platforms have been developed that simplify the data entry process, an example of which is the Know Your Place website shown below.

Case Study: Geo-crowdsourcing for Know Your Place, West of England

Know Your Place was a digital mapping project led by South Gloucester Council in partnership with Bristol City Council. The project gave unprecedented online access to historical maps, onto which users could add information about their local area by selecting the community layer. It ran from June 2015 until June 2017 and encouraged voluntary participation by the public.



Section of Know Your Place map of Gloucester. Image: Know Your Place West of England.

The section of map for Gloucester shows the community layer in use. Here users can click on existing entries for historic information and pictures, and add records of their own. As well as utilising the vast potential resource of geo-crowdsourced public information, the project aimed to open up the prospect for a broad definition of culture.

There are limitations of the Internet, including the danger of creating an information underclass among those who cannot access the Web (Carver et al., 2000) or lack of representation from certain social groups less likely to access it (Heywood et al., 2001). Many studies report low levels of participation, suggesting there is also an issue with apathy or antipathy surrounding remotely sourced geographic surveys (Carver et al., 2000; Reed and Brown, 2003; Brown, 2005; van Riper et al., 2012). Nevertheless, Carver et al. (2000) credit online public participatory systems as **taking steps towards empowerment of the majority, even if a only minority choose to participate**.

Geo-crowdsourcing is a potentially vast source of primary geographic information; but for a successful process, the capabilities and needs of the users must be taken into consideration in the design of geo-crowdsourcing systems to make it as accessible as possible (Carver et al., 2000).

Data mining is a process that utilises the secondary data contained in existing large data sets and is beneficial because it cuts out the expensive and time-consuming data gathering process and the results are available immediately. Some useful sources of secondary geographic information on assets include WikiMapia, Google Maps, Open Street Map and Flickr**. The potential in crowdsourced data**

is continually growing with advances in web technology and increasing accessibility to internet and mobile devices (Tenerelli et al., 2016).

Classification clustering is the most useful data mining method for asset mapping. It is a process involving organising data into categories from which patterns of clusters can be identified. An example of the use of classification clustering data mining is the World Explorer app, which was created from data mining on Flickr.

Case Study: World Explorer App

Image: AudioGuidia

The World Explorer app, was developed by analysing the content of Flickr photo captions. Relevant phrases were extracted from the captions and an algorithm called TFIDF (the product of term frequency and inverse document frequency) was used to identify points of interest. The larger the TFIDF value, the more frequently a phrase appears in captions within the cluster and less frequently outside the cluster, suggesting a point of interest. World Explorer is now available as an app for PC, iPhone and android. The app covers all countries and has over 850,000 articles on the iPhone version, covering individual points of interest. Maps and geolocation provide instant localised information on points of interest nearby.

Crowdsourced information from social media like Flickr has been used to quantifiably assess visitation and value as measures of cultural ecosystem services. All of the literature reviewed on data mining suggested it was useful. Wood et al. (2013) was the first study to ground-truth the use of data crowdsourced from social media to predict visitation rates. They found their analysis of Flickr photographs corresponded well with empirical information about where people visited. Richards and Friess (2015), likewise, concluded that photographs on social media are rapid and reliable as indicators of cultural ecosystem services. Casalegno et al. (2013), in a study using photo-sharing website Panoramio, found that quantifying geo-tagged digital photos uploaded to social media was an effective metric for mapping the perceived aesthetic value of ecosystems. This was based on the premise that images will be captured by greater numbers of people in areas that are perceived as being of higher aesthetic value. Gliozzo et al.'s (2016) study of multiple online georeferenced digital photograph collections in South Wales supports Casalegno et al's findings through demonstration of the use of three photo sharing websites as a measure of degree of appreciation of a place. Their study is particularly interesting for their comparison between the three websites: Flickr, Panoramio and Geograph. Flickr was deemed to be the most successful in terms of pictures and contributions. It was also found to be more focused on human environments and activities than Panoramio, which represented on more natural areas. Flickr and Panoramio were thought to be more similar in terms of photo sharing behavior than Geograph. Though it covers more territory than the other two used, Geograph was not considered as useful as Flickr or Panoramio for this type of study as its use of leaderboards, rewards and games may skew the results.

Although a relatively new data gathering method, the main issues surrounding both primary and secondary virtual techniques are the same as those for the in-person ones. Most of the same concerns over data quality, language, quantity, detail and selection apply to web-sourced information as to traditionally sourced public information (Brown et al., 2013). Ensuring quality is one of the most frequently raised problems associated with virtually gathered information (VGI):

"Innocent mistakes and intentional falsehoods can reduce not only the quality of the information, but also people's confidence in VGI as a legitimate source of data" (Mummidi and Krumm, 2008, p.215).

Heywood et al. also allude to the difficulty of distinguishing valid responses from "those made by people just 'playing around' or wishing to bias the results one way or another" (Heywood et al., 2001, p.248).

For the use of photographic mined data from social media such as Flickr, Wood et al. (2013) highlight three factors that should be considered when analysing the data. Echoing Heywood et al.'s concern that there may be uneven representation across social groups, they suggest that there could be biases in who is taking digital photographs and uploading them to social media websites. They also note that some recreational activities are more suited to taking photographs than others. Finally, they discuss a possible bias against visitors who travel shorter distances from home, as it has been found that the perceived value of a trip may influence whether an individual takes or shares photographs.

Monitoring and evaluating the information being gathered is the only way to determine data quality and be ready to intervene and make changes in the process where necessary.

2.5 Making Decisions on Incorporating Participatory Asset Mapping

The literature on using participatory methods is broadly in agreement on the benefits in adopting them. Participatory methods foster integrated management by taking a wider approach to knowledge management and social learning (Stoll-Kleemann and Welp, 2008). The two-way learning process is a driver of community development (Chalker, 1994) and a support to asset management Renn et al., 1995; Thomas and Middleton, 2003). Public participation is also part of the biosphere reserve concept (Stoll-Kleemann and Welp, 2008). However, it has not always proven successful (Berkes, 2004). Sources of failure may be in implementation, for example failing to secure the commitment of the community (Songorwa, 1999) or by creating volunteer fatigue from over-involvement of the public (Wester Ross Biosphere, 2017). Also, some fundamental concerns over the method should not be overlooked. The subjectivity of public opinions has been described as an issue (Shin and Jaakson, 1997; Bunruamkaew and Murayama, 2011), as have the homogenization of the public that can cause the loss of variation in perspectives (Agrawal and Gibson, 1999; Cooke and Kothari, 2001; Gray, 2003; Berkes, 2004) and concerns regarding access to participatory methods (Carver et al., 2000; Heywood et al., 2001; Burns, 2012). Agrawal and Gibson (1999) and Carlsson (2000) propose taking a multi-dimensional approach that views communities as diverse with multiple interests and interrelationships. Achieving this is a challenge when undertaking participatory asset mapping.

Four methods of incorporating public participation into asset mapping may be identified with reference to their potential for the representation of multiple interests. **Community-Engaged Mapping** is beneficial for promoting discussion and collaboration among diverse groups in the identification of assets (Burns, 2012), but can result in a homogenised output. To combat this, individually supplying participants with details of the exercise in advance and break-out groups can be facilitated. **Surveys** are a quick way to gather input from a wide range of people, but have a notoriously low response rate that may not result in the reflection of the wide range of views. **Interviews** can produce multiple layers of detail, although they require a great investment in time. **Geo-crowdsourcing** is a potentially vast resource that is more time- and cost-effective than face-to-face methods. It can gather multiple viewpoints, providing there is a significant level of access for all (Carver et al., 2000). The traps of underrepresentation of certain groups less likely to use the Internet (Carver et al., 2000; Heywood et al., 2001) and high levels of apathy or antipathy towards remotely sourced opinions (Carver et al., 2000; Reed and Brown, 2003; Brown, 2005; van Riper et al., 2012) must be considered. In addition, there are data quality issues associated with this method (Mummidi and Krumm, 2008; Brown et al, 2013). Ensuring multiple interests and valid data are gathered when geo-crowdsourcing requires close monitoring and evaluating during the process. In the end, deciding how to approach the community for involvement in participatory mapping will predominantly be dependent on which the individual characteristics of the community favours, and on the resources available to conduct the activity. With any method, enhancing the representation of the many dimensions of a community requires incorporation into planning.

The strengths and weaknesses of each of the participatory methods discussed in this section are summarised in **Table 1**, below, to aid decision-making regarding which to use.

	Strengths	Weaknesses
Community-Engaged Mapping/Focus Groups	• Inclusive of multiple groups • Conducted in a single session • Promotes active discussion • Can uncover diverse range of assets	• Requires large space • Difficult to coordinate • Can conceal heterogeneity of community • Some voices may be lost in the crowd
Surveys	• Can be distributed in large numbers • Quick and simple to do • Participants can contribute at convenient time • Can reach remote participants	• Typically low response rate • No discussion between participants to develop ideas • Valuable information can get missed if questions don't direct to it • Open to misinterpretation
Interviews	• High level of detail • New direction of enquiry can be instigated • Individual stories can be uncovered	• Time-consuming • No discussion between participants to develop ideas
Geo-Crowdsourcing	• Remotely accessed • Participants can contribute at a convenient time • Gathers multiple viewpoints • Requires few resources • Time efficient • User-friendly platforms available • Anonymity and privacy • Existing data can be utilised • Potentially vast resource	• Lack of representation of some groups • Typically low response rate • Accessibility may be an issue • Potential data quality issues • Mistakes and intentional falsehoods by participants • No discussion between participants to develop ideas

Table 1: Summary of strengths and weaknesses of different participatory methods.

3. Approaches to Asset Mapping

3.1 The Whole Assets Approach

The whole assets approach (Fuller et al., 2001) is a broad-based overview of all assets of all types. It covers natural and cultural assets, as well as services and facilities. Links beyond the immediate local area may also be explored. This is an **extensive and comprehensive** method that represents the area as a functioning system, as is illustrated by Nordland Museum's Nature and Culture app, below.

SHAPE Case Study: Nordland Museum's Nature and Culture App, Norway

Nordland Museum's history, culture and nature app is an example of whole assets mapping. It is an interactive map available as a free app for PC, tablet or smartphone. The app guides users to natural, historical, cultural, archaeological and experiential assets, as well as viewpoints. When the user clicks or taps on one of the colour-coded icons, they are provided with a picture and description. The app is a user-friendly way of displaying assets identified in a whole assets approach because all of the information is visible but users can still be selective of the categories.

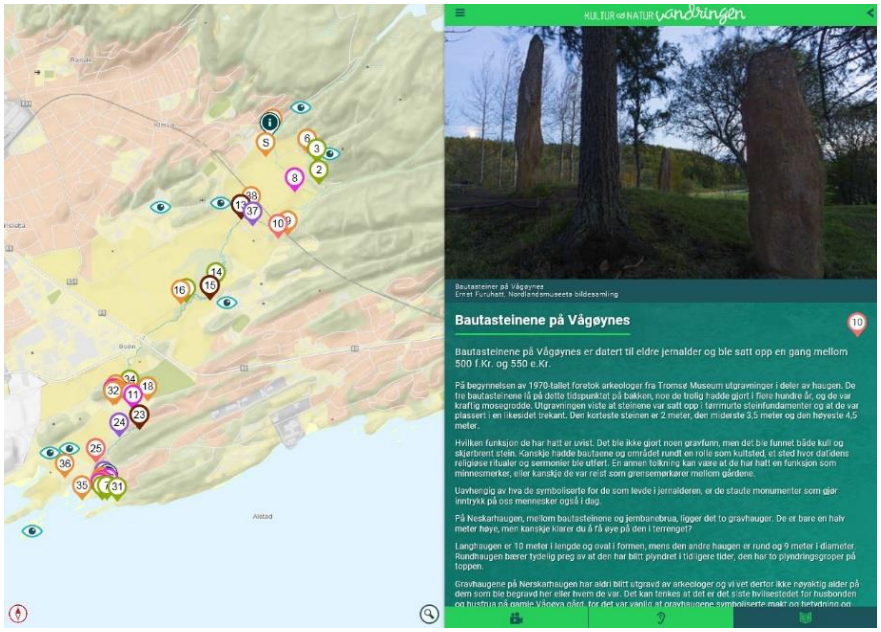


Image: Nordland Museum.

This may be a useful way to map assets in a whole assets approach that allows assets that are very different to be mapped alongside each other in an easily comprehensible way.

While comprehensive, there may be some specific local issues associated with mapping everything considered an asset, as North West Highlands Geopark discovered.

SHAPE Case Study: North West Highlands Geopark Map Site Selection, Scotland

North West Highlands Geopark is a social enterprise and charity run by the local community that incorporates the north of the Wester Ross Biosphere. They undertook mapping of cultural assets as part of their development and business plan formulation, and also to inform design briefs. Their methods combined desk-based review of the Historic Environment Record and community consultation through meetings, attendance at community events and community organisations' meetings. Communities were asked "What is important to show off in our area?" This information was collected verbally and recorded by Geopark staff. They found that some sites were sensitive and showing them off was controversial, therefore the policy adopted was to avoid promoting sites where this was a concern. To ensure community support, a brochure, leaflet and website with maps, images, poetry and written interpretation were created and feedback sought before publication.

North West Highlands Geopark's communities map. Image: North West Highlands Geopark.

Potential sites were similarly excluded from the Review of Nature Based Tourism Sites in the South of Scotland (Dunira Strategy and The Borders Foundation for Rural Sustainability, 2003). It was noted that the Borders data set was noticeable for the number of sites which do not include SSSIs and where access was not already recognised or promoted. It was recognised that a large number of sites were

excluded due to ecological sensitivity, protected species presence, health and safety on farms or client confidentiality.

3.2 The Heritage Approach

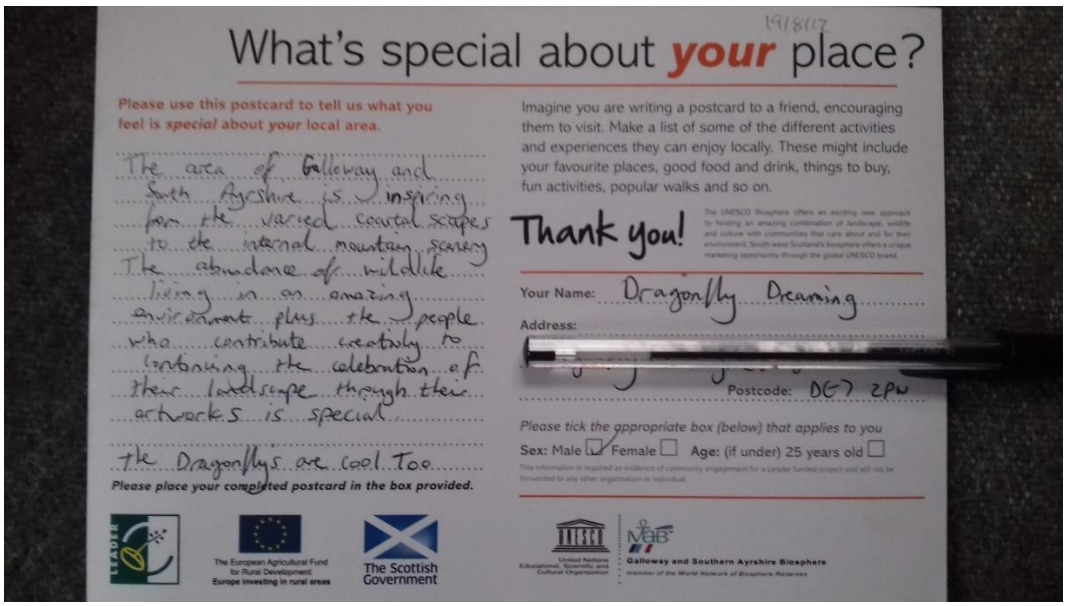
The heritage approach (Fuller et al., 2001) focuses on **physical features that are connected to community identity**. Participants are asked to identify features that make their community special. These can be parks, historical buildings, a popular local café, a bridge, or almost anything to which the community can form a connection. The aim is to produce a unique account of features that local people identify with. It can be used alone or as part of a whole assets assessment. Galloway and Southern Ayrshire Biosphere Reserve have practiced the heritage approach as part of their mapping efforts.

SHAPE Case Study: Sense of Place Postcards in Galloway and Southern Ayrshire Biosphere, Scotland

Galloway and Southern Ayrshire (GSA) Biosphere Reserve was the first UNESCO Biosphere Reserve in Scotland, designated in July 2012. It is located in southern Scotland, based around the mountainous Galloway Hills, and covers an area of 5268 km^2. The Biosphere has many special wildlife areas and a rich cultural heritage, as well as incorporating the UK's first International Dark Sky Park.

A sense of place toolkit was produced by consultants Countryscape on behalf of the Biosphere, with the intention of exploring perceptions of place and developing new ideas for improvement. One method used to produce the toolkit was the collection of information through discussion with local people to discover 'what is special' about the biosphere area, including their favourite places, things to do, local produce, walks, landscape and scenery, heritage, culture and events. This information was then used to develop the different special qualities or sense of place themes.

The team attended various events across the GSA Biosphere encouraging visitors to complete "What's special about your place?" postcards. Those completing the postcards were asked to imagine they were writing a postcard to a friend, encouraging them to visit the area.



Example of a completed sense of place postcard. Image: Galloway and Southern Ayrshire Biosphere Reserve.

The method was a useful way of capturing description of assets, in particular less tangible assets such as friendly people and creativeness of an area. Other assets identified ranged from places to go for a walk and cultural heritage to visit, to local pubs and cafes and some particularly local 'hidden gems' like community run gardens. Most importantly, these assets were considered valued by local people.

3.3 The Storytelling Approach

Described by Fuller et al. (2001), this method is designed to tease out assets that may be hidden. It is based on **the social history of a community**, focusing on the human element. Assets that are discovered through the storytelling approach can often be linked with other assets to strengthen them or provide new opportunities for developing them. This method can also be used as one part of a whole assets approach. The storytelling mapping conducted by the Sandhills Family Heritage Association is a good example of using the approach to preserve and enhance the area's social history. This is followed by the SHAPE case study in Snæfellsnes Regional Park which shows storytelling mapping being used to create a tourism product.

<u>Case Study: Storytelling Mapping in Sandhills, North Carolina, United States of America</u>

The Sandhills Family Heritage Association (SFHA) was set up by community members in Sandhills to protect the land and cultural heritage of African-American people in the region. They used storytelling as part of their cultural mapping in 2003. Stories were collected from interviews with 130 elders to

capture and preserve community history. Alongside this, significant commercial and social sites and hubs of community activity were identified, and original African-American land holdings were researched and reconstructed.

Storytelling community mapping exercise and the gardening project in action. Images: Resourceful Communities Program.

The results of the mapping were used to preserve and regenerate African-American heritage in Sandhills. To preserve the original land holdings, minority landowners were given assistance generate income from their land. To preserve social and cultural history, a gardening project linked elders and youth so they could share agricultural traditions, including medicinal herbs. Then the SFHA opened the community's first African-American farmer and craft market on the site of a civil rights era community centre and founded the annual Sankofa Festival. They also offer tours of significant sites in the community and have combined the oral histories and old photographs to create the book "Preserving Our Family Heritage." The SFHA were able to link culture and land through cultural assets mapping using the storytelling approach, and use this to link cultural concepts and intangible assets to physical locations - land plots, gardens, community sites - to add greater economic and heritage value to them.

SHAPE Case Study: Storytelling Mapping in Snæfellsnes Regional Park, Iceland

Storytellers of Snæfellsnes advertisement. Image: Snæfellsnes Regional Park.

Snæfellsnes Regional Park is a pioneering development project in Iceland. It is the country's first Regional Park and was the first region in Europe to receive Green Globe certification for sustainable travel and tourism. Snæfellsnes Regional Park held a public storytelling mapping exercise. Paper maps of the region were used, on which volunteers labelled the location of local stories. The mapping exercise worked to uncover, circulate and thereby preserve local culture, as well as providing a marketable intangible asset for tourism.

Snæfellsnes now has a group of trained storytellers based across the region. These local storytellers are a diverse group of people with different backgrounds, interests and knowledge who can offer different approaches and emphases in chat, stories, facts and history about Snæfellsnes. They offer a high-quality service to add to the value of visitor experiences by communicating the intangible assets of history, folklore and local culture. Storytellers can be met an agreed location, jump onto coach tours, or go on hiking or vehicle trips with guests to recount the stories at their locations.

A Snæfellsnes storyteller in action. Image: Snæfellsnes Regional Park.

3.4 Asset Clustering

It is also possible to focus on the spatial distribution of assets, in terms of both **density and composition** (CultureBlocks, 2017). Point data are represented as a series of individual geo-coded points. Point cluster detection can been conducted as simply as manually performing what may be referred to as an eyeball analysis (IACA, 2013). This is a simple, visual method that is useful for spotting trends, although it is not statistically significant. The Philadelphia CultureBlocks, a mapping project, undertaken in 1997 and repeated in 2010, that was used on the basis of eyeball cluster analysis, is presented as an example of this.

Case Study: Philadelphia CultureBlocks, USA

The purpose of Philadelphia CultureBlocks was to display Philadelphia's cultural assets in a way useful to artists, development managers, cultural organisations and the general public. A sample entry can be seen below.

By comparing the maps from 1997 and 2010, the project team was also able to investigate whether the clustering of cultural assets was good for the cultural sector and for the community. They found high volatility in the ebb and flow of cultural assets, especially in blocks dominated by a single type. Districts with the most diverse cultural assets were the most stable in terms of individual assets remaining throughout the time period. So-called "natural" cultural districts also tended to have a variety of other beneficial conditions, such as high-income neighbourhoods and close access to the city centre.

July 11, 2017

CULTUREBLOCKS

Block Group: 421019809001 (2010)

Nonprofit Arts and Cultural Organizations
Neighborhood(s): EASTWICK, GRAYS FERRY, PACKER PARK
Planning District(s): Lower Southwest; Lower South
Council Districts(s): 2nd District - Kenyatta Johnson, 3rd District - Jannie Blackwell
Zip Codes: 19153, 19145, 19143, 19146, 19176

Neighborhood Resources
Parks: Fort Mifflin
Recreation Centers: 83rd & Tinicum Playground
Libraries: *None Found*
Civic and Neighborhood Organizations: Grays Ferry Community Council

Cultural Assets

Nonprofit Arts and Cultural Organizations	2 (click to see list)
Cultural Businesses	9 (click to see list)
Public Art	13 (click to see list)
Art Galleries	1 (click to see list)
Cultural Events (Permits)	0
Resident Artists per 1,000 Households	0
Cultural Participation per 1,000 Households	23.59

For a list of all arts related data available for this area, click to download the *Asset Directory*.

A CultureBlocks Block Group. Image: CultureBlocks.

The information gathered from cluster mapping can be valuable for assisting with the direction of resources. Nordhordland are planning on employing this method in their mapping exercise, as is described below.

SHAPE Case Study: Developing a Mapping Process for Nordhordland, Norway, Using Clustering

Lofoten Farm Trail. Images: Nordhordland.

At the time of writing, Nordhordland was in the application process to become Norway's first Biosphere Reserve. The region is in the north of Hordaland County in western Norway and comprises a landscape of coast, fjords and mountains. Nordhordland are also planning on using visual interpretation of asset clustering as a means of identifying areas to develop in-depth mapping for their resource analysis. The selected areas will then be comprehensively mapped through collecting secondary information from databases in Norway such as Askeladden for cultural assets and The Nature Base for natural assets as well as stakeholder engagement with selected individuals who can contribute and members of the tourism business. The cultural history will be collected from written materials and interviews with local people. This methodology follows that which was successfully used in the development of the Lofoten Farm Trail, which started out by making a landscape resource analysis (Lofoten Farm Trail, 2017). Landscape resource analysis is a tool which integrates nature and the human relationships to it. It is then used for developing business opportunities. In a landscape resource analysis, the area's natural and cultural landscape is considered in terms of how best to receive guests and give them a memorable nature experience. Stakeholders work together to devise many different measures on this common theme but strive to retain the distinctiveness of each individual business within the cluster.

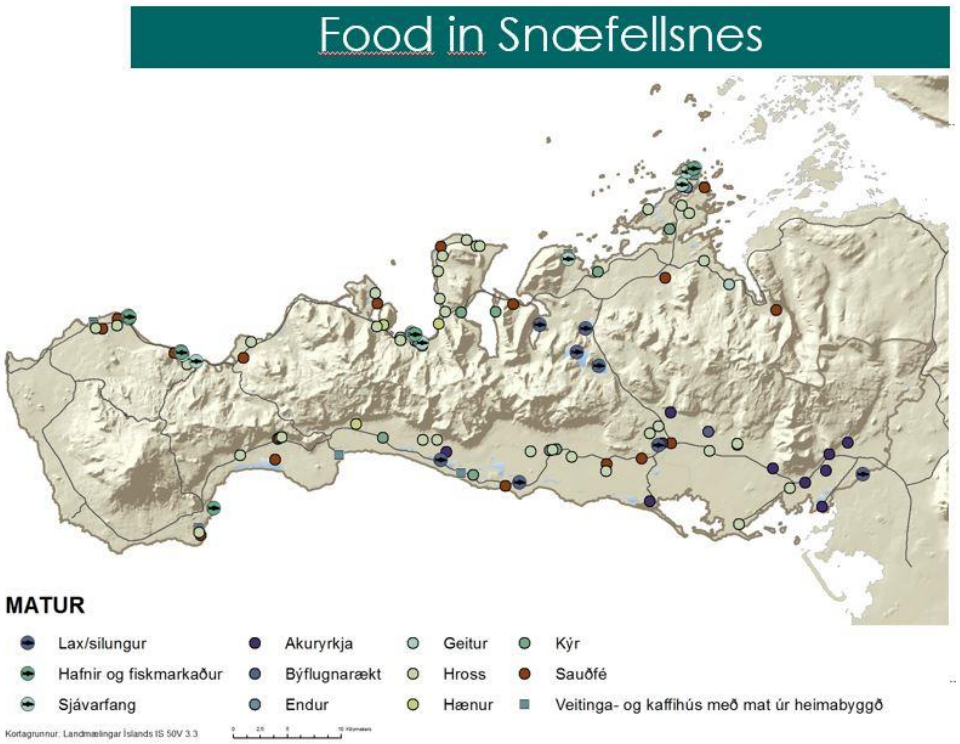
3.5 Mapping by Theme

Instead of mapping a range of assets, it may be useful in some cases to map by theme for management or marketing purposes. **Themes to map might include food, archaeology, heritage, links with literature, or natural attractions**, some examples of which are presented in the case studies below. Encouraging participants to focus on a single topic can draw out a greater number of assets pertaining to it, and mapping by a single topic can make it easier to assess where such assets are clustered and where there are gaps or needs.

3.5.1 Food Mapping

SHAPE Case Study: Map of Food in Snæfellsnes

This map was created by Snæfellsnes Regional Park. Restaurants and food vendors were mapped to guide tourists to local businesses. The location and the spread are clearly visible, and further classification by type helps clarify choices further. This map featured on the Snæfellsnes Regional Park website where clicking the coloured dots would reveal a description and the precise location of the restaurant.



Food in Snæfellsnes map. Image: Snæfellsnes Regional Park.

3.5.2 Wildness Maps

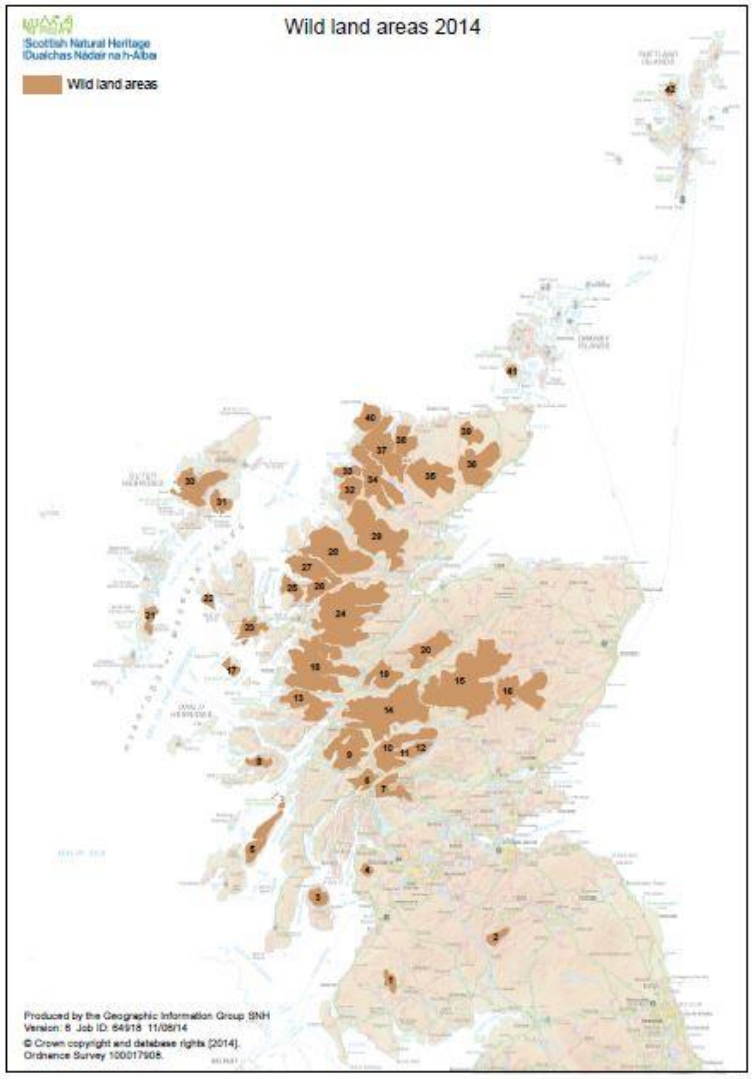
Wildness, also referred to as wilderness, is an example of an intangible asset. It cannot be tied to a specific physical structure or assigned a quantifiable value, yet it is significant as a natural asset:

"The increasing intensity of modern society, and its accelerating development and loss of natural environment everywhere, only accentuates the appeal to protect areas that have not yet been lost and still retain primal qualities. It is comforting to millions that, even if they never visit wilderness,

places exist that have not been compromised by modern life – and metaphorically this nurtures the idea that a pilgrimage could restore one's perspective" (Hendee and Pitstick, 1995, p.66).

Wild land offers a range of ecological and social benefits, from supporting biodiversity and storing carbon, to providing opportunities for recreation and tourism. Defining wildness in objective, physical terms is difficult and insufficient for management purposes. Wildness mapping and wilderness inventory (WI) have been devised to attempt to spatially locate it. WIs map wildness by its adherence to a set of user-defined characteristics considered wildness qualities. This list might include characteristics such as remoteness, natural vegetation, lack of habitation and lack of man-made structures.

WIs are lengthy processes to conduct, but many organisations have already mapped wildness areas for the purpose of identifying areas to preserve their natural qualities or to identify suitable areas for wildness recreation activities such as camping and hiking. If these maps can be obtained they can be incorporated into asset mapping and management planning. One example of this is the map of wild land areas produced by Scottish Natural Heritage, reproduced below.



Scottish Natural Heritage Wild Lands Map (Scottish Natural Heritage, 2014).

3.5.3 Transportation and Accommodation Maps

As transport and accommodation are integral parts of the tourism industry and necessary for tourism planning, it is important to map them as assets. Online resources are extremely useful for beginning to map transport and accommodation options in an area.

There are several online resources to draw on when mapping transportation links. OpenStreetMap is a free and editable map of roads and streets that is being built largely by volunteers. It shows road, rail and ferry networks. An example from OpenStreetMap for an area of SHAPE partner North Karelia Biosphere Reserve is shown below. The railway line is depicted in black, the roads in grey and ferry routes in dotted blue lines.

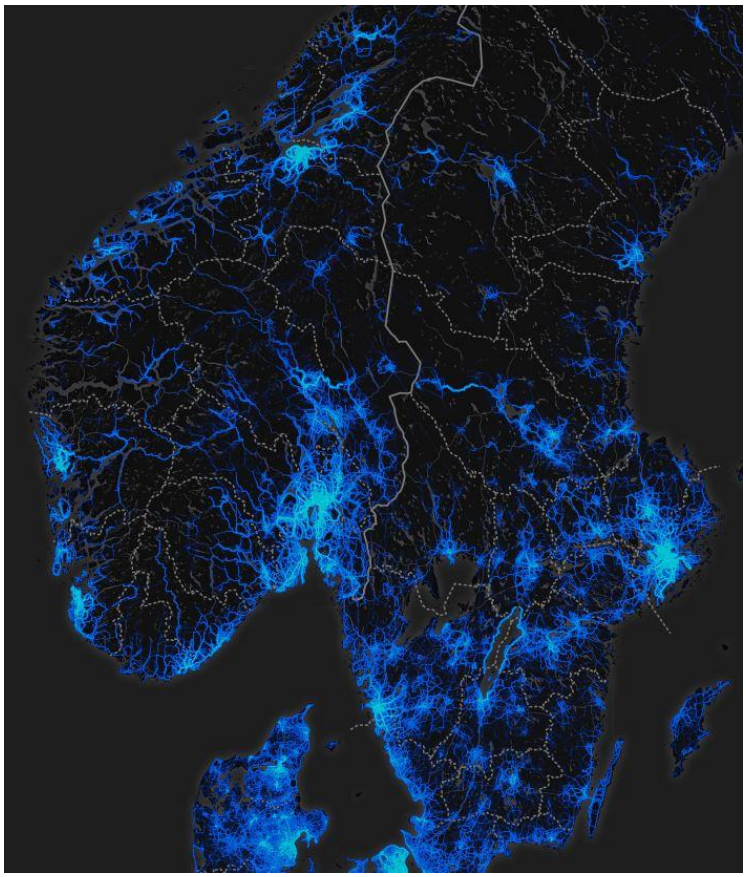
OpenStreetMap showing road, ferry and rail transportation in part of North Karelia Biosphere Reserve, Finland.

Google Maps, similarly, shows road, rail and ferry links, although the emphasis is not specifically on transportation networks, but rather more general mapping. Another option of this type is Avenza Maps' Global Transportation Map. A compilation of highway and railway routes, as well as seaports and airports for the world, it is available as an app for iOS, Android and Windows devices.

A project currently under construction that may have potential for future use is the Harvard WorldMap. An open source web mapping system, it is designed to archive multi-disciplinary, multi-source and multi-format data, organised both spatially and temporally. The project started mapping Africa in 2008 and has since spread to several other locations, although coverage is far from global as yet.

Some mapping sites specialise in a single mode of transport, offering a higher level of detail on it. OpenRailwayMap shows railway systems. Trafficways has multiple road data sets that can be explored visually on the website or exported for use in GIS. It maps roads and highways based on use.

Strava's Global Heatmap is a similar data gathering site that is useful for planning or monitoring cycle routes. It shows over 160 million routes mapped by cyclists and runners using their technology globally. There are separate displays for cycling and running, and users can zoom in to view areas more closely. A sample view of the Strava Global Heatmap for southern Norway and Sweden is shown below.



Strava's Global Heatmap for southern Norway and Sweden.

Another category of transportation mapping resources is the trip planner. Rome2rio is a popular example of this which covers over 158 countries globally. The start and end points are entered into the website or app which then displays flight, train, bus, ferry and driving options, with estimated travel times and fares. A similar function operates with Google Maps.

For mapping accommodation, among the most useful resources are booking engines such as booking.com, Hotels Combined and trivago. The websites typically have a map view option which will assist with spatial location. These accommodation maps may need to be supplemented by further research as they are unlikely to cover all accommodation options. Not every hotel, B&B or hostel is likely to be listed, and campsites and caravan parks are not within their remit. Additional accommodation may be located through Airbnb, national and local tourism organisations, or enquiring locally.

3.6 Mapping Seasonality

There is a "seasonality of recreational activity which inevitably leads to peaks in popular seasons and a lull in less favourable conditions" (Hall and Page, 2006, p.43). Ecotourism markets, in particular, tend to be seasonal (Chauhan, 2006), although some assets and locations will have a higher degree of seasonality than others. Seasonality is therefore an issue in mapping and integrated management for ecotourism (Dhami et al., 2014). It has generally been neglected in tourism research (Santarem et al., 2015), although there have been some methods suggested to incorporate this in mapping. Online mapping methods and online data mining methods are able to accommodate seasonality, as results can be tagged or filtered by date (Mummidi and Krumm, 2008). This can be used to identify trends linked to season or temporary events or festivals, or even to diversity marketing to increase low season demand. Ochils Landscape Partnership mapped seasonality recruiting local volunteers to photograph locations, and the Cairngorms National Park conducted a similar exercise by installing photo posts. Both of these are described in the case study below.

Case Study: Mapping Seasonal Change in Scotland

The Ochil Hills is a range of hills spanning around 40 km from the Firth of Tay to Stirling. The Ochils Landscape Partnership works with local people to conserve and celebrate the heritage of the Ochils and Hillfoots, and they developed a novel environmental monitoring programme. Members of the community adopt a part of the landscape, such as a view, tree or section of river and photograph it on a set date every week or month, building up a database over time. They are also asked to write descriptions of what they see, hear, smell and touch. The outcome has proven useful in pinpointing pressure sites, such as overused paths and flooding areas, and is also being used to chart climate change.

A sample from the Ochil Hills monthly database. Image: The Ochils Landscape Partnership.

A similar citizen science initiative is found in the Cairngorms National Park. Scenic Photo Posts are wooden posts placed at selected locations in the National Park. Locals and visitors place their camera on top of the post and take a photo. They then register and upload their pictures to contribute to a visual record of the long-term changes in the Cairngorms. The project is intended to run until 2025 and is linked to a sister project that started in Wester Ross in April 2017.

A sample of the first (26th March 2015) and most recent (9th July 2017) photos taken at the Parkin's Moss Scenic Photo Post. Images: Cairngorms National Park.

The photos taken at the Parkin's Moss post, Muir of Dinnet, will record seasonal and long-term changes in the vegetation of the bog and adjacent woodland, including changing water levels, tree removal in some areas and tree regrowth in others. The use of posts in this project is not only beneficial for gaining identical views, but is also effective as on-site promotion for the initiative and works as an educational tool that gets the public involved at an individual level, encouraging them to notice changes in the landscapes around them.

Once trends in seasonality have been identified, fluctuation in tourism demand can be planned for and managed. Although seasonality in the tourism market is often regarded as an issue of under-utilisation in low season, there can also be the converse problem of overutilization in the high season (Goulding, 2003). This can manifest in signs of deterioration of assets and resources through over use, as well as congestion, diminished visitor satisfaction and community costs such as increased litter and noise.

Goulding (2003) suggests that, while visitor attractions are typically at the mercy of the seasonal nature of the tourism market, they can contribute to offset seasonality patterns in a tourist destination

through their operational policies. Though seasonality is a demand-driven phenomenon, Goulding and Hay (2001) also recognise supply-side impacts, which are mainly the result of operational decisions, and other wider and causal factors as playing roles. This suggests a multi-dimensional approach to managing seasonality is required (Butler, 2002).

Goulding (2003) urges visitor attractions and destination marketers to reappraise their role in the context of destination seasonality and consider their operations in a tactical or strategic way. He considers **three types of action that could be taken in response to the effect of seasonality on tourism draws such as natural and cultural assets**. The first is to **accept the situation as it is**, which involves managing the existing peak season crowds, perhaps through increasing staffing levels or limiting visitor numbers at any one time and extending attraction opening hours. Low season could then be devoted to routine maintenance and any other tasks associated with preparing for the next high season. The second approach is based on **tactical responses to seasonal extension**. This would typically involve periodic pricing to shift or stimulate demand, or product extension based on creating events or market themes such as retail or food and drink. Goulding's final suggestion takes the **strategic view**, which may include product diversification such as hosting functions, targeting under-represented social groups in off-peak periods, investment in facilities and services, or adopting the yield management philosophies of budget airlines and hotels to be responsive to seasonal market fluctuations.

3.7 Considering Approaches to Asset Mapping

This section has described a number of different approaches to asset mapping, ranging from broad-based to those focused on specific types of asset. The **whole assets approach** (Fuller et al., 2001) is a broad-based overview that covers all assets and services, although mapping everything can result in local issues (Dunira Strategy and The Borders Foundation for Rural Sustainability, 2003; North West Highlands Geopark, 2017). Also, care must be taken to map assets in such a large number and of varying types clearly and comprehensibly. The **heritage approach** (Fuller et al., 2001) documents features with a link to community identity. Galloway and Southern Ayrshire Biosphere's Sense of Place Postcards provided an excellent applied example of this. The **storytelling approach** (Fuller et al., 2001) is based on a community's human element, unearthing assets through local stories, and is an effective means of linking assets through a local theme. **Asset clustering** focuses on spatial distribution and density of assets (CultureBlocks, 2017) and can be useful for direction of resources or site-selection for development. **Mapping by theme** may be useful for clarity in management or for marketing purposes. Wildness maps can be used to identify the intangible asset of wildness, and existing online transportation and accommodation resources can help with mapping services. Finally, **seasonal mapping** was discussed as a way of mapping temporal changes to inform year-round management or use of resources. The strengths and weaknesses of each of the approaches discussed are summarised in **Table 2**.

These approaches may be used alone or combined to best fit mapping requirements. Those that are selected will be directly reflective of the type of assets considered to be strongest in the area. **The more methods that are applied, the richer the resulting natural and cultural assets map will be**. Seasonality is particularly important to ecotourism (Chauhan, 2006; Dhami et al., 2014), and once

trends have been identified, fluctuation in tourism demand can be planned for and managed by adopting the types of responses suggested by Goulding (2003) that best suit local conditions.

	Strengths	Weaknesses
Whole Assets Approach	• Comprehensive • Useful for planning to link assets of different types	• Locals may not want to map sensitive sites • Can result in a cluttered map
Heritage Approach	• Representation of unique community identity • Can form part of a whole assets approach	• Solely based on public opinion
Storytelling Approach	• Captures social history • Can form part of a whole assets approach • Preserves local stories • Can be used to revive traditions	• May be of limited interest outside of local community • Used alone is not a comprehensive method of mapping assets
Asset Clustering	• Identifying spatial distribution is useful for planning and analysis of activities • Gaps, opportunities and links are easily identified	• Focus is not on individual assets
Mapping by Theme	• Useful for marketing • Can focus participants to identify assets that might be overlooked in a general assessment • Gaps and opportunities for are identified • Can be used to develop themed itineraries and trails	• Used alone is not a comprehensive method of mapping assets • Not useful for developing links between different types of asset
Mapping Seasonality	• Useful for planning, particularly in visitor management, service provision and product diversification • Can be used to market different tourism packages/products at different times of year	• May be of little relevance for some assets or locations

Table 2: Summary of strengths and weaknesses of asset mapping approaches.

4. Tools for Mapping

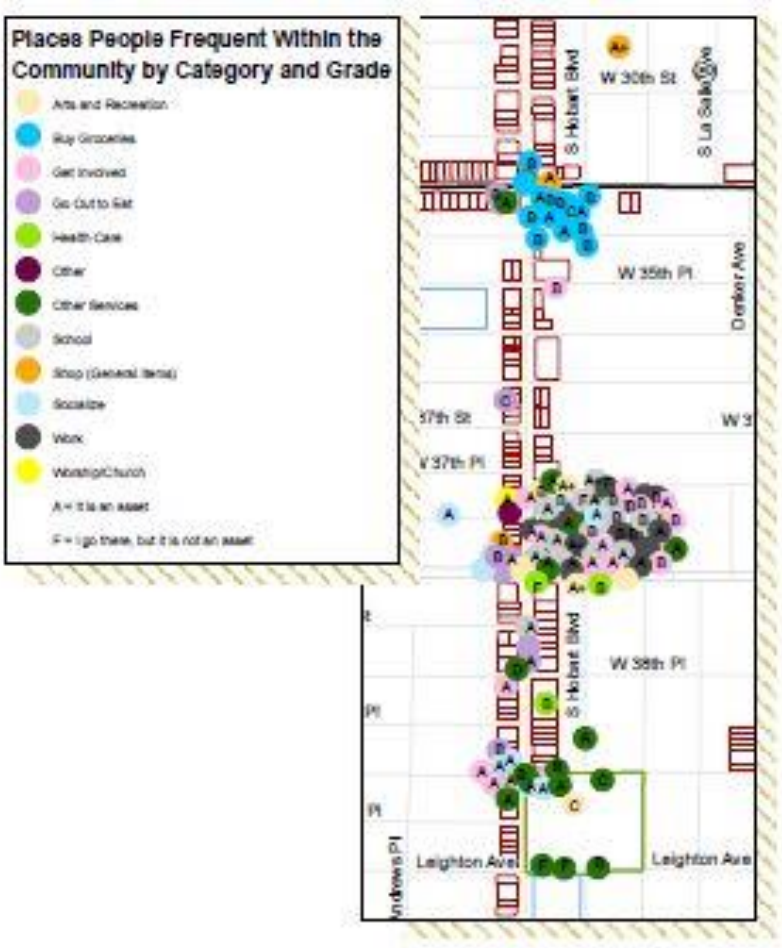
4.1 Paper Map

Paper mapping, most frequently used in focus groups, requires a large printed area map. This could be obtained, for example, from Google Maps. Participants are requested to mark the geographic location of assets with **pen, sticky dots, tags or push-pins**. A good example of mapping in use was conducted as part of the Healthy City project in California, USA, discussed in the case study below.

Case Study: Healthy City Mapping Values, California, USA (Burns et al. 2012)

The Healthy City project used a variety of paper maps for their participatory mapping project. They located and categorised assets by type through the placement of different coloured dots to represent community assets such as health care assets and arts and recreation assets. The Healthy City project mapped assets by category, whether they were frequented or not and irrespective of value they might be considered to hold. They then asked group members to grade these according to a grade scale of A to F, where A is the highest level of asset and F is used but is not an asset. An example of one of their graded community maps is shown below.

It can be useful to acquire information on the **value of assets** that are identified by group members or individual participants. The value of assets is a largely subjective quality and mapping values can be complex. Howard (2003), in discussing value placed on heritage, uses the analogy of an optician putting lenses in front of the eye: "The values which we hold can be envisaged as a series of lenses placed in front of our eyes, which correspond to our various attributes, each of which alters our perception of what is heritage" (Howard, 2003, p.211). The lenses that Howard refers to include characteristics such as nationality, gender, ethnicity, class, religion, poverty, 'insideness' (the extent to which a person is part of the community or just a temporary resident or visitor), expertise and age. Collective grading of assets in a community combines a spectrum of these perceptions, creating a richer overall picture from the mapping exercise.



Grading of assets in asset mapping for Healthy City. Image: Burns at al. (2012).

Dot placement is user-friendly and a good method of measuring relative values, but there are some concerns with its use for mapping assets. Mapping the abstract values associated with intangible assets will result in less precise dot placement because they are not anchored to any physical features. This can result in ambiguity over the respondents' intentions. Also, because the dot placement is interpreted as point data, it is unclear the size of area each dot refers to. The values could be typical to a single spot or an entire forest, for example. To address this, **it can help to spatially classify assets**. Wall (1997) suggests classification as **point attractions**, requiring visitors to be in a specific area (such as waterfalls, temples, galleries), **linear attractions**, that concentrate visitors along a narrow strip of land or transportation corridor (such as coastlines, rivers, scenic routes and trails), and **areas**, which attract large numbers of people but are widely dispersed (such as parks and protected areas, wilderness and scenic landscape). This can be represented in the mapping process by utilising a polygon method of mapping or by gathering greater detail on respondents' dot placement at the survey stage.

A variation of the paper mapping exercise was completed by East Dunbartonshire Association for Mental Health (2017). Volunteers mapped community assets on paper using pen to define the spatial aspects, drawn as points, lines and areas, and using figurines to represent the assets occupying these spaces. This method of paper mapping incorporates Wall's suggestion of mapping points, lines and areas. The inclusion of this avoids the spatial ambiguity of point data associated with the use of dot placement.

Instead of the A to F or a similar numeric scale for grading value, there is also the possibility of grading according to tourism attraction value of assets. These could be described using McKercher's (2002) classification of primary, secondary and tertiary tourist attractions. **Primary attractions** are of greatest importance to tourists visiting an area and influence the region's tourism market and visitation behaviour. These may even be nationally significant. **Secondary attractions** are those that are very popular with visitors but do not influence tourists' decisions to visit or drive demand for tourism in the region. They are typically locally significant assets. **Tertiary attractions** have very low influence on visitor behaviour and tend to be visited because they are close to other places that tourists plan to visit. It is important to bear in mind that attractions could be categorised differently depending on different tourists' primary reason for visiting.

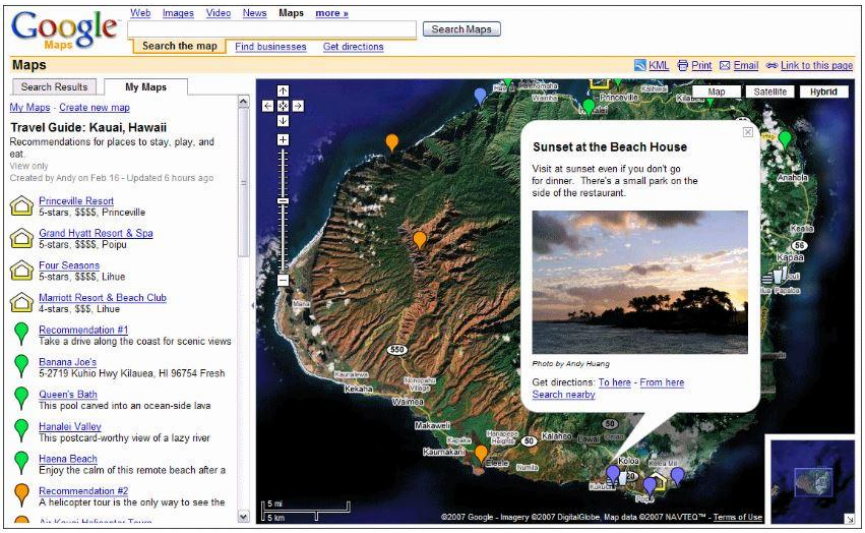
The cartographer working in Wester Ross offered some additional advice to combat spatial confusion when mapping on paper, suggesting maps containing small communities had these places enlarged to give a bigger area to locate assets in and to allow for more detail to be added:

"Enlarge sections of village communities to show facilities and communities on large maps – this in itself is added infrastructure. Expand on the little communities more and this will help them communicate the facilities and attractions they have. Local knowledge is essential."

4.2 Online Mapping Applications

Mapping software can be used in place of a paper map when gathering information from participants, or to digitise the information that participants had mapped. Participants can map in person at focus groups or can contribute remotely from their home computer, making this one of the most flexible methods of mapping assets. **Geo-coding the information on a digital map helps by visualising it and revealing spatial associations between assets.** Some mapping software is free or has free options, including Google's My Maps, Mapline and Wikimapia. There are other mapping tools specifically designed for asset mapping, such as Community Walk and Green Maps. While tailored for the purpose, these are not always as flexible as the general mapping software and may not be as professional in appearance. The features of each of those mentioned here are described in more detail below.

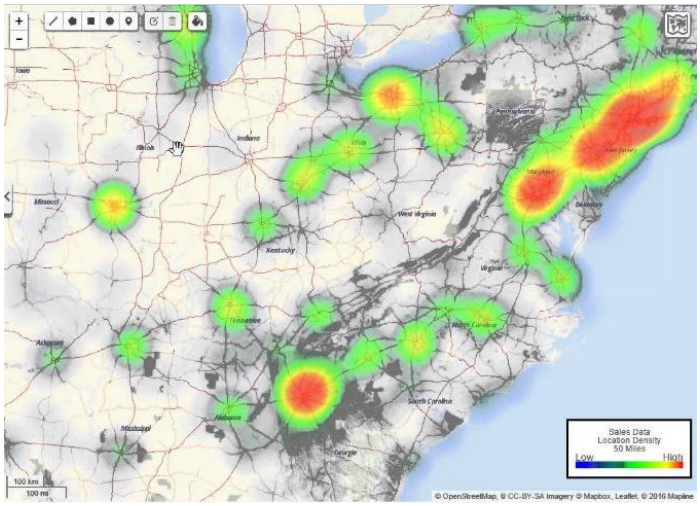
Google My Maps



My Maps in use. Image: internetnews.com.

My Maps (https://www.google.com/maps/about/mymaps/), a feature of Google Maps, is a free mapping service offered by Google. It was previously known as Google Map Maker, until this was discontinued and merged with Google Maps in March 2017. Google Maps software includes street maps, Street View, satellite imagery and route planning. My Maps is used to create users' own maps by dropping pins to mark locations. Markers are customisable, and photos or comments can be added to them. The main benefit of this software is that the format and use of Google Maps are familiar to most Internet users and it is popular for its accessibility and simplicity. Maps can also be accessed by multiple users, or made open to public access if required. One downside is that as Google Maps uses the Mercator projection, there is spatial distortion in representing areas close to the poles. This is a consideration when mapping at high latitudes. Completed maps can be downloaded and printed at high resolution.

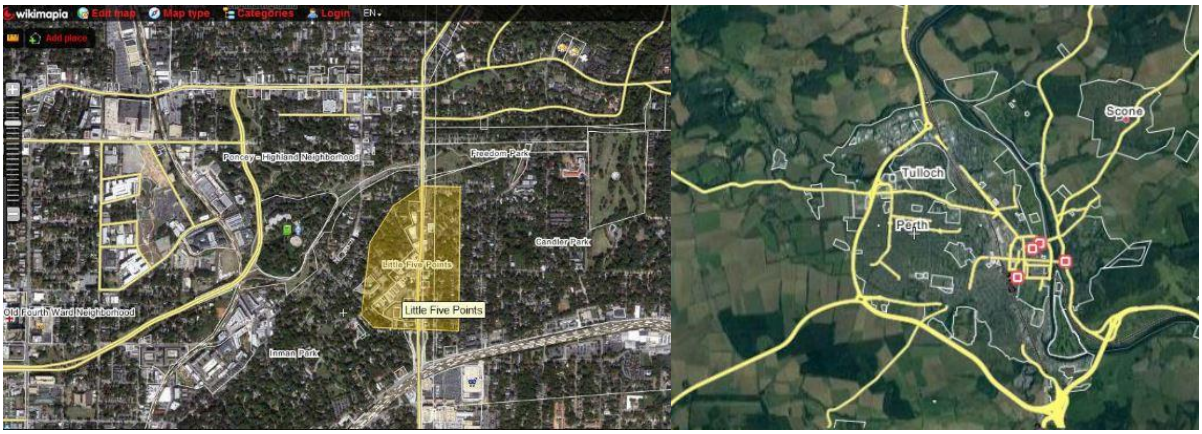
Mapline



Mapline's radial heat mapping. Image: Mapline.

Mapline (https://mapline.com/) offers a range of mapping features, some of which are free and others require a subscription. Unlike Google's My Maps, Mapline plots data from Excel spreadsheets. This allows users to plot multiple locations quickly in one step, instead of having to pin them individually. Mapline also offers sophisticated features such as sub-layering, radial hotspot mapping of clusters and overlaps, and a suite of territories to choose from for boundary lines, allowing the segregation of data and creation of maps for visual analysis as well as basic mapping. Map pins are also customisable, with users able to classify categories and import individual icons. Mapline is a little more difficult to use than the others, however there are Youtube videos provided by Mapline for assistance.

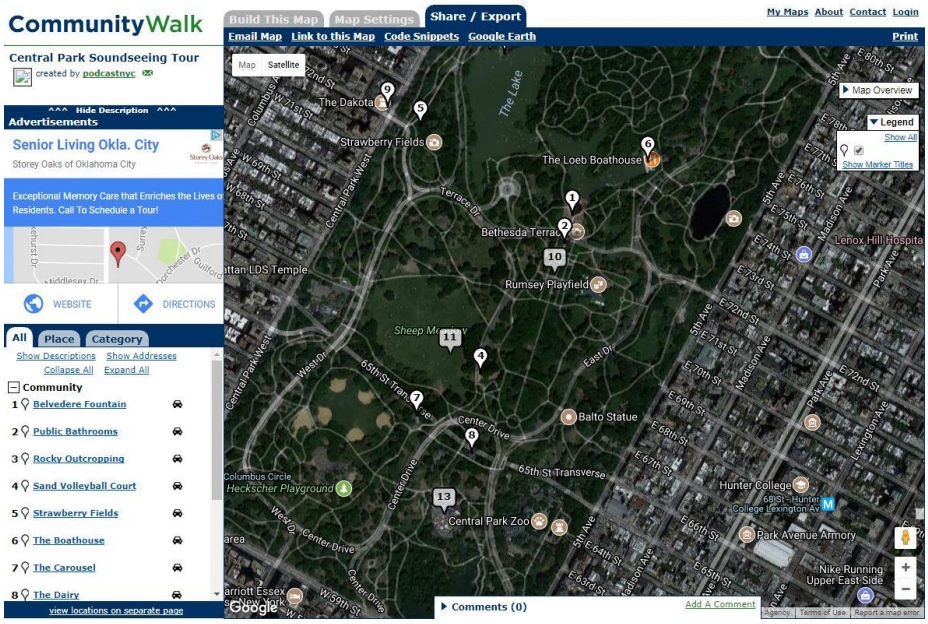
Wikimapia



WikiMapia in use demonstrating polygon area mapping, like road mapping and point feature mapping. Images: wikimapia.org.

Like My Maps, WikiMapia (http://wikimapia.org/) is a major player in online mapping. It differs from My Maps in that, as per the wiki principles, it is focused on community creation and is open content, shared freely under the Creative Commons Licence Attribution-ShareAlike. WikiMapia lets users explicitly mark points, lines and polygons to indicate places of interest. It is particularly useful for mapping networks, such as paths or roads, and areas. Users can edit, add to, and vote on places mapped by previous users. Before a new place appears on the map, it must be approved by other users, which can be an issue when trying to create a map for custom purposes. The entries are also listed under a set list of categories which may prove restrictive for some asset mapping. The collaborative nature of WikiMapia means others have already added information that is free to use, and this feature may prove more useful than the mapping itself. Some downsides to using the existing community gathered data on WikiMapia are the poor quality of some entries and lack of standardization in format for any of them, and also the inclusion on the map of old or other data that may be obsolete. It is, however, possible to use WikiMapia as a secondary data source, making use of this content for your own maps.

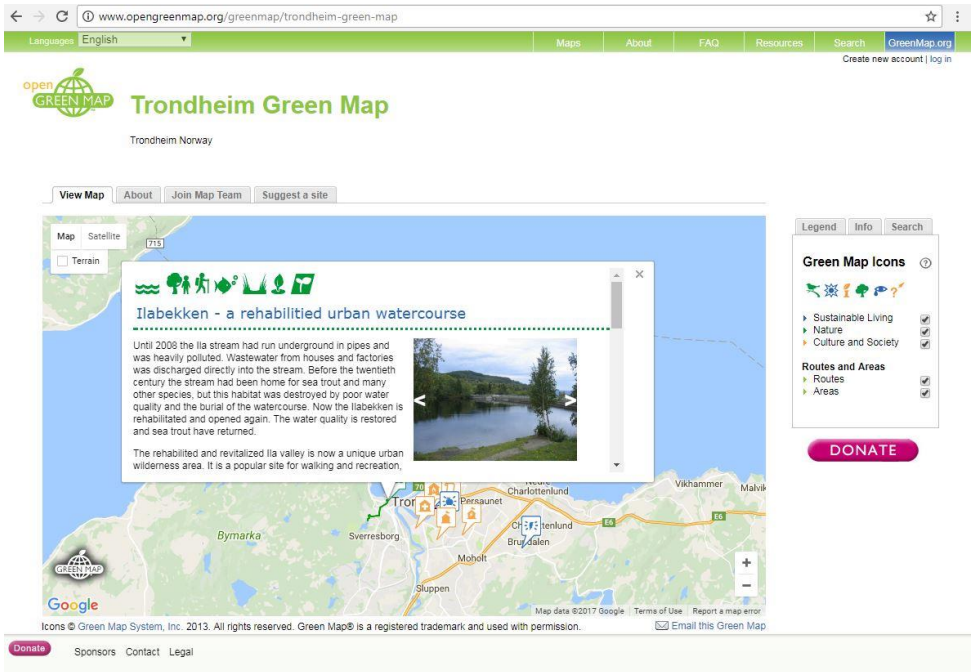
Community Walk



Community Walk map for senior living in Oklahoma City. Image: Community Walk.

Community Walk (http://www.communitywalk.com/) is a free and simple interface for map creation based on Google Maps. Originally created as a website for mapping communities for real estate, Community Walk provides the ability to show photos, add comments, display interactive media, hide and show categories of locations, add audio to the map and include unique icons. It is best used for smaller area projects, as there is a limitation of 100 markers on a map.

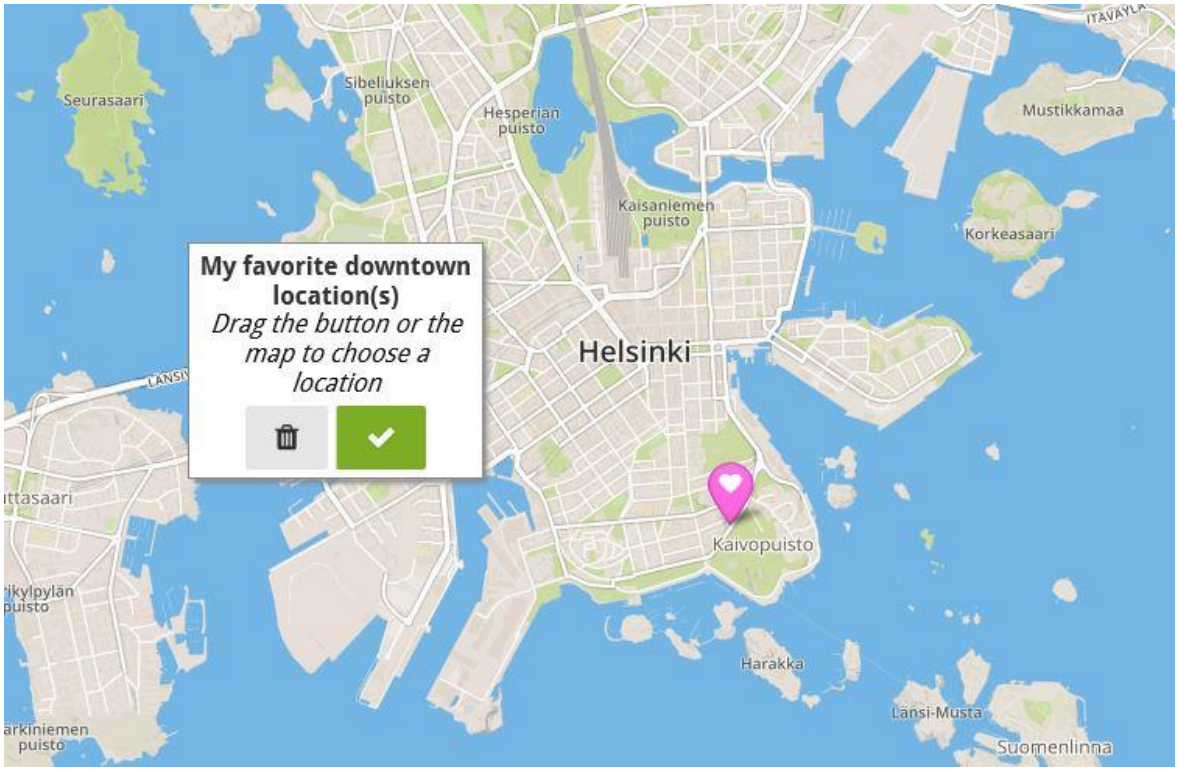
Open Green Map



Green Map for Trondheim, Norway. Image: Open Green Map.

Open Green Map (www.opengreenmap.org) is part of a wider mapping project that also fits in with asset mapping. The goal of the Green Map project is to promote sustainable community development worldwide through mapmaking. Their maps are intended to create comprehensive inventories of natural, cultural and sustainability assets, for decision making and as guides for locals and tourists. Open Green Map is more sophisticated in appearance than Community Walk but is still easy to use, and has a mobile phone website and an iPhone App. Maps are interactive and can be added to online by members of the public who register on the Open Green Map website to do so. Open Green Map charge a service fee, which is dependent on country, organisation type and ability to pay, but Open Green Map insist that cost should never be a barrier to participation.

Maptionnaire



Maptionnaire in use. Image: Maptionnaire.

Maptionnaire (https://maptionnaire.com/) is not a free tool, but it is a useful public participatory research tool that is simple to use. It uses cloud-based software to create a platform for crowdsourced community information and interaction. Users create a map-based questionnaire that is answered by community members and can be designed to include questions to gather opinions and values. The data can be analysed and visualised in Maptionnaire without the need for any GIS experience. The data can also be downloaded for use in all major GIS software if desired.

4.3 Non-Spatial Mapping

Resources do not have to be represented spatially on a map. They can also be presented on a diagram or represented through words. Schematic diagrams and flow charts are useful for mapping lists of assets categorically. A diagram represents the assets systematically using graphics, without the

concept of space or clutter of detailed text or images, and is **ideal for presenting complex and abstract information** (Lowe, 1993).

Resource framework diagrams feature five or six main categories with sub-categories leading off from these (Millier Dickinson Blais, 2014). These diagrams offer a visual dimension to locate assets and identify how they are related. The example below is the result of a cultural resources mapping exercise conducted in the City of St Thomas, Ontario, Canada.

Case Study: Schematic Cultural Assets Mapping in the City of St. Thomas, Ontario, Canada

The schematic cultural assets diagram shown below was used to map information derived from interviews and surveys asking residents for qualitative descriptions of the city's most important tangible and intangible assets. Participants in the project were asked about current resources and also, looking to the future, what they would regard as signs of success in the city to inform potential development initiatives. The layout of the diagram allows spatial and non-spatial assets to be mapped easily and equally.

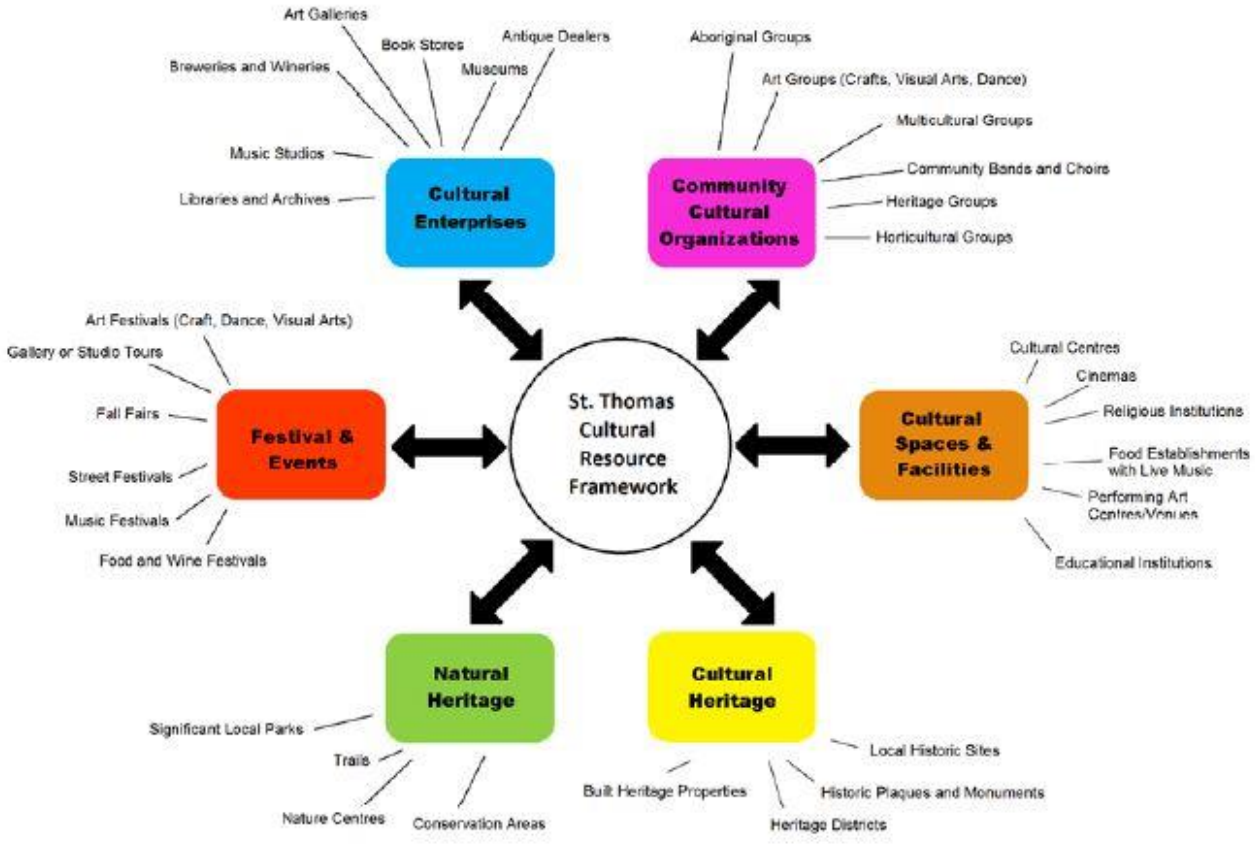


Diagram of the Cultural Resource Framework used in cultural assets mapping in the City of St. Thomas. Image: Millier Dickinson Blais (2014).

The information from this schematic map was subsequently geocoded, as most assets mapping exercises are, but the diagram format remains the quickest visual reference for understanding what assets are there, though it does not inform where they are.

Ketso (http://www.ketso.com/) is a more dynamic schematic method of participatory asset mapping. Coloured paper leaves represent different questions – yellow for 'What do you like about the place?' white for 'What do you not like about the place?' and green for ideas for improvement. Branches are created for the asset categories, such nature, history and community, and participants write their ideas on the leaves. They then share opinions and ideas in groups, moving the leaves or branches as they see fit. In using the metaphor of leaves on tree branches for representing and linking assets, this method makes use of visual simplicity and familiarity, identified by Eddy (2014) as the two key characteristics of successful diagrams.

Another project that is useful for ideas on innovative, alternative forms of community mapping is the Parish Maps project.

Case Study: Parish Maps, United Kingdom

Common Ground's Parish Maps project has produced a varied selection community maps at the parish scale. This scale was chosen as one at which people feel a sense of familiarity and ownership in their place. It is your "home place, your own familiar territory, the neighbourhood to which you feel a sense of belonging, the locality which 'belongs' to you" (Common Ground, 2017).

Example of a pictorial Parish Map. Image: Parish Maps.

Parish maps are visual representations of what people claim as their own locality and what they value in it. They include wildlife, history, work, landmarks, buildings, people and festivals. They do not have to be cartographically correct, but are designed to illustrate locally distinctive activities and features that focus on everyday things for the people living there. Parish maps help to maintain local identity and generate ideas for involvement.

4.4 Database

Information gathered from participants could be entered into a database management system and stored electronically. The asset database could also include supplementary information such as public transportation, and nearby parking or services. This method is often used in areas dense with assets as **databases are ideal for storing large numbers of records efficiently**. A database of cultural assets in Vienna, Austria, is one example of database mapping being used.

Case Study: Database of Cultural Assets, Vienna, Austria

In 2008 the City of Vienna publicly launched its database of cultural assets. The database was compiled from information from the City Archives, the Museum on Demand, the Department of Urban Archaeology, and the Municipal Department for Architecture and Urban Design. It presents updated information on Vienna's architecture, artworks in the public space, urban history and urban archaeology in a concise and easily accessible way. Vienna's database features a quick search function leading to interactive material about individual assets such as buildings, monuments, archaeological finds and works of art.

The main benefit of representing the assets on a database is the volume of information that can be stored and presented alongside them. The database can also easily be searched or filtered, and information on an individual or groups of assets retrieved.

4.5 Geographic Information Systems

Geographic Information Systems (GIS) are valuable tools for the analysis of spatial relationships among assets. GIS has potential for use in asset resource inventories, integrated management and identifying suitable locations for development (Korte, 1997; Bahaire and Elliott-White, 1999; Hall and Page, 2006). It has often been used for inventory mapping of natural and cultural resources for ecotourism (Boyd and Butler, 1996; Williams et al., 1996; Farsari and Prastacos, 2004; Randrianaly et al., 2016). Products of GIS mapping for management and planning frequently include tourism resource maps, tourism use maps and tourism capacity maps (Bahaire and Elliott-White, 1999).

GIS analysis is comprised of two forms of data. The spatial data are the geographic locational aspects, which can be as precise as coordinates or as general as an area or district. The attribute data are the information attached to the spatial features, and can be descriptions, measurements or classifications. An example of attribute data might be type of land cover. In the simplest terms, spatial data is 'where' and attribute data is 'what.'

GIS is a powerful means for analysis and decision making in tourism planning and management. It allows for integration of different data sets leading to a comparison of options on a selected basis, the most suitable and sustainable of which can be identified. The potential for GIS as a solution in tourism mapping is summarised in **Table 3** below.

Problems of Tourism	Nature of Problem	GIS Application
Lack of Knowlegde	Of dimensions, nature, power of tourism, i.e. by key decision-makers and communities	A key point is that stakeholders do not have the types of information needed to assess their point of view. Using GIS for the *systematic inventory* of tourism resources and analysis of *trends* can help ameliorate this problem.
Lack of ability	To determine levels of sustainable tourism development given the fuzziness of the concept	GIS can be used to monitor and control tourism activities once levels of development deemed appropriate and acceptable by stakeholders have been determined. By integrating tourism, environmental, sociocultural and economic data GIS facilitates the identification and monitoring of indicators of sustainable development.
Lack of ability	To manage and control development – associated with uses, capabilities, capacities	GIS can be used to identify suitable locations for tourism development, identify zones of conflict/complementarity.
Lack of appreciation	That tourism is an industry and causes impacts which cannot be easily reversed	GIS can be used to *simulate* and *model* spatial outcomes of proposed developments. To sensitize stakeholders to externalities associated with their actions, e.g. visibility analysis, network analysis, gravity models.
Lack of appreciation	That tourism is dynamic and causes change as well as responding to change, i.e. tourism is just a part of wider development process which can produce intra- and inter-industry conflict which may destroy the tourism resource	GIS enables the *integration* of datasets representing socioeconomic development and environmental capital within a given spatial setting. GIS sits comfortably on top of integrated and strategic spatial planning.
Lack of agreement	Other levels of appropriate development, control and direction	GIS functions as a *decision support system* – to produce more informed arguments and (hopefully) facilitate compromise and resolution. However, this presupposes the existence of a coherent planning and development control framework.

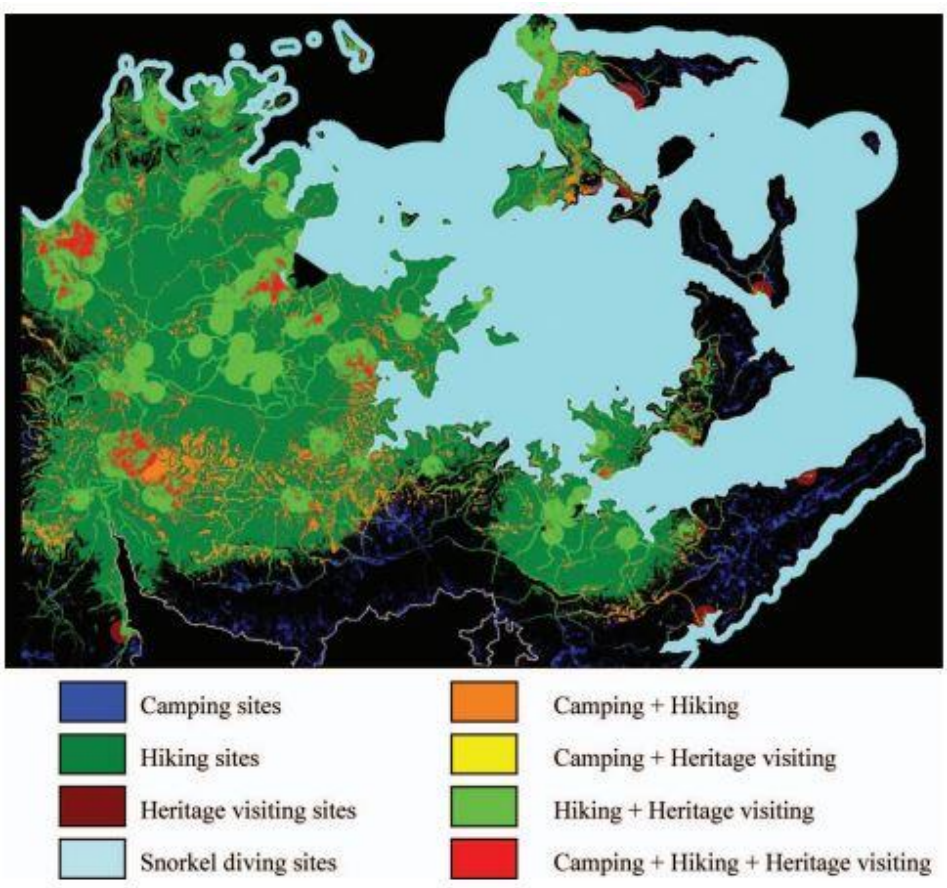
Table 3: Problems of tourism to which GIS can be applied (Bahaire and Elliott-White, 1999, adapted from Butler, 1993).

There is a substantial availability of different software and developed techniques, meaning that GIS can be applied in a range of circumstances. Multi-criteria evaluation (MCE) is one of the main GIS approaches used in ecotourism mapping (Dashti et al., 2013) and can be adapted to suit a wide variety of natural resource management situations. It is useful because it takes into account the many

different criteria that impact on land management decisions. In MCE, criteria that function as either factors or constraints are used to apply weights to GIS models to produce suitability maps, as Fung and Wong (2007) have done for Hong Kong's New Territories in the following case study.

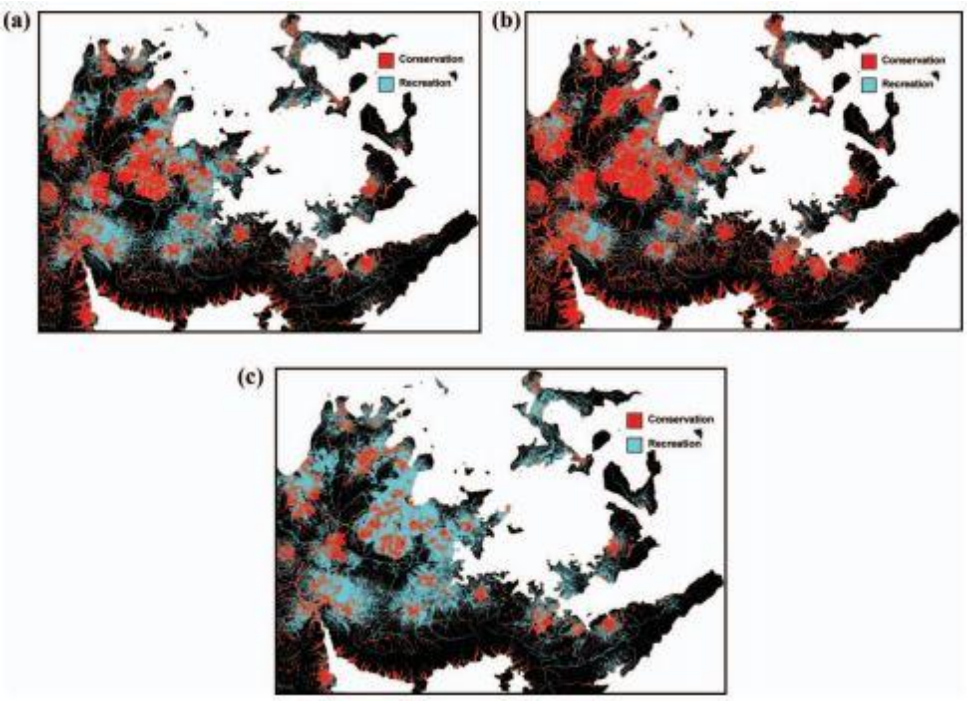
Case Study: Multi-criteria Evaluation in the New Territories, Hong Kong (Fung and Wong, 2007)

The New Territories comprise 86.2% of Hong Kong's territory. It is a region of wetlands, mountains, coast and islands, with cultural attractions such as ancient Hakka villages, temples and a museum. GIS was applied in the form of an MCE in ecotourism planning for Hong Kong's New Territories. An MCE for recreation was conducted to produce a map of integrated suitability for recreational uses. To identify the suitable sites, criteria and constraints were applied for four activities – camping, snorkelling, heritage visits and hiking – before assessing integrated suitability. The resulting map shows the suitability of areas for all of these recreational uses together.



Results of the recreational MCE in Hong Kong's New Territories. Image: Fung and Wong (2007).

Another analysis called a Multi-Objective Land Allocation (MOLA) was then performed to help with land use decisions under different priorities.



Results of the conservation-recreation MOLA for Hong Kong's New Territories. Image: Fung and Wong (2007).

In scenario (a) equal weight is given to matters of conservation and recreation, in scenario (b) conservation is prioritised, and in scenario (c) recreation is prioritised. The resulting maps can be used to guide ecotourism planning and development in the region under selected objectives.

GIS can incorporate public-generated information. One of the strengths of GIS as a tool is that community gathered information can easily be combined with other data types. Public Participatory GIS (PPGIS) is a community values mapping method which is able to "link local perception of place to a broader measure of environmental values at the landscape level" (Raymond et al., 2009, p.1301). Human assessment is typically incorporated by means of survey, interview or focus group.

Another potential use of GIS is for mapping point data for identification and analysis of clustering, as is illustrated in the example from southern Scotland, below. The data can be mapped by a simple operation on commonly used GIS software such as ArcGIS and the free QGIS.

SHAPE Case Study: Clustering with GIS for Nature-Based Tourism Sites, Dumfries and Galloway and Borders, Scotland

Loch Trool, a freshwater loch and historic battle site in Galloway Forest Park, Dumfries and Galloway. Photographed from the Loch Trool Trail. Image: Laura Ferguson.

The Southern Scottish region of Dumfries and Galloway incorporates some of the Galloway and Southern Ayrshire Biosphere. The South of Scotland Nature-based Tourism Steering Group led by the Southern Upland Partnership commissioned a review of natural heritage sites which could currently or potentially offer tourists in the South of Scotland a natural heritage experience. The project was in two phases, the first of which focused on identifying sites and their clustering. Phase two then followed with the appropriate linking and marketing of these clusters.

The identification of clusters was deemed necessary to overcome an issue with the condition of nature-based tourism sites. It was realised some sites may never acquire facilities and may not individually need them to attract tourists, where they could be provided elsewhere in the cluster. A questionnaire was developed to support the development of a nature-based tourism resource by the initial examination of the resource as a cluster, and the identification of an anchor site or location which currently or potentially could provide the facilities necessary. Anchor sites are those with the greatest tourist attraction and the necessary facilities, as well as the capacity to facilitate the tourism development of the wider cluster.

GIS maps of all the identified sites were produced. In addition to providing a graphic illustration of site locations and clusters, this allowed some analysis of the sites to be undertaken according to, for example, their location in relation to designated sites and according to landscape types. An initial assessment of the cluster methodology suggested a majority of the clusters were self-defining or already presented logical activity themes.

The clustering analysis was viewed as a highly successful element of the study. The majority of nature-based tourism sites, while they are often important for specific habitats or landscapes, offer pleasant walking and set cultural, historic and archaeological sites in a natural context, cannot be considered to be major tourist attractions in their own right and often have few, if any, facilities for visitors. In many cases, they only form attractions when marketed as part of geographical or thematic clusters, or are presented as additional sights of interest around an anchor site or town.

One of the criticisms directed towards GIS is that it is an elitist technology (Pickles, 1995). The cost in time and resources required to employ it is a barrier to its application in asset mapping (Korte, 1997). Access to, or availability of, quality data may be another issue that has serious effects on the outcome of GIS mapping (Korte, 1997; Brown et al., 2013). Data quality issues include positional accuracy, attribute accuracy, currency, completeness, logical consistency, lineage, interpretation and uncertainty (Brown et al., 2013). Due to the complexities and cost, GIS may only be an option for those with the necessary expertise on hand or the funding available.

Though GIS is the most technical of the tools described here, is also the most analytical and detailed. The depth of information for planning purposes is unparalleled in the other physical and digital methods.

4.6 Selecting Tools for Map Making

A range of map making tools were presented in this section. **Paper maps** are a user-friendly and easily annotated tool for mapping, while a variety of **online mapping tools** are also available. Features of these online tools vary from simple to more detailed, and access is easily shared. **Schematic diagrams** are a non-spatial means of representing assets based on characteristics such as theme or frequency of use. They are also a useful means of illustrating links between assets. **Databases** could be used to store information on assets. Finally, **Geographic Information Systems** are a powerful set of tools for geographic analysis of natural and cultural assets, particularly in land use and cluster analysis. As with approaches to asset mapping, the tools selected will depend on suitability for the identified purpose, as well as on available skills and resources. To aide selection of appropriate asset mapping tools, **Table 4** summarises the strengths and weaknesses of those discussed here.

It is important to remember that mapping can be spatial or non-spatial. For spatial mapping, clarification of the area covered by the mapped asset is needed, This can be achieved by classifying the assets as point, line or area features (Wall, 1997). Non-spatial mapping can be bring clarity where the complexity or abstract nature of assets renders them difficult to represent spatially (Lowe, 1993).

Participants could be asked to grade assets as a means of mapping information on their value. Representing value by letter or number grading (Burns et al., 2012) or as primary, secondary or tertiary attractions (McKercher, 2002) are suggested ways of incorporating value into a map. Mapping value will provide a richer overall picture, although individual values are very much subjective (Howard, 2003) and intrinsic values are intangible and difficult to capture (Callicott, 1986; Worboys et al., 2005).

	Strengths	Weaknesses
Paper Map	• Simple to use • Many ways to annotate it • Inexpensive • Can be adapted to incorporate values	• Requires participants access the map in person • Information requires more work to process and store • Paper maps easily damaged or lost
Online Mapping Applications	• Participants can contribute remotely • Many free options available • Visually appealing • Some basic spatial analysis options available	• Lack of representation of some groups • Accessibility may be an issue
Non-Spatial Mapping	• Useful for mapping categories • Good for complex and abstract information • Useful means of illustrating links between assets	• No spatial information
Database	• Good for storing a large number of records • Supports a range of supplementary information • Easily searched and filtered	• Typically lack visual appeal
Geographic Information Systems	• Powerful analytical tool • Spatially accurate • Varied applications • Free GIS software is available	• Time-consumptive • Complex • Requires GIS expertise (which may be expensive) • There may be data quality issues • Availability of or access to data may be an issue

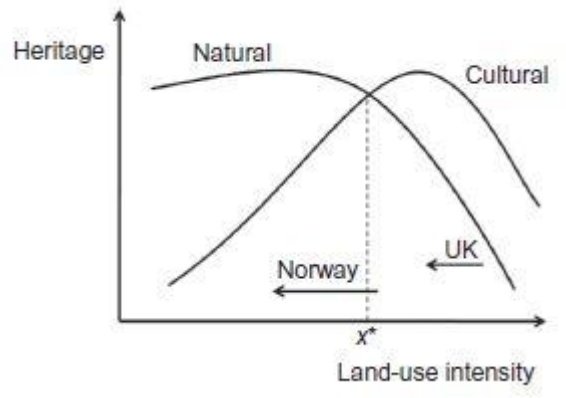
Table 4: Summary of strengths and weaknesses of different mapping tools.

5. Applying Asset Mapping in Integrated Management

5.1 Integrated Management in Protected Areas

Integrated management of natural and cultural heritage assets involves **the comprehensive and coordinated management of resources and their use**, and combines social development and conservation goals. The area is managed as a whole system, and with respect to interrelationships between individual elements of the system. Rössler (2000) observes a fundamental shift in environmental management in which the links between communities and their environment have been identified.

Speed et al. (2012) propose a model for integrating natural and cultural heritage values based on land-use intensity. Originally designed for application in mountain areas with a history of human use, it is intended to be used to conceptualise valuation within the landscape and facilitate management decisions by showing the total loss of heritage under different land-use scenarios. As the plot of the conceptual model below shows, natural and cultural heritage values take different trajectories under varying land use intensity. The model can also be extended to incorporate other values, such as ecosystem services or economic value.



Speed et al.'s (2012) conceptual model of how cultural and natural heritage vary along a gradient of land-use intensity in protected areas in north-west European mountain regions. x* indicates the land use intensity at which the sum of cultural and natural heritage peak. Recent trends in landscape change in Great Britain and Norway are denoted by arrows.

Consideration of the concepts modelled by Speed et al. is helpful in considering management decisions based on the combined values of natural and cultural heritage and the total potential total loss or gain. This helps management practitioners to seek the optimal solution overall, rather than focus on individual outcomes.

The integrated management approach is advocated as a holistic approach that embraces the management of natural areas together with visitor management (Newsome and Moore, 2001). In particular, there is evidence that ecotourism development initiatives can be more successful if

integrated with other sustainable development initiatives at the local or regional level, and with other sectors of the rural economy (Chauhan, 2006).

Sustainability is a key goal of integrated management. Unmanaged tourism and recreation is a significant threat to protected areas (Worboys et al., 2005). It is vital that the nature which people come to experience is preserved from damage due to tourism or other factors (Edgell, 2006). In preserving local values and authenticity, tourism experiences are also richer (Destination British Columbia, 2014). Developing an integrated management approach to asset managing and tourism planning through asset mapping facilitates this. The SHAPE case study below describes how a landscape character assessment identifies spatial units for a holistic, integrated management approach.

SHAPE Case Study: Holistic Landscape Approach to Management of Coigach and Assynt, Scotland (Williams et al., 2015)

Coigach is a peninsula in Wester Ross, and Assynt a neighbouring region. Coigach and Assynt Living Landscape Partnership (CALL) is a Heritage Lottery Funded Living Landscape Scheme which incorporates the North of the Wester Ross Biosphere. It is composed of a range of partners including Community Organisations, Scottish Wildlife Trust, Scottish Natural Heritage, North West Highlands Geopark and the Woodlands Trust. CALL commissioned a private company to produce a Landscape Character Assessment (LCA) for the Coigach and Assynt region. This aimed to identify units within the landscape with recognisably different identities, describing what makes each unit special. CALL takes a holistic and landscape-based approach to management. Instead of using estate or administrative boundaries, they encourage landowners and partners to work together to meet objectives for the environment, people and cultural heritage. As CALL is a recent initiative, the practical implementation of these ideas have yet to be tested.

This protected landscape approach links nature, culture and community to form a multi-dimensional stewardship that is founded on a participatory process. It focuses on natural and cultural resources, and their connection to the area. Mitchell et al. (2005) identify **seven key characteristics of the protected landscape approach**:

1. The protected landscape approach is bioregional in scale and represents a mosaic of designations and land uses.
2. The protected landscape approach embraces the interrelationship of nature and culture.
3. The protected landscape approach recognises the relationship between tangible and intangible values and the value of both.
4. The protected landscape approach is community-based, inclusive and participatory.
5. The protected landscape approach is based on cross-sectional partnerships.

6. The protected landscape approach is founded on planning and legal frameworks that create an environment of engagement through equity and governance for a diverse set of stakeholders.
7. The protected landscape approach contributes to a sustainable society.

The protected landscape approach protects ecosystems, ecosystem services and cultural heritage, while developing civic engagement and community education. This collaborative management approach can also have economic benefits in identifying and developing opportunities to improve the local economy and quality of life sustainably.

As so many diverse features and groups are included in such an integrated approach, there are many complications in preparing and delivering a management plan, as well as wider influences such as climate change and national or global economic conditions. Gaining and maintaining stakeholder involvement is crucial to the protected landscape approach but in practice is not always easy to secure, as some of the case studies for assets mapping demonstrate, and is also difficult to coordinate. As individual components and the whole system are both dynamic, planning must be flexible enough to adapt, an approach which shall be discussed in detail for climate change in Section 6. With the protected landscape approach being a relatively new concept in conservation management, in addition to it having to be tailored to individual sites, there is a lack of definition in procedure and shortage of long-term cases to contextualise and guide its use. Individual landscape systems while build on the framework of the characteristics outlined by Mitchell et al. (2005), must have their own specific approach formulated.

The UNESCO Biosphere Reserve concept was originally concerned with protecting and managing natural ecosystems. Reflecting the move towards integrated management, the concept evolved in the 1990s to incorporate communities and the sustainable use of ecosystems (Price, 1996). At the UNESCO Biosphere Conference in Seville in 1995, **three main objectives for biosphere reserves** were specified:

1. Conserve natural and cultural diversity
2. Be utilized as models of land management and of approaches to sustainable development
3. Be used for research, monitoring, education and training.

(UNESCO, 1996)

These objectives are goals for many parks and reserves around the world, and integrated management is increasingly the basis of planning. Nature conservation has become integrated with local needs and development (Frost, 2001), as The Wildlife Trusts' Living Landscape Scheme demonstrates.

Case Study: The Wildlife Trusts - Living Landscape, United Kingdom

A Living Landscape is a nature recovery plan that has been implemented by The Wildlife Trusts since 2006 that integrates nature conservation with the surrounding society and economy. There are currently 150 Living Landscape schemes around the UK, working restore wildlife in the landscapes

around them. Each Living Landscape scheme consists of core areas of high quality wildlife habitat, connections between core areas (stepping stones or corridors for wildlife) and permeability across the whole landscape. Many Living Landscape schemes also contribute sustainably to the local economy through employment opportunities, promoting locally grown food or marketing conservation grade beef from grazing herds (The Wildlife Trusts, 2017).

OnTrent is a project which is particularly informative on integrated management of a defined area. OnTrent is a long-term initiative to benefit local people and the natural and cultural heritage in the parishes along the River Trent in the English Midlands. Bringing together a collaboration of public, private and voluntary organisations, the scheme aims to reverse the decline in biodiversity along the River Trent by achieving a better balance between wildlife and agriculture, commercial activity and development. OnTrent specifically aims to improve the quality of life for local people and support the local economy by:

- Creating a rich diversity of linked wetland habitats along the Trent from Stoke to the Humber estuary;
- Encouraging sustainable practices in agriculture, forestry, mineral extraction and building development;
- Conserving and enhancing the river valley's historic and cultural identity;
- Encouraging environmentally sustainable recreation and tourism;
- Working with organisations and land managers to promote the value of wetlands and, where appropriate, re-establish natural processes in the floodplain.

(The Wildlife Trusts, 2006)

OnTrent projects that have already contributed to these aims include the Trent Valley Way, a long-distance route along the Trent Valley that connects a range of natural and cultural sites and towns and villages alongside which the Trent flows; and the Trent Vale project, which is working to connect the river to its people in the Trent landscape between Newark and Gainsborough through a range of community and environmental activities. One of the most ambitious projects planned is the Trent River Park, which aims to create a model park for the 21st Century that uses the power of water as a focus for sustainable regeneration of both the built and the natural environment along the water corridor. Flagship schemes for the park include the transformation of the Nottingham Waterside to a major new waterfront urban quarter and the regeneration of the Victoria Embankment into a sustainable urban park.

This example from the Living Landscape scheme illustrates some of the possibilities for development through integrated management of an area. However, it is clear such projects require sustained and coordinated effort from a large number of parties, as well as sufficient funding.

5.2 Tools and Frameworks for Managing Tourism Sustainably

Tourism is part of land management and development in parks and biosphere reserves, and an integrated management approach must incorporate this sector**. Integrated tourism development strategies should aim to maximise the benefits of tourism development while preserving the natural and cultural assets on which tourism depends.** While tourism is often associated with widespread

economic benefits for local areas, it can also bring problems (ECEAT and EUROPARC, 2012). Stresses of tourism can damage tangible assets, although Gunn (1994) argues that the greater risk to resources is not from the number of visitors but from lack of planning, policy and action to accommodate them sustainably.

Goeldner and Ritchie (2003) comprehensively describe the place of preservation in planning for sustainable tourism involving both natural assets and cultural heritage assets:

Natural Assets

1. All the stakeholders in tourism development should safeguard the natural environment with a view to achieving sound, continuous, and sustainable growth geared to satisfying equitably the needs and aspirations of present and future generations.
2. All forms of tourism development that are conducive to saving rare and precious resources, in particular water and energy, as well as avoiding as far as possible waste production, should be given priority and encouraged by national, regional, and local public authorities.
3. The staggering in time and space of tourist and visitor flows, particularly those resulting from paid leave and school holidays, and a more even distribution of holidays should be sought so as to reduce the pressure of tourism activity on the environment and enhance its beneficial impact on the tourism industry and the local economy.
4. Tourism infrastructure should be designed and tourism activities programmed in such a way as to protect the natural heritage composed of ecosystems and biodiversity and to preserve endangered species of wildlife. The stakeholders in tourism development, and especially professionals, should agree to the imposition of limitations or constraints on their activities when these are exercised in particularly sensitive areas – desert, polar, or high mountain regions, coastal areas, tropical forest or wetlands propitious to the creation of nature reserves or protected areas.
5. Nature tourism and ecotourism are recognised as being particularly conducive to enriching and enhancing the standing of tourism, provided they respect the natural heritage and local populations and are in keeping with the carrying capacity of the sites (p.430).

Cultural Heritage Assets

1. Tourism resources belong to the common heritage of mankind. The communities in whose territories they are suited have particular rights and obligations to them.
2. Tourism policies and activities should be conducted with respect for the artistic, archaeological, and cultural heritage, which they should protect and pass on to future generations. Particular care should be devoted to preserving and upgrading monuments, shrines, and museums as well as archaeological and historic sites, which must be widely open to tourist visits. Encouragement should be given to public access to privately owned cultural property and monuments, with respect for the rights of their owners, as well as to religious buildings, without prejudice to normal needs of worship.
3. Financial resources derived from visits to cultural sites and monuments should, at least, be used for the upkeep, safeguarding, development, and embellishment of this heritage.
4. Tourism activity should be planned in such a way as to allow traditional cultural products, crafts, and folklore to survive and flourish, rather than causing them to degenerate and become standardized (p.431).

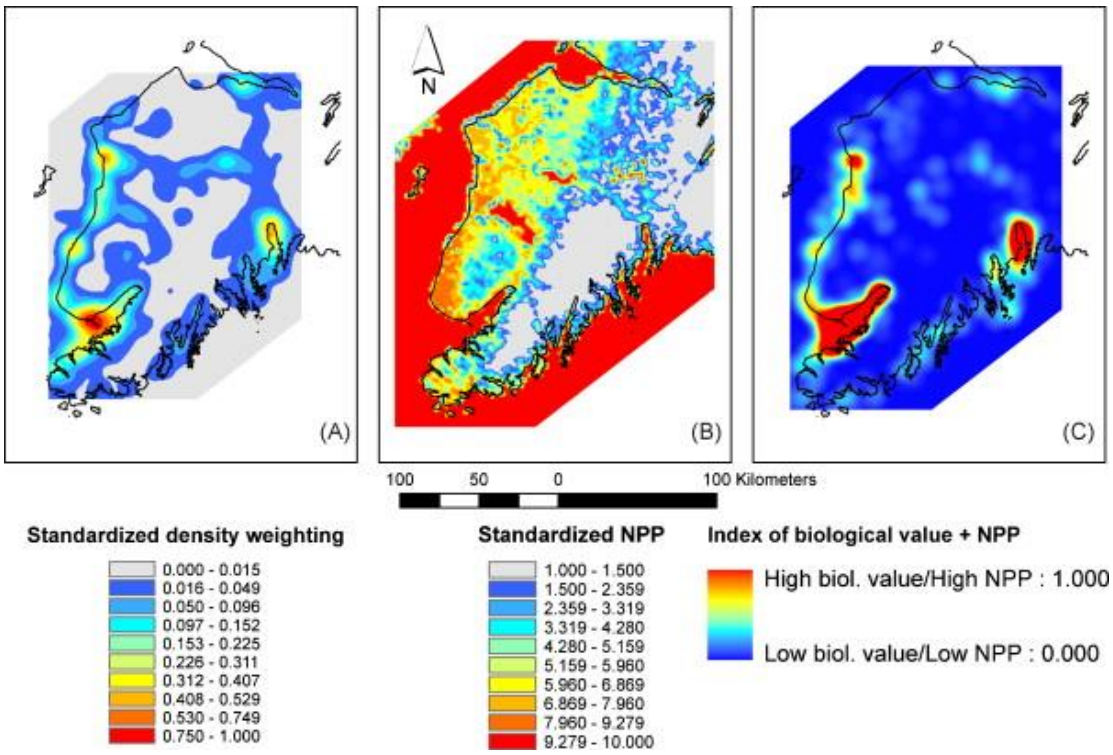
Maintaining these standards in management and planning requires measuring and monitoring visitor activity to ensure it remains within sustainable limits. One means of doing this is working within a **carrying capacity**, a term that has its origins in ecology before emerging as a tourism concept in an attempt to set targets for management (Wagar, 1964). Once maximum visitation levels are decided,

zoning can be used to prescribe the level of visitation permitted in a zone, depending on its environmental sensitivity (Elk Island, 2011).

Carrying capacity refers to "the level of use beyond which impacts exceed acceptable levels specified by evaluative standards" (Shelby and Heberlein, 1984). In other words, it is the maximum level of tourism at which the environment and infrastructure is able to cope without harm. Negative impacts from the stress of over-visitation or poorly planned tourism include erosion of land, overdevelopment or poorly planned development of structures, pollution, littering, noise, disturbance to wildlife, overcrowding at sites and facilities, and direct damage or vandalism to cultural or natural features (Brandon, 1996). Exceeding the carrying capacity also has a negative effect on the local people who feel overwhelmed and no longer welcome tourists, as well as on tourists themselves as services are stretched and resources overcrowded. GIS analysis in the Alaskan Kenai Peninsula, described in the next case study, demonstrates mapping areas of natural value at risk of exceeding their carrying capacity.

Case Study: Identifying Hotspots in the Kenai Peninsula, Alaska, USA (Alessa et al., 2008)

The Kenai Peninsula is a 240 km long peninsula in Alaska. The peninsula has a large glacier-capped mountain range, fjords and lakes of various sizes. It also has several of the most populous towns in the south-central region of Alaska, along with many smaller settlements. PPGIS was used to identify hotspots of conflicting interest between areas of social use and ecological importance. The analysis combined surveyed social use with measured ecological value to identify hotspots of conflict where the natural asset was at risk of harm from overuse. Community values were collected as point data for point density maps that were cross-correlated with an ecological map based on net primary productivity (NPP) as a measure of biophysical value. The study identified areas at risk of suffering overuse and was a contribution to a more coupled social-ecological system of management. The maps below show the results of the analysis.



Carrying capacity hotspot mapping in the Kenai Peninsula, Alaska. Image: Alessa et al. (2008).

Map A shows areas of high social value and use, while Map B represents the standardized index for net primary productivity. Map C is the result of a combined analysis of these. Areas at highest risk of overuse are shown in red, while areas at lowest risk are shown in blue. The identification of the hotspots, however, did not indicate which social activities would be compatible and those which would be in conflict with biophysical systems. It is possible that human activities could be carried out in these areas without causing substantial ecological damage. This would require further investigation by managers to determine the areas truly at risk from exceeding their carrying capacity; the map is useful in directing them to the relevant locations where they may need to implement strategies to return the area to balance.

Carrying capacity assumes a known and fixed relationship between use or visitation level and impact that is not necessarily reflective of tourist behaviour in practice. Carrying capacity also changes whenever management parameters are altered and is therefore neither fixed nor comparable across management boundaries. Such factors have led to it being described as "complex and confusing" (Hall and Page, 2006, p.147). Nevertheless, some form of assessing and managing access is required if resources are to be preserved from overuse and misuse.

Limits of Acceptable Change (LAC) (Stankey et al., 1984) is an alternative methodology that stops short of the critical limit imposed by carrying capacity. It defines minimal accepted conditions in areas of conflicting interests, so that management can intervene if conditions approach that state. LAC combines practices of design capacity for wilderness areas and estimation of effects of alternative use

levels on the environment. A broadly similar system is in operation in South Africa's National Parks where **Thresholds for Potential Concern** (TPCs) determine the point at which management intervention in an area is required (Biggs and Rogers, 2003).

Determining asset condition for carrying capacity, LAC or TPC can be established by assessing how it has changed in relation to one or two key values (Rogers et al., 2013). Rogers et al. recommend the limit is set by local asset managers, as they are in the best position to identify them. When this threshold is reached or approached, it should trigger management intervention. The case of the Lower Murrumbidgee River Floodplain demonstrates LACs and TCPs in use.

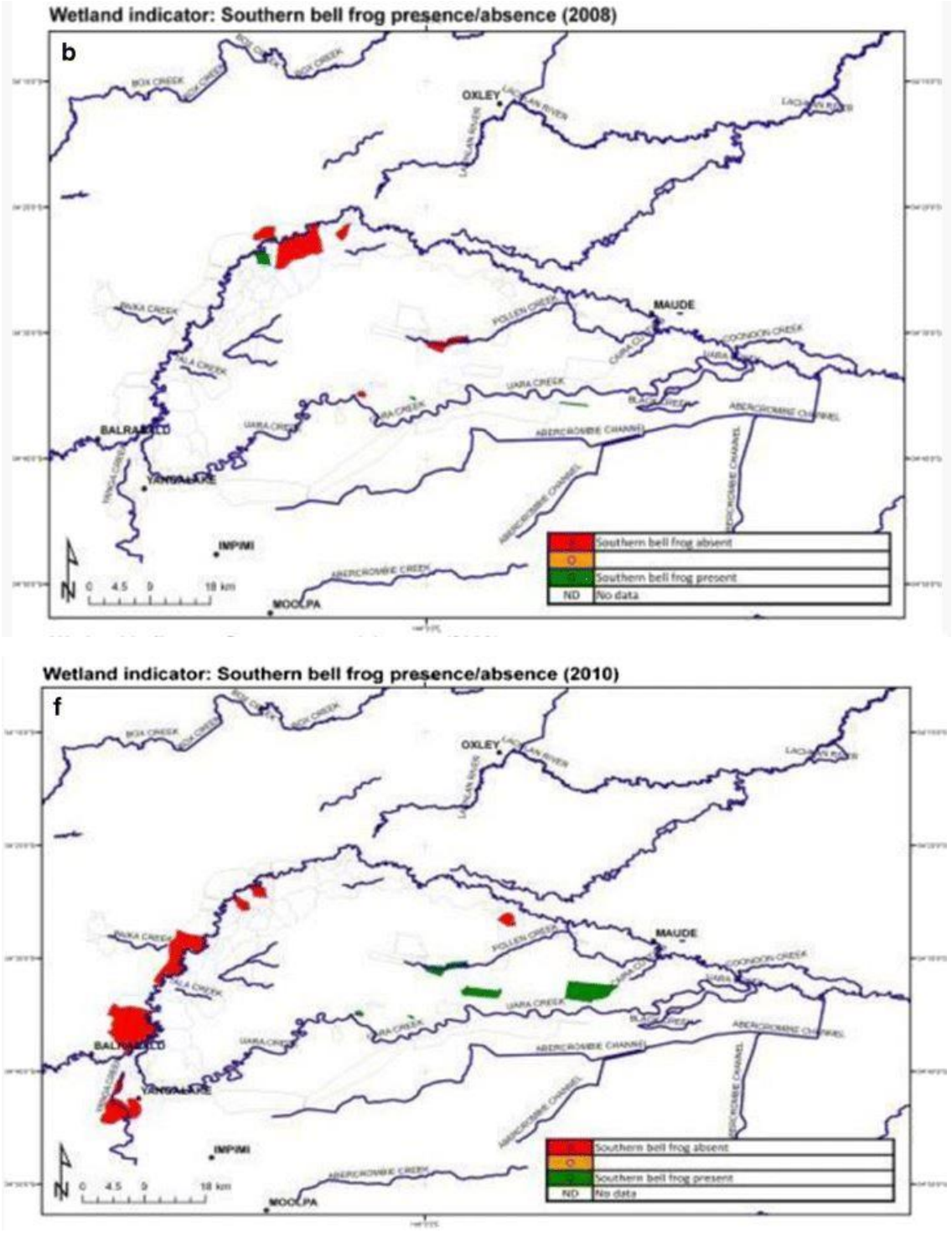
Case Study: Lower Murrumbidgee River Floodplain, Australia (Rogers et al., 2013)

LACs and TPCs were established for the Lower Murrumbidgee River floodplain in Australia. Key representatives of all relevant State and Federal agencies were brought together at a workshop where they defined the LACs by consensus and discussed TPCs with the aid of conceptual models linking threats to ecological values. The resulting agreed LACs as they relate to the key values are shown in **Table 5**. The TPC discussion resulted in a table with similar format but far more extensive content.

HCVAE criterion/value	Component or process	Limit of acceptable change
Vital habitat	50,000+ breeding pairs of waterbirds in favourable hydrological conditions	Less than 30,000 breeding pairs in three consecutive events of suitable climatic conditions, co-incident with loss of suitable hydrological and/or vegetated habitat
Representativeness	Second largest stand of river red gum (RRG) forest and woodland in Australia at 45 000 ha	Loss of 7,000 ha of RRG, i.e. loss of status as third largest stand
Distinctiveness	Stronghold of the southern bell frog, especially critical drought refuge	Reduction in distribution of mature frogs and tadpoles to 5 waterholes, threatening population viability
Diversity	Supports extensive area and diversity of wetland habitat including spike rush, RRG forest and woodland, Black Box woodland and lignum shrubland	Reduction in extent of spike rush by 20 % (measured post-flood against previous post-flood benchmarks). Reduction in RRG as above. Reduction in Black Box woodland and lignum shrubland by 20 % each

Table 5: Limits of Acceptable Change, Lower Murrumbidgee River floodplain (Rogers et al., 2013).

A chloropleth map, which displays data variables as coloured areas, was produced for each of the agreed TPC and LAC indicators, using a traffic light colour scheme. Red shows the crossing of the threshold or limit, green shows where it has not been crossed, and orange indicates the possible crossing of a threshold, given data variability. An example of the indicator maps comparing the presence or absence of southern bell frogs in 2008 and 2010 is below.



Chloropleth maps for southern bell frog TPC (Rogers et al., 2013).

These maps provide a geographic representation of the variability of the indicator. The areas where action is required are clearly indicated in red, and a timely management response can therefore be directed there.

Assessments of carrying capacity and LAC can be used to inform integrated tourism and conservation management strategies following one of several frameworks, including Tourism Optimization Management Model (TOMM), Visitor Impact Management (VIM), Visitor Experience and Resource Protection (VERP), Recreational Opportunity Spectrum (ROS), Tourism Opportunities Spectrum (TOS), Ecotourism Opportunity Spectrum (ECOS) and Protected Area Visitor Impact Management (PAVIM), as presented below.

The **Tourism Optimization Management Model** (TOMM) (Mandis Roberts Consultants, 1997) builds directly on the methodology of LAC to provide a management system. It monitors and manages tourism based on an LAC assessment, as opposed to the maximum carrying capacity, for a more sustainable outcome. TOMM combines knowledge, community values and opportunities with knowledge of optimal conditions and the point at which the limits of these are breached. Monitoring systems and management options are then built around these parameters. TOMM was devised specially to manage tourism on Kangaroo Island, as described below.

Case Study: TOMM on Kangaroo Island, Australia (Miller and Twining-Ward, 2005)

Situated 112 km southwest of Adelaide, Kangaroo Island is Australia's third largest island and has several nature reserves and a wealth of natural assets. It was also the development site for TOMM. For the TOMM system, collaborative community partnerships reached shared agreements on measuring, monitoring and evaluating processes, as well as funding and management support. The approach linked social, environmental and economic values, and incorporated the effects of tourism on these in order to plan at a wider level. Initially a set of 60 indicators for optimal conditions was identified. After assessing the extent to which each indicator would be useful and how feasible it would be to measure, these were then reduced to an agreed 17 optimum conditions and 23 indicators that are continually being refined in line with current conditions and knowledge. The main monitoring systems are a visitor exit survey and an annual resident survey, undertaken by an external agency. The management team then compares the monitoring information with the optimal conditions and communicates recommendations for any action required to stakeholders. The application of TOMM on Kangaroo Island has been successful, but it is acknowledged that this has been the result of "enormous ongoing belief and commitment in the process, as well as ongoing resources at an operational level" (Miller and Twining-Ward, 2005, p.227).

Visitor Impact Management (VIM) (Graefe et al., 1990) is the development of plans to reduce visitor impacts. This is done with the objective of preserving both the resources and the visitor experience. Visitor management could involve dispersing tourists or restricting numbers to relieve stress on sensitive areas. Other strategies include visitor education policies (instructing visitors where to go and how to behave), mandatory guides for visits, or employing on-site guardians to monitor visitors. Physical changes might include installing basic facilities such as toilets and litter bins where needed, building or reinforcing paths, creating designated parking areas or increasing hotel stock. VIM is demonstrated in the example of Krakow Old Town.

Case Study: Visitor Impact Management in Krakow, Poland (Airey, 1998)

Krakow, Poland. Image: Rj1979 [Public domain], via Wikimedia Commons.

Krakow Old Town was the political centre of Poland between 1038 and 1596, and in 1978 was among the first sites to be inscribed on the UNESCO World Heritage List. It is one of the most visited places in Poland. Visitor management strategies were employed in Krakow to manage numbers and preserve the Old Town. Visitors were encouraged to visit sites away from the Old Town through publicity and the development of other cultural sites outside this area. There was also the introduction of a timed booking scheme at the Royal Castle to limit the size of groups and times of entry. These strategies reduced visitor impact on this popular area.

Visitor Experience and Resource Protection (VERP) (Manning et al., 1995) is an alternative visitor management framework in which the limit is defined by the quality in condition of the resources and the main aim in visitor management is to enhance the quality of the visitor experience. This is a more visitor-oriented approach than solely managing impacts, as is shown in the following Malaysian case study.

Case Study: VERP at National Elephant Conservation Centre, Malaysia (Rahman et al., 2010)

VERP was chosen as a management plan for the National Elephant Conservation Centre at Kuala Gandah, Pahang, in Malaysia because of its capacity building approach to recreation and tourism, as well as its aim of minimising the environmental impacts of these activities. Data for the VERP planning was gathered by visitor survey and interview, as well as observations. Responses were gathered from a total of 64 visitors of local and international origin. The survey gathered information on nine key areas affecting quality of resources and visitor experience:

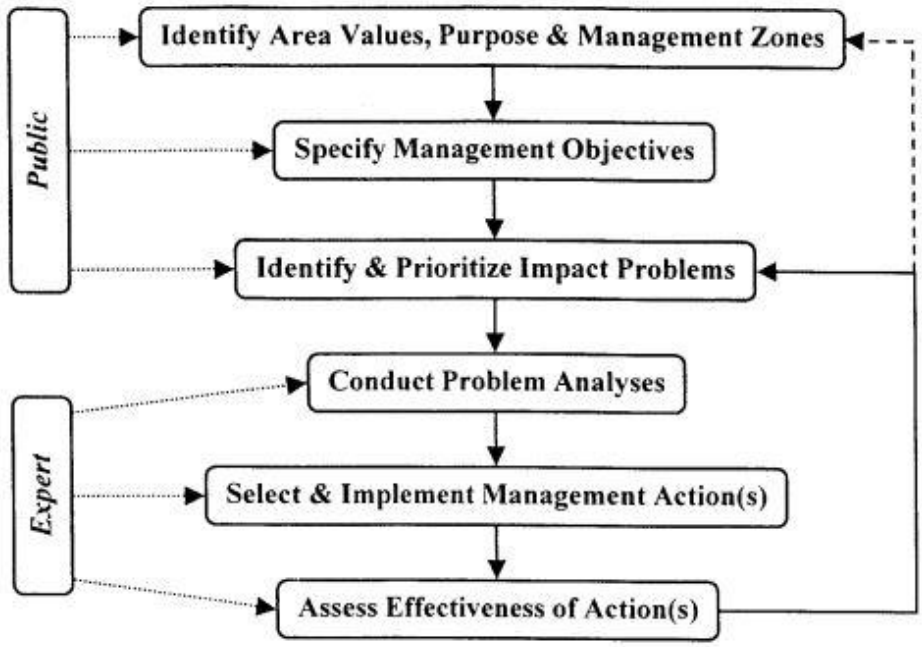
i) socio demographic characteristics of visitors
ii) characteristics of KGECC (location, duration, group size, etc.)
iii) overall park visitation patterns (frequency, activities, reasons for visiting)
iv) experience of social impacts (crowding, user group conflicts, depreciative behaviour)
v) attitudes and knowledge about the park and its ecological elements
vi) evaluation of resource conditions (soil/plant damage, litter, etc.)
vii) trail users' interactions with park wildlife
viii) evaluations of park facilities
ix) evaluations of current management actions and preferences for future management

(Rahman et al., 2010, p.263).

The results of this research were used to inform planning for the management of tangible assets such as the flora and fauna; intangible assets such as naturalness and opportunities for social encounters with other visitors; and visitation issues such as overcrowding based on visitor preferences. Rahman et al. concluded that the centre was having an overall positive impact on tourists and local visitors, however the signs of human use adversely affected the centre's appearance and work was needed to reduce this and enhance the naturalness in its appearance. The park management team were satisfied with the application of VERP at the National Elephant Conservation Centre and intended to monitor it as a continuous process.

Recreational Opportunity Spectrum (ROS) (Clark and Stankey, 1979) was developed in the USA and is based on carrying capacities and managing within them. It does not focus on visitor numbers or amount of use, but on the level of biophysical and social harm. Its purpose is to manage recreational impacts by identifying which recreational activities can be sustainably undertaken in an area, which areas the visitors prefer, and which areas can withstand recreational use. In Canada, the broadly similar methodology of the **Tourism Opportunities Spectrum** (TOS) has been used (Butler and Waldbrook, 1991), and for ecotourism the framework was again adapted for the **Ecotourism Opportunity Spectrum** (ECOS) (Boyd and Butler, 1996).

Protected Area Visitor Impact Management (PAVIM) (Farrell and Marion, 2002) is a framework that is less expensive and simpler to implement. It is built on public participation by requesting stakeholders identify values and management zones, as well as stating development objectives and impacts that need mitigating. The process for PAVIM is illustrated in the figures below.



Problem analysis steps	
I.	IDENTIFY AND EVALUATE THE PROBLEM
A.	Statement of the problem(s): Concise summary describing the primary resource and/or social visitor impact problems.
B.	Description of problem(s): Brief descriptions of each impact.
C.	History and context of the problem(s): Summary of how the problem developed, previous management interventions and their effectiveness.
D.	Causes and influential factors: Causes and influential factors – evaluation of the underlying causes and influential factors that may intensify impacts. Consideration of user-related factors (e.g. type and amount of visitor use, visitor behaviour and use density), environmental factors (e.g. topography, soil and vegetation type) and managerial factors (visitor management and the siting, design, construction and maintenance of facilities).
II.	IDENTIFY AND EVALUATE STRATEGIES AND TACTICS
A.	Develop a comprehensive list of appropriate and potentially effective management strategies and tactics for each impact.
B.	Evaluate the potential effectiveness, management feasibility (cost, staffing, long-term maintenance), costs to visitor freedom-satisfaction and expected visitor compliance for each strategy and tactic.

The PAVIM Framework and PAVIM problem analysis procedure (Farrell and Marion, 2002).

Placing the framework in the context of actual and potential use has resulted in a tailored integrated management plan specific to local needs that involves stakeholders to achieve community goals. Such site-specific management planning has been praised as having far more value than generic planning methods designed for application everywhere (Alexander, 2008).

PAVIM was created for management of selected protected areas in Central and South America at the request of the Mexican protected area managing agency PROFAUNA. No published results of the application of PAVIM were found.

The assessment strategies and management frameworks described demonstrate that **by mapping places at risk, managers are directed to critical areas and can take appropriate action to preserve them and plan for their future use**, as is demonstrated in the case of the Grampians National Park.

Case Study: Managing for Resiliency in Grampians National Park, Australia (Arrowsmith and Inbakaran, 2002)

The Grampians National Park in Victoria, Australia was designated a national park in 1994. It covers 1672 km^2 and is most notable for its series of sandstone mountain ranges. A resiliency estimation was conducted for the Grampians National Park for use in planning for increased tourism. This combined existing biophysical digital data with field measurements and estimated a level of impact derived from predicted visitor numbers. Then, by employing multivariate techniques and extrapolating the resultant factor across the region, it was possible to produce a resiliency map. The results suggested that the lower parts of a popular walking track were at risk of damage through over-use. This led to the recommendation that multi-path trails be installed in the vulnerable area, converging eventually on the more resilient ground, to disperse tourists throughout the sensitive areas. While more areas would be impacted, the overall damage would be lessened.

Assets mapping can also be used in integrated management planning to identify strengths and gaps in the form of a **SWOT analysis**. A SWOT analysis is a simple framework for identifying these attributes (Pickton and Wright, 1998), and is a popular planning model for tourism because it balances multiple factors to lead planners to a best-fit plan (Wickramasinghe and Takano, 2009). SWOT stands for Strengths, Weaknesses, Opportunities and Threats:

Strengths are the attributes in which the area has good provision or outstanding quality. They are factors which set it apart from similar places. Strengths might include a wealth of old buildings, outstanding scenic value or an established reputation and popularity.

Weaknesses are attributes in which the area is deficient, either by nature or through poor planning or other lack of facilities. These can identify gaps where improvements can be made. Weaknesses could be a shortage of parking facilities, or isolated location.

Opportunities are primarily influenced by outside factors. They identify areas in which events or trends can be taken advantage of. Opportunities could include walking trails development.

Threats are also the result of outside influence. They are factors which may impact upon an areas success by limiting use or damaging assets. Threats might involve climate change or changing market circumstances.

A sample SWOT analysis, conducted for the Cairngorms National Park in Scotland, is given below.

Case Study: Cairngorms National Park SWOT Analysis, Scotland

Cairngorms National Park, in the northeast of Scotland, is the largest national park in the British Isles, covering 4528 km^2. The park has a diverse landscape of mountain territory, lochs, ancient Caledonian forests, moorland and farmland, and is also a popular tourism destination.

Strengths	Weaknesses
• Magnificent scenery • High wilderness plateau • Extensive natural woodland • Straths, rivers, glens • Extensive biodiversity with easily seen iconic wildlife • National Park designation • Range of outdoor activities • Royal heritage and connections • Relative accessibility • Leading UK ski destination • Cairngorms Business Partnership • Ranger services/events • Strong brand identity	• Quantity and quality of accommodation and catering • Divided area – physical, historic, institutional • Public sector co-ordination • Limited cultural offer • Housing for staff • Few large enterprises • Levels of professionalism and service • Public transport • Clarity of outdoor access opportunities
Opportunities	**Threats**
• Developing National Park awareness • Recognition of economic significance of tourism in the Cairngorms National Park • Domestic market • Growing interest in environment/wildlife • Growing interest in activities/health related experiences • Search for authenticity and local distinctiveness • Public sector realignments and need to work together • Local sense of community as basis for action • National Park expansion • Policy focus on sustainable development	• Longer recession • Viability of enterprises • Public spending cuts • Continued divisions • Climate change – reliability of snow etc • Impact of development and access on biodiversity and landscape • Impact of tourism on land management and other activities • Dependence on car-based travel • Perceived inter-user conflict

Image: The Cairngorms National Park (2011).

This SWOT analysis for sustainable tourism in the Cairngorms National Park, Scotland, over the five-year period 2011-2016, was produced mainly from a public consultation exercise. It was also informed by other activities including a stakeholder workshop, online survey, visitor survey, interviews, analysis of market data, and review of existing policy documents, research studies and reports.

The outcome of a SWOT analysis is then used to assist strategic planning in the area (Wickramasinghe and Takano, 2009; Reihanian et al., 2012).

5.3 Linking Assets

Tourism is a highly decentralized industry. **Many of the assets identified in mapping exercises will have potential links that, if developed, could enhance visitor experiences and improve prospects for local enterprises.** A UNESCO tourism study (UNESCO, 2005) indicates that tourists are increasingly physically and intellectually active, and therefore demand for recreation, adventure and cultural experiences has grown. Yet natural and cultural heritage management professionals and the tourism industry often operate in isolation of each other, resulting in missed opportunities to provide optimum visitor experiences and manage tourism in a sustainable way.

Lockwood (2006) identifies five types of protected area values that could be linked:

(i) Intrinsic value – e.g. fauna, flora, ecosystems, landscapes/seascapes

(ii) On-site goods and services – e.g. plant products, animal products, recreation & tourism, representations (such as films), historic sites and artefacts, scientific knowledge and research, education

(iii) Off-site goods and services – e.g. human life support, non-human life support, water quality and quantity, air quality and quantity, fishery protection, agriculture protection, protection of human settlements

(iv) Community value (non-material) – culture, identity, spiritual meaning, social well-being, bequest for future generations

(v) Individual value (non-material) – satisfaction (existence), satisfaction (experiential), physical health, mental health, spiritual well-being

(Lockwood, 2006, p.103)

For integrated ecotourism management, it is necessary to link the mapped assets, facilities and values in a cohesive way. The **area needs to be packaged** by linking assets and services, such as transport and accommodation.

Asset mapping can assist with linking assets by identifying geographical clusters or thematic links. Linkages and networks between assets and service providers are mutually beneficial, and can be business-based or information-based (Griffin 1994).

Route tourism is a distinctive type of asset linking. It is "a linkage together of the tourism resources of a number of smaller centres and collectively marketing them as a single tourism destination region"

(Rogerson, 2007, p.49). Routes might be designed to be travelled on foot, by bicycle, car, horse or other means. They are considered to be a very effective means of dispersing tourists around a geographical area (Rogerson, 2007), particularly in the development of less mature or infrequently explored tourist areas (Meyer, 2004). In addition to geographical dispersion, **routes can also be developed and promoted to encourage seasonal dispersion** (Santarem et al., 2015), reducing tourism pressures at peak times and encouraging year-round economic benefits from tourism.

Route tourism can be encouraged by using an assets map to create itineraries that bring together attractions and businesses in the area. Lourens (2007) views a thorough assessment of the region's tourism assets and needs as an essential starting point for route tourism development. This audit of tourism assets and products, including the natural environment, man-made products and human assets, is one of the key steps on **Lourens' roadmap for route tourism development**. A summary of this roadmap comprises seven steps:

1. Conceptualise the route on the basis of solid market research that identifies key target markets and their requirements.
2. Conduct an audit of tourism products in the designated area.
3. Scrutinise the tourism assets and identify the unique selling features of the area and its products.
4. Determine the size of the potential membership base and encourage product diversification.
5. Finalise the membership plan and determine a clear brand identity for the area.
6. Determine a clear strategy to direct the work plan and day-to-day operations of the organisation.
7. Plan the long-term finances.

(adapted from Lourens, 2007).

A study by Denstadli and Jacobsen (2011) revealed the crucial role of roadside facilities in achieving overall satisfaction and loyalty among motor route users, highlighting the need for route managers to improve the quality of these as a priority. Rest areas and opportunities to pull over at scenic viewpoints are also important in encouraging visitors to stay longer and to make return trips (Vegdirektoratet, 2004). Supporting this perspective, Denstadli and Jacobsen (2011) claim developing picnic areas may be the single most important factor in developing roadside facilities.

Rogerson identifies **five factors that are particularly significant for success of tourist routes**:

- Cooperation networks, regional thinking and leadership
- Product development, infrastructure and access
- Community participation, micro-enterprise development and innovation
- Information and promotion
- An explicit pro-poor focus (i.e. tilting the project to provide the greatest benefits to those most in need of them).

(Rogerson, 2007, p.52).

In an examination of tourism routes, Olsen (2003) argues for the importance of a fully integrated package, claiming "routes are more than just roads with signage promoted to visitors. If developed in

cooperation with a range of agencies, they should be part of an integrated visitor information network which starts with maps and brochures, flows through road signage and interpretation to attractions on the ground" (Olsen, 2003, p.335). Pre-planning information is also essential. Over 60% of the route planning for a longer-haul journey was found to be done prior to departure (Olsen, 2003). Information, therefore, must be available to tourists at this stage in a format that makes the area accessible to them. Some examples of such integrated packages and their online planning resources are presented as case studies.

Case Studies: Self-Driving Tours in Scotland, Norway and Canada/USA

The North Coast 500, or NC500, is a 516 mile (830 km) scenic road route around the north coast of Scotland, launched in March 2015, that starts and ends at Inverness Castle. It also passes through SHAPE Partner Wester Ross Biosphere Reserve. Designed by the North Highland Initiative to bring together the best of the North Highlands of Scotland in one iconic touring route, the NC500 aimed to open up a fresh tourist market targeted at car and motorbike users, as well as cyclists (Munro, 2015).

Visit Scotland report that the NC500 has helped increase tourist visitor numbers to places on the north west coast, citing increases in numbers at its visitor centres of 30% in Ullapool, 27% in Durness and 25% in Thurso (BBC News, 2016). The route is packaged and presented with a series of itineraries, available on the NC500 website. There are different itineraries for different interests, with themes including 'food and drink,' 'golfing,' 'history, heritage and archaeology' and 'active adventurer,' as well as separate itineraries for motorcycles and cyclists. Maps for accommodation by type are also available to assist with planning. There is a map showing luxury accommodation and food and drink along the route, as well as one detailing campsites and their full range of facilities offered.

A similar type of self-drive tour packages are promoted for Norway by Nasjonale Turistveger: National Tourist Routes in Norway. They provide 18 scenic routes of varying distances as suggestions for people's holidays, with details of stops to make for attractions and travel arrangements for the tour. While these routes have been created with scenic aspects as a priority (Denstadli and Jacobsen, 2011), the Norwegian Public Roads Administration has stressed the need for quality accommodation and eating options for a route's success (Vegdirektoratet, 2004).

In the United States of America and Canada a tour guide app called GyPSy Guide is available for Android and Apple to direct independent tours along scenic drives. It uses the device's location abilities to automatically play commentary on the background stories of features along the route and to recommend places worth stopping at. Its major selling points are that it is cheaper and more flexible than a scheduled tour.

Routes can be the general packaging of a variety of tourist attractions linked by their geographical proximity and ease of access from one another, or they could be thematic routes. Some examples of thematic routes are promoted in Galloway and Southern Ayrshire.

SHAPE Case Study: Linking Assets in Galloway and Southern Ayrshire, Scotland

Wild Seasons arose from a previous Southern Uplands Partnership project, Nith Estuary Nature Based Tourism, that brought together private, public and third sector nature-based bodies seeking to promote the region for its wildlife importance. Under the Wild Seasons title, this group developed a central online resource website offering information and advice to businesses wishing to make nature-based tourism an integral part of their operation.

One of the Wild Routes – The Flooders Trail. Image: Wild Seasons (2017).

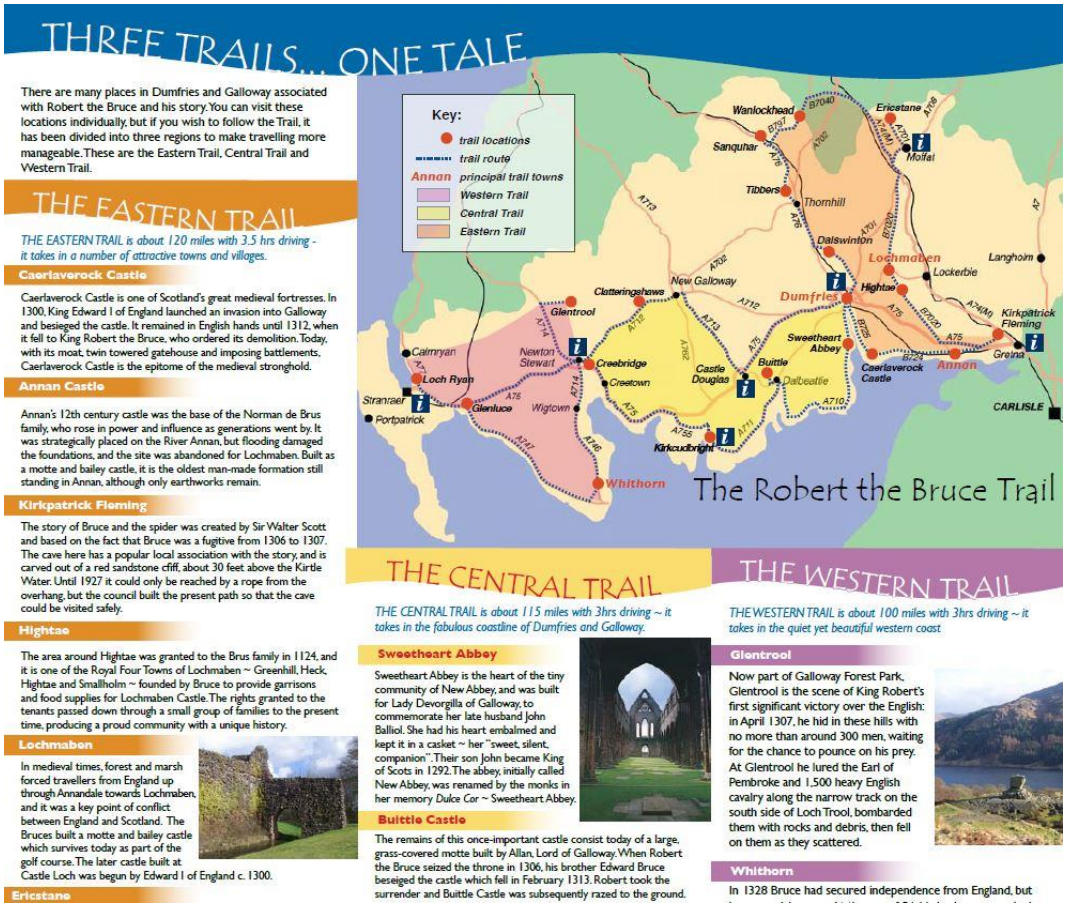
The first phase of Wild Seasons was intended to enhance the capacity of businesses and nature-based bodies in the region to identify, synthesize and promote wildlife attractions to the wider public over the long term. This led to the creation of the Wild Seasons website which featured natural sites, trails and individual walks in Dumfries and Galloway with the greatest potential for viewing wildlife. Phase 2 aimed to develop more information on the wildlife sites and to link them to create a more coherent visitor product, including a series of self-guided visitor itineraries, known as Wild Routes. These would be promoted using information on the range of local accommodation, visitor attractions and other

facilities, plus wildlife events, in order to retain visitors in each area. Wild Seasons is promoted online through its website, Facebook and Twitter. The website facilitates greater linkages between natural attractions, events and businesses, offers opportunities for joint promotions, and provides greater and more up to date information to both businesses and consumers.

The identifying and synthesising of the mapping of nature-based sites worked well in populating the website, but promoting the website and products like the Wild Routes was difficult due to the complexities of individual organisations, mainly public sector and some larger NGO's, involved in the working group, which had marketing systems that were typically managed centrally and difficult to influence the content of.

Another example of a thematically linked tourism map in the region is the Robert the Bruce Trail. This features three driving routes visiting the many locations associated with Robert the Bruce. These are a range of heritage assets, including castles, abbeys, battle sites, churches and museums. This map links these attractions but, unlike Wild Routes, does not link them with other assets such as places to buy food and drink, accommodation or picnic sites, aside from identifying towns with tourist information centres.

Though it does not function as a comprehensive single tourism map, it does draw focus to a marketable theme that will encourage tourists to explore the region and visit sites they might not journey to, were they not linked to the others in this way.



The Robert the Bruce Trail. Image: Sulwath Connections.

While driving tours are a popular form of route tourism, there is also a growing market in Slow Travel, which makes use of public transportation, and cycle and walking paths. It is comprised of both holiday style choices and travel mode choices, with travel an integral part of the experience: "By travelling slowly, people are not just part choosing a mode of transport, but they are also negotiating with the place, the environment, their personal identity as a tourist (Dickinson et al., p.282). It is a more environmentally friendly way to travel, though not necessarily influenced by a tourist's environmental concerns (Germann Molz, 2009), but requires the tourism structures and facilities to support it. To encourage more people to choose slow travel, the limiting travel supply structures must be addressed (Dickinson et al., 2011). **Only by establishing a good transportation system and strong, well-mapped linkages between sites and services can area managers facilitate tourism movement for more sustainable forms of route tourism to thrive.**

The NPA project Slow Adventure in Northern Territories (SAINT), running for three years (2015 to 2018) may be of assistance to anyone seeking to create slow travel packages that link assets in an area. The main objective of the project is to develop, test and disseminate to businesses new marketing models that will enable them to more effectively market slow adventure experiences. Slow adventure campaign guidelines and digital marketing guidelines have been produced and are available on the SAINT website.

Networks linking assets and facilities or services can be brought together by local authorities or organisations in this manner, or they could be official business or information-sharing linkages. Griffin (1994) identifies business networks as having one of three main purposes. These are networks primarily relating to marketing, networks designed to reduce costs, and networks which are run to be of highest management efficiency. They are **financially-focused linkages** and can take the form of franchises or independent business networks. Franchises are highly standardised in appearance and have formulaic joint management, purchasing, and marketing arrangements. Independent business networks, including consortia, may have joint marketing, including branding under a network logo, and also group purchasing power but without the standardisation and management control of franchises.

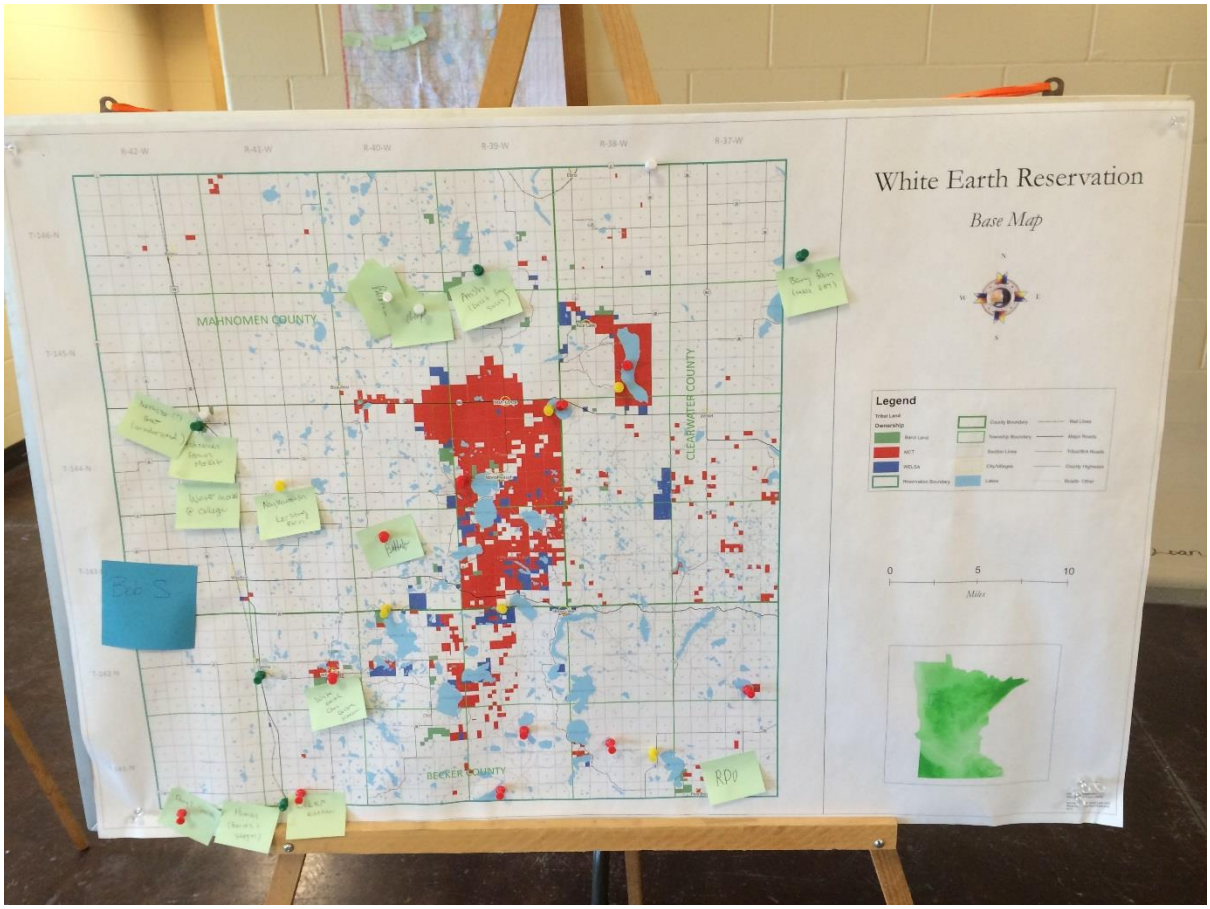
Knowledge-based networks promote the free flow of information which informs decision making and helps reduce risk. Information is of higher quality and more timely when it is the combined effort of a larger linked entity. Skills and experiences can be shared, and cooperative marketing or shared promotions can increase business. Such information-based networks can be as simple as shared marketing and, with the correct commitment and coordination, are relatively easy to maintain.

An example of mapping and linking assets together under shared marketing and retail is the foodshed mapping exercise undertaken by the White Earth Land Recovery Project in Minnesota, USA.

Case Study: Anishnaabe Foodshed Mapping, Minnesota, United States of America

The White Earth Land Recovery Project (WELRP) has worked for over 25 years to recover land for the indigenous Anishnaabe people in Minnesota, USA. The project has also aimed to help people use this land to sustainably produce the food that communities needed. To this end, WELRP has worked to secure fair prices for the traditional wild rice harvesters, prevent the University of Minnesota from producing genetically engineered wild rice, and return heritage corn and bean varieties to the reservation (Hoover, 2015). Another large part of the heritage element of the project has been the acquisition and storage of over a hundred seed varieties.

Producing the heritage food was only one side of the equation. To facilitate the integration of the food production and the consumption of food in the communities, a foodshed mapping exercise was undertaken.



The Anishnaabe food map. Image: Elizabeth Hoover (Hoover, 2015).

During this exercise, communities on the reservation identified food assets and needs, representing them on a paper map with post-it notes. Consumers were then provided with information on where they could go for local produce, and producers were made aware of target markets and any gaps in provision. In addition, the WELRP sells Anishnaabe produce from the network of producers on the reservation under its Native Harvest Retail scheme, which operates through a store and online.

5.4 Transportation Management

One of the most important elements in linking assets is transportation. How visitors travel and the packaging of the destination are crucial in determining the level of sustainability (Sorupia, 2005). Transportation is an integral part of the tourism industry, as **tourism cannot thrive without sufficient transport links between assets and services** (Sorupia, 2005). It is also necessary for the operation of support services and facilities such as fuel stations, accommodation and food and retail outlets (Culpan, 1987). The growth in ecotourism partly results from the ease with which modern transportation allows people to access remote areas (Honey, 1999).

Transportation can also have negative impacts on the tourism experience (Page and Lumsdon, 2004). **Poorly managed tourist transportation can degrade the natural environment, to the detriment of the people, heritage and biodiversity in the area and also to the detriment of the tourists' experience** (Croall, 1995; Sorupia, 2005; Robbins and Dickinson, 2007). The environmental consequences of transport include noise, localised air pollution, greenhouse gas emissions, traffic congestion, accidents, visual intrusion, impact on flora and fauna, and community severance (Acutt and Dodgson, 1997).

A review of that literature on how transportation might be optimised in an ecotourism setting suggested one of the most crucial issues was reducing dependency on the car as a mode of transport. As Herala (2003) stated, for any transport system to be environmentally and socially sustainable, there must be less use of cars and improvements in provision for public transport, walking and cycling. The utilisation of sustainable modes of public transport, vehicle hire and private tour companies may also be an option. Typical examples of these include the use of electric-powered or bio-fuel vehicles, and availability of bicycle tours and hire. Cullinane and Cullinane (1999) argue that alternative forms of transport in national parks must be improved and marketed so that people consider them to be viable options.

While parks and reserves have little control over external transportation networks, it is possible to manage the internal transportation network to reduce the environmental impacts from vehicles. Cullinane and Cullinane (1999) found that the majority of traffic management schemes that have been implemented and advocated are based on incentivising the use of alternative forms of transport rather than the car. However, their survey of visitor attitudes towards traffic problems and public transport in the Dartmoor and Lake District National Parks in England revealed driver attitudes to public transport in the parks was so negative that to increase alternative transport use, policies would have to ensure an integrated package of both incentives for these alternative forms and disincentives for car travel.

There are some regulatory instruments and market mechanisms that can be used to manage car traffic in parks and reserves. **Price-based policies** are various taxes and charges for driving or parking that act as a market mechanism to drive down vehicle usage. These are most effective when used in combination with area public transport subsidies and service improvements, otherwise they may simply discourage people from visiting (Acutt and Dodgson, 1997). **Regulatory instruments** include vehicle use restrictions, restricted parking with the provision of additional parking elsewhere and ideally also improved public transportation, and traffic calming measures (Acutt and Dodgson, 1997).

Traffic calming schemes are designed to reduce traffic speeds and to divert traffic away from environmentally sensitive areas They can be engineering measures, such as speed humps or chicanes, enforcement measures, such as speed limits or one-way roads, or education measures, most typically publicity campaigns (City of San Jose, no date). While traffic calming measures should reduce road accident rates (Acutt and Dodgson, 1997) and nitrogen oxide emissions (Abbott et al., 1995), they could also result in some negative environmental effects including a rise in fuel consumption, carbon dioxide, carbon monoxide and volatile organic compounds emissions (Abbott et al, 1995).

An improvement in public transportation would be beneficial to the environment and to businesses along the route who would benefit from improved links giving new customers access to them. The development of cycle paths and footpaths would also encourage the use of more environmentally friendly transport, as well as slowing the visitor down to engage more with local businesses and experiences.

5.5 Updating the Assets Map

One of the characteristics of natural or cultural values is that they are often not static. They are social constructs and are influenced by culture and experiences:

"Our understanding and appreciation of natural and cultural values is significantly different from that of 50 years ago, of 100 years ago. No doubt future generations will have different values than our own" (Lockwood, 2006, p.101).

While some natural and cultural assets are permanent, many come and go over time. Views within communities also change over time as opportunities emerge and problems arise (Agrawal and Gibson, 1999). Once a map has been created, the process for updating it should therefore be agreed as part of the management program. There must **be tools or arrangements in place to add new listings**. In general, the more people who have access to update the assets listed, the more likely it will continue to be accurate and relevant. It is also important to **periodically review the map to ensure entries are still relevant and delete them if necessary**. This review might be carried out by government or park management staff, key community figures or individual organisations associated with the map.

5.6 A Summary of Using Asset Mapping for Integrated Management

This section introduced the concept of integrated management, with specific reference to integrated management of natural and cultural assets for ecotourism. **Integrated management** is recommended as a holistic approach that manages the natural and human elements of an area together (Newsome and Moore, 2001). Integrated tourism development strategies should simultaneously aim to maximise the benefits of tourism development while preserving the natural and cultural assets on which it is built. A **protected landscape approach** links nature, culture and community to form a multi-dimensional stewardship (Mitchell et al., 2005). The participatory process on which protected landscape management is founded is supported by the literature on participatory mapping discussed earlier and is a cornerstone of the biosphere reserve concept (Stoll-Kleemann and Welp, 2008).

Mapping assets is important in integrated management as it helps managers to think strategically about the resources they have, and how to plan for their sustainable use. A landscape character assessment can identify spatial units for an integrated approach (Williams et al., 2015). Measures

such as identification of areas in danger of conflicting interests, carrying capacity and LAC can inform management strategies, and frameworks like TOMM, VIM, VERP, ROS, TOS, ECOS and PAVIM are available to structure planning. The main characteristics of each of these are summarised in **Table 6**, below.

Tool/Framework	Characteristics
Carrying Capacity	• Maximum level of tourism at which environment and infrastructure can cope • Assumes a known and fixed relationship between visitation and impact that is not necessarily reflective of reality
Limits of Acceptable Change (LAC)/ Thresholds for Potential Concern (TPC)	• Imposes a limit at minimal accepted conditions • When this threshold is reached, management intervene
Tourism Optimisation Management Model (TOMM)	• Management system built on monitoring and managing to LAC • Incorporates knowledge, community values and opportunities • All recommendations for action are communicated to stakeholders
Visitor Impact Management (VIM)	• Visitor management framework to reduce impact of visitors • Comprises provision of facilities, visitor restrictions and visitor education
Visitor Experience and Resource Protection (VERP)	• Visitor management framework • Limit is defined by the quality in condition of resources • Visitor-oriented approach that aims to enhance the quality of the visitor experience
Recreational Opportunity Spectrum (ROS)/ Tourism Opportunities Spectrum (TOS)/ Ecotourism Opportunity Spectrum (ECOS)	• Based on carrying capacities • Focuses on the level of biophysical and social harm, rather than on visitor numbers • Management of impacts by identifying which activities can be sustainably undertaken in an area, which visitors prefer, and which areas can withstand the use
Protected Area Visitor Impact Management (PAVIM)	• Less expensive and simpler to implement than other frameworks • Tailored integrated management plan specific to local needs • Built on public participation for identifying values, objectives and problems • Plans formed from this by expert analysis and action

Table 6: Characteristics of various tools and frameworks for sustainable tourism management.

Asset mapping is also integral to linking assets and can add value to visitor experiences and improve opportunities for local businesses and organisations. Linkages and networks between assets and service providers are mutually beneficial (Griffin, 1994). Collaborative networks can facilitate linkages between cultural and natural attractions, and businesses and service providers (Wild Seasons, 2017).

These linkages can have a financial element or be based on knowledge and information (Griffin, 1994). In order to link assets, they must first be mapped so that their presence is known and links can be visualised, and it is vital that the asset map remains usable. Assets and their value will change over time (Agrawal and Gibson, 1999; Lockwood, 2006) and it is important to update the assets map to keep it relevant for use in management planning. This requires there to be an individual or group responsible for the map and updating it.

6. Climate Change in Future Planning

6.1 Impacts of Climate Change on Assets and Ecotourism

Climate change will be a key driver in future landscape change and of particular relevance to nature-based tourism, therefore it is important to consider it in management plans (Natural England, 2015). As ecotourism is such a varied sector of the industry, climate change impacts are diverse and difficult to assess. Potential impacts of climate change on assets and infrastructure may be general to the tourism sector as a whole, or specific to ecotourism and therefore affecting only the infrastructure, natural assets or activities associated with nature-based tourism and ecotourism initiatives. Some common risks experienced locally might include coastal erosion, sea level rise, water acidification, eutrophication, an increase in extreme events (storms, wind, etc.), flooding, drought, glacier melt, shorter snow season, species invasion and species extinction. Potential impacts vary by region and biome, however, and care is required to avoid over-generalisation and maintain a localised focus when planning strategies.

Caring for assets in the context of climate change is an important part of their management. Baron et al. (2009) describe the foundation for initiating and maintaining climate change-related management as including prioritising resources and processes at risk, identifying thresholds between desirable and undesirable conditions, establishing reference conditions for protection or restoration, developing programs for monitoring and assessment, and developing models of how systems could change.

Managing under climate change can involve trying to resist change, increasing resilience to change, or transforming to adapt to inevitable change (Moore et al., 2012). **Mitigation strategies** try to resist change by reducing factors that contribute to climate change, such as carbon emissions. This might include actions such as encouraging reduced electricity consumption, installing solar panels or wind turbines on properties, or using biomass or biofuels (Moore et al., 2012), as well as carbon storage through minimising the loss of carbon currently stored in vegetation and soils as well as carbon capture and storage in natural ecosystems (Dudley et al., 2012). **Adaptation measures** attempt to reduce the effect of changes that cannot be prevented. Millar et al. (2007) identified **three distinct types of adaptive measures** that are similar to Moore et al.'s description of managing under climate change: R**esistance measures**, that attempt to prevent change; **resilience measures** that improve the ability of the system to cope with changes; and **response options** to adapt to new conditions. An **additional fourth type of adaptive measure** is **realignment** (Stephens et al., 2010; Peterson et al., 2011). The basis of realignment is to restore an aspect of an ecosystem or an asset to a level that allows it to survive the changing climate. Mawdsley et al. (2009) recommend managing for ecosystem function rather than focusing on specific components. Harris et al. (2006) likewise propose restoring

processes instead of structure, by focusing on ecosystem services rather than species composition. The Adaptation Wizard (UKCIP, 2015) can be used to assess current and future climate, and to consider adaptation options.

Effects of mitigation strategies have more long-term results than many adaptation strategies but Moore et al. (2012) stress that it is important to view them as complementary rather than opposing methods. Overland et al. (2013) describe the mitigation time scale as impacting the period 2080-2100, with the period prior to this solely on the adaptation time scale. Much of the focus of climate change planning is therefore on adaptive strategies in the nearer future (Knutson and Heglund, 2012). It is expected that weather extremes would impact much earlier than changes in average climate, leading Fankhauser et al. (1999) to recommend increasing the flexibility of services to function, and the robustness of infrastructure and other assets to withstand, a wider range of climatic conditions; in other words, to increase their adaptive capacity. Adaptive capacity is the extent to which an ecosystem or community is resilient to climate change by being able to adapt to it. Though the risks from climate change are extremely serious, planning for adaptation can be effective in minimising them for ecotourism:

"Although ecosystems can be highly vulnerable to climate change impacts, probably there are good adaptation options in ecotourism, given the wide range of activities that can be developed and conducted in natural areas. Therefore there are good possibilities to design effective adaptation strategies for ecotourism and nature-based destinations" (World Tourism Organization and the United Nations Environment Programme, 2008, p.8).

There are two NPA projects, one completed and one newly started, that may provide useful resources in adapting to climate change. Clim-ATIC ran from 2008-2011, resulting in a service that provided information, training and advice to communities, small businesses, and local administrations across the Northern Periphery who wish to significantly increase their capacity to adapt to the impacts of climate change. The service, which can be accessed online, provides training modules on analysing climate vulnerability, developing adaptation strategies, implementing adaptation measures, and monitoring and evaluation. Adapt Northern Heritage is a three-year project that began in June 2017 and focuses on protecting cultural heritage assets from the effects of climate change. It seeks to support communities and local authorities to adapt northern cultural heritage to the environmental impacts of climate change and associated natural hazards through community engagement and informed conservation planning.

Lack of resources is a significant issue when attempting to mitigate or adapt to climate change (Macgregor and van Dijk, 2014). Baron et al. (2009) suggest that, to ensure cost effectiveness, it may be wise to **prioritise adaptation strategies in favour of 'no-regret' measures** that are sensible regardless of climate scenarios, and typically can provide other benefits and are flexible. This may come at a cost, however, if high risk impacts are side lined in the process.

In addition to risks, **climate change could also provide opportunities** through a warmer climate and extended summer season, which should also be adapted for and capitalized on. Risk from impacts is a more high profile issue, but the best management plans attempt to minimize risk while also maximizing opportunities. In some cases, opportunities may simply be an extension of current tourism

or growing seasons, but in others new markets may. It has been suggested, for example, that climate change may present a new opportunity for mussel farming in the Southern Baltic (Klamt and Schernewski, 2013). Galloway and Southern Ayrshire Biosphere have included a study of the opportunities presented by climate change in their region as part of their climate change planning.

SHAPE Case Study: Climate Change Risks and Opportunities in Galloway and Southern Ayrshire Biosphere, Scotland

Galloway and Southern Ayrshire (GSA) Biosphere have a vision to optimise the biosphere's future under predicted climate change projections for the region. These predictions suggest warmer and drier summers, accompanied by increasingly warmer and wetter winters (UKCP09, 2009). GSA Biosphere understand the risks posed to habitats and species under these conditions. Warmer, drier summers will put stress on peat bogs, and these conditions will also increase the risk of forest fires. It is expected new species will appear, while some current species will decline or even disappear. Mild wet winters may increase pests and diseases as they are spread more easily under these conditions. An increase in rainfall, and greater likelihood of flooding events may damage assets such as buildings and natural habitats, as well as disrupting transport. Coastal flooding and erosion from rising sea levels are also an issue, as many towns, villages and important habitats are located on the coast.

The biosphere also recognizes the benefits from a warmer climate that encourages people to get outdoors and take advantage of the region's recreational and tourist facilities. They are planning to diversify activities and attractions to capitalize on a warmer climate. The predicted conditions will also lengthen the growing season for farming and forestry. These are important industries in the biosphere, and an increase in productivity will be of value to agriculture, as local potato grower George Norris explains:

"Frosts, rainfall and temperatures all affect the size, quantity and quality of the Ayrshire tattie [potato] crop. Less frost and earlier springs could be a benefit to the Ayrshire tattie growers. An earlier growing season also benefits dairy farmers as earlier grass crops mean reduced winter feed costs" (cited in Galloway and Southern Ayrshire Biosphere, 2015).

Farming and tourism businesses will have to adapt to many of the effects of climate change in order to take full advantage of these opportunities, but by recognizing these as well as threats, they are encouraging the community and businesses to engage in climate change planning and action.

One of the climate change opportunities identified by Galloway and Southern Ayrshire Biosphere is changes in tourism demand. These could be positive or negative and can have particularly strong effects on the local and regional scale. Altered weather patterns resulting from climate change may reduce visitation in some cases, and increase it in others. It is also possible they could affect the timing or duration of peak tourism season, either for the better or the worse to the region. Studies have

been conducted with the aim of estimating these affects under predicted future climate scenarios. Two of these are described here.

Case Studies: Visitation Analysis in Rocky Mountain National Park, USA, and Waterton Lakes National Park, Canada

Rocky Mountain National Park – Bear Lake looking toward Glacier Gorge. Image: Daniel Mayer (Mav) (Own work) [CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons.

Rocky Mountain National Park (RMNP)in Colorado, USA has a varied landscape of mountains, alpine lakes, forest and tundra that has proven increasingly popular with recreational visitors. In 2016 there were more than 4.5 million visits to the park, up around 9% from 2015 and 56% from 2007 (National Park Service, 2017).

A contingent visitation analysis was conducted to estimate how changes in climate and resource variables associated with climate change would impact on nature-based tourism demand in RMNP in the 2020s (Richardson and Loomis, 2004). Two key ways in which the climate may affect visitation were identified. These were changing weather patterns (temperature, precipitation and snow depth), which may directly affect visitor behaviour; and ecosystem effects such as wildlife and vegetation composition, which may indirectly affect it. The direct change was predicted to be an increase in the number of hot summer days, and the indirect changes were an increase in alpine tundra as a result of increasing temperatures and changes in elk population numbers. The analysis estimated a 13.6% increase in visitation under the Canadian Climate Center (CCC) scenario and 9.9% increase under the

Hadley Climate Center scenario. This was due to the positive effect on visitation behaviour of an increase in temperature.

In another study, covering the whole of the United States, Loomis and Crespi (1999) found 2% negative effects on forest-based recreation due to loss of forest cover, however the RMNP climate change effects analysis predicted modest gains in forest coverage in the park under both scenarios. For RMNP, they found the overall net effect of climate change on visitation to be small, and that, while nature and scenery were the main reasons specified to visit, tourists are not very sensitive to slight changes in climate.

In the Richardson and Loomis (2004) study, 13.1% of survey respondents claimed they would alter their visitation behaviour under the predicted climate scenarios, with 7% indicating they would visit the park less often, and 6.1% saying they would visit more often. The implication from this is that an increase in the number of hot summer days was linked to a decrease in visitation. This suggests that changes would take place, but that the majority of respondents would not change their visitation plans and those who did would create only a very small net effect.

Cameron Lake, Waterton Lake National Park. Image: Michael Rogers, who retains copyright and releases the image under the GDFL. http://en.wikipedia.org/wiki/Image:Cameron_lake.jpg [[C.

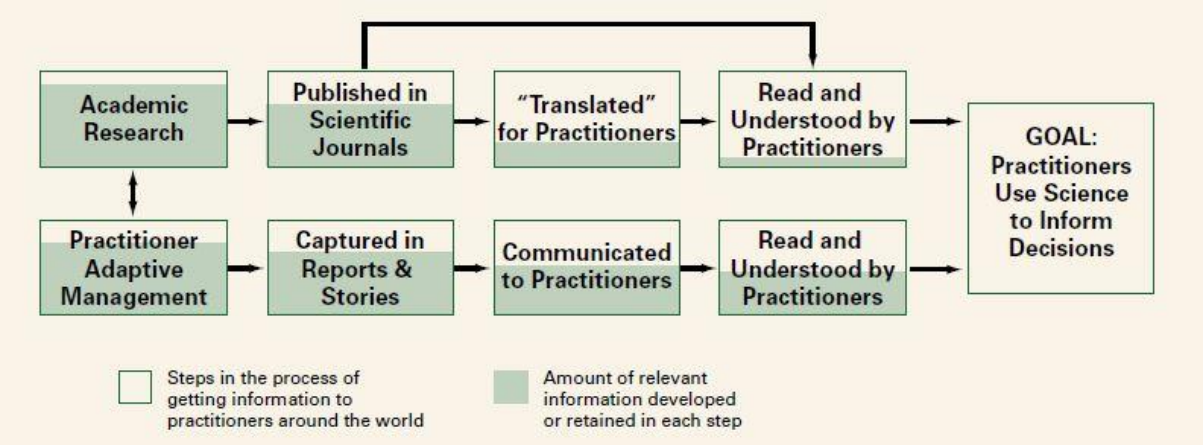
Waterton Lakes National Park (WLNP) in Alberta, Canada, is a UNESCO Biosphere Reserve and World Heritage Site. A study by Scott et al. (2007), based on a statistical model of monthly visitation and climate and visitor surveys, examined the direct impact of climate change on visitation in the WLNP. The model projected an increase of between 6% and 10% in the 2020s and between 10% and 36% in the 2050s. They also found that climate change scenarios for the 2020s and 2050s were expected to have minimal influence on visitation. The projection for the 2080s was a negative effect, with 19% of respondents stating they would not visit the park and 37% stating they would visit it less often. The inclusion of the 2050s and 2080s extends this study far beyond the Richardson and Loomis (2004) study in Rocky Mountain National Park. In doing so, the longer-term negative impacts on climate change on visitation are observed. By the 2020s, there are no changes predicted in the number of glaciers, population of grizzly bears, moose and big horn sheep, the occurrence of forest fires, or the

number of rare plant species. These changes are predicted to occur on a small to moderate scale in the 2050s, and on a moderate-large scale by the 2080s. This highlights the importance of long-term planning for climate change.

As with physical impacts, the visitation effects of climate change will be location-specific. Managers will have to predict these and factor them into their planning. In order to predict how climate changes may affect a particular locality, it is first necessary to access information on the predicted effects of climate change in the area. Most national meteorological offices have branches responsible for climate science that have modelled climate change effects on typical weather patterns. Scientific papers and reports on climate change studies can also be a valuable resource when available.

6.2 Bringing Climate Change Science and Management Practice Together

There are many studies in climate science and potential climate change impacts, and more are ongoing. One of the challenges of planning for climate change is acquiring the relevant information from this body of work and converting it to material that can be readily understood and used in the management of parks and reserves. Salafsky et al. (2001) present two approaches to generating and getting relevant information to management practitioners.



Two approaches to generating and getting relevant information to practitioners, indicating the proportion of relevant information that is retained through each step. Salafsky et al. (2001).

In this diagram Salafsky et al. (2001) illustrate that practitioners are the best placed to communicate to other practitioners because a higher amount of information is passed down the line. This is mostly due to it being communicated in a language and style that is more readily understood by those working in the field. The diagram also indicates how much valuable information is lost, especially in the chain of the traditional academic approach which may contain the highest quality information initially. This information could be extremely valuable in informing practice but is lost in the communication process. The greatest challenge in communicating climate science is translating academic findings to a form that can be understood by those outside of the academic sphere. The existence of the information is of little use if it is not accessible. Salafsky et al. suggest the best solution would be a

closer working relationship between academic researchers and management practitioners. Schmidt-Thome et al. (2013) also support such collaboration to foster greater understanding between academics and practitioners with improved communication. Another helpful step is for practitioners to share their learning and experiences, through publishing in journals, brochures, online or through networking initiatives.

6.3 Management Approaches to Climate Change

Climate change will place different demands on different places in different ways. Forward thinking and creating a plan that considers the effects of climate change are necessary starting points in long-term integrated management of assets.

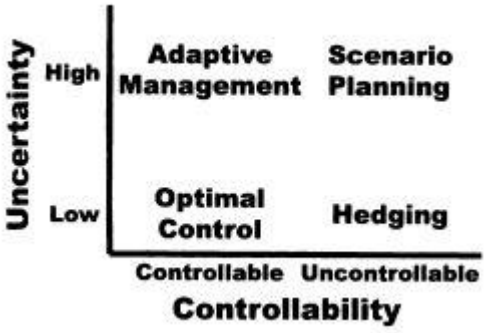
Strategies for mitigating climate change, while still dependent on local resources, have greater commonality across sites than adaptive strategies. A large amount of carbon is stored in vegetation, soil, permafrost and wetland (Bonan, 2008), and protected areas are more effective than other areas in maintaining vegetation and carbon (Dudley et al., 2012). They are therefore in a position to be at the forefront of natural climate mitigation practices. Vegetation restoration and enhanced protection, carbon storage and sequestration, and prescribed burning to reduce fuel load and prevent larger future losses have been suggested as methods of maximising carbon storage in protected areas (Dudley et al., 2012). The northern drift of vegetation species in a warming climate can be viewed as an opportunity to increase carbon storage in vegetation. Already, the increasing shrub abundance in the Arctic, a result of warming temperatures over the past 150 years, is increasing the amount of carbon stored in the region (Sturm et al., 2001). There are, however, concerns that the northern expansion of trees into tundra may warm the climate faster due to the increased albedo and, in this situation, deforestation to cool the climate may be the best mitigation strategy (Bala et al., 2007), although vegetation masking of snow albedo will become less of a factor in a warmer climate that has less snow cover (Bonan, 2008).

Protected areas also serve as safe and managed habitats for threatened species (Dudley et al., 2012). They are predicted to retain climatic suitability for species better than unprotected areas (Araujo et al., 2011). Climate change is affecting the geographic distribution of flora and fauna globally (Parmesan and Yohe, 2003). Some species extend northwards, without decline in their previous inhabited region, while others undergo an entire range shift (Hampe and Petit, 2005), and increased extinction risk is another possible outcome (Araujo et al., 2011). Interdependencies between species will be affected if one or more species leave the system (Araujo et al., 2011), and invasive species, including parasites and pathogens, are a threat to existing species. In this situation, invasive species will require control and some of the native species will require preservation (Hellman et al., 2007).

Mitigating the effects of climate change on corridors for movement, stepping stones and climate refugia are key management actions for wildlife conservation (Mawdsley et al., 2009). Some species may only persist if they have climate refugia, either as patches of their former ranges or can relocate to new areas when their habitats become unsuitable (Araujo et al., 2011; Hannah et al., 2007). Rear-edge populations, living at the lower latitudes of their species range, are of disproportionate importance to their long-term conservation, therefore retaining a stable rear-edge population helps mitigate the effects of climate change on threatened species (Hampe and Petit, 2005). Preserving the

greatest number of these rear edge populations may be a better direction of conservation strategies in the face of climate change than focusing on the more viable core populations (Hampe and Petit, 2005).

Strategies for adapting to climate change are more site-specific than mitigation strategies, and have to consider the uncertainties associated with predicted future climate scenarios. There are significant gaps in knowledge regarding climate change. Uncertainties stem from the natural variability of the Earth's climate system, uncertainty over future emissions of greenhouse gasses, and limitations in scientists' ability to model the climate system, although advances in understanding and modelling have increased confidence in predictions significantly (European Climate Agency, 2016). The uncertainty surrounding climate change was one of the most commonly cited barriers to taking action against climate change in Macgregor and van Dijk's (2014) study. They also found that the goals adopted in some cases were clearly linked to the level of uncertainty about future changes. Peterson et al. (2003) illustrate the appropriate approaches to management depending on degree of uncertainty and degree of controllability.



Management approaches in high and low uncertainty and controllability as categorised by Peterson et al. (2003).

As Peterson et al. (2003) show, two approaches to managing in uncertainty that might be considered for application in a changing climate are adaptive management and scenario planning. These methods and their application will be discussed in detail.

6.4 Adaptive Management for Climate Change

Adaptive management has been recommended as an approach to managing for climate change. Climate change is a novel situation which requires the capacity to learn and is dynamic, therefore requires knowledge and practice to be continually challenged and updated (Peterson et al, 1997; Lawler, 2009). Adaptive management achieves this through **a systematic, iterative process**. Managers learn and adapt during the course of implementation: "Adaptive management promotes flexible decision making that can be adjusted in the face of uncertainty as new outcomes from management actions and other events develop" (Panel on Adaptive Management for Resource Stewardship, 2004).

The adaptive management method has been recommended as an adaptation strategy for climate change by Parks Canada (McLennan, 2012; Lemieux and Scott, 2005; Welch, 2005) and the inventory and monitoring processes have been developed for other purposes (McLennan, 2012), but the

approach has not been widely adopted. Adaptive management has been employed at Waterton Lakes National Park for selected species, particularly species at risk (Waterton Lakes, 2010) and also at Elk Island National Park to manage the landscape in the interests of elk and bison populations (Elk Island, 2011), although no data on the success of these efforts has yet been published.

The origin of this approach can be traced back to the ideas of scientific management proposed by Frederick Taylor in the early 20th century (Haber, 1964). It was later developed for natural resources management, most notably by Holling (1978) & Walters (1986). As adaptive management is site-specific, being developed in the context of the location and conditions in which it is to be applied, it accounts for the locality of climate change effects. **Incorporating reflection into the management plan allows for timely and suitable action under unpredictable circumstances.** As Jacobson (2009) warns: "There is no such thing as a "no action" alternative, and the decision to not act can itself carry significant risks to values judged to be important" (p.57). Jacobson recommends adaptive management over the precautionary principle when managing under uncertainty because precautionary management can prevent taking steps necessary to learn and develop. He distinguishes the short-term benefits of minimising risk with precautionary management and the necessity of taking a certain degree of risk when managing over the long term in a climate of uncertainty. Adaptive management is ideally suited for long timeframes such as that of climate change because of its constant revision.

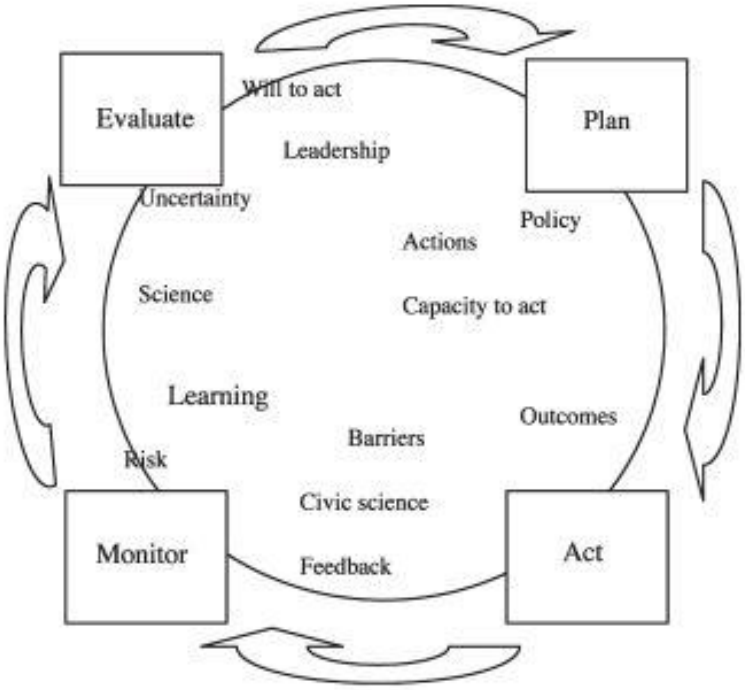
Adaptive management can be anticipatory or reactive, in other words the implementation of the plan can begin either before or after events take place. Becken and Hay (2007, p.226) advise **that an anticipatory approach to adaptive management is wise for five main reasons**:

- If adaptation is reactive, as opposed to anticipatory or proactive, the range of response options is likely to be fewer; adaptation may also prove more expensive, socially disruptive and environmentally unsustainable.
- Many adaptation strategies are consistent with sound environmental management, wise resource use, and are appropriate responses to natural hazards and climate variability, including extreme events – such 'no-regrets' adaptation strategies are beneficial and cost effective, even in the absence of climate change.
- Many development plans and projects have a life expectancy that requires future climate conditions and sea-levels to be included in their design.
- Tourism has a heavy dependency on valuable and important ecosystems that are sensitive to climate variability and change, including extreme events – it is easier to enhance the ability of ecosystems to cope with these variations in climate if they are healthy and not already stressed and degraded.
- Adaptation requires enhancement of institutional capacity, developing expertise and building knowledge – all these take time.

In addition, adaptive management can be passive or active. Under passive adaptive management a hypothesis is formed and tested, typically from historical data, and the management action updated according to the outcomes monitored. Active adaptive management tests competing hypotheses to compare the effectiveness of strategies (Gregory et al., 2006). Either approach can be applied, depending on the available resources and options, with Lawler (2009) suggesting both may be needed

to address climate change. Passive adaptive management is typically simpler and less expensive (Prato, 2006) but also less reliable as a means of testing actions and gaining knowledge (Wilhere, 2002).

The process of adaptive management is summarised in the diagram by Stankey et al. (2006).



Adaptive management cycle (Stankey et al., 2006).

This model shows adaptive management as a continuous cycle that begins, in the first instance, with planning. The planning process for adaptive management consists of identifying the issues and goals and determining what strategies are available for addressing them. The appropriate strategies are then selected and the means of monitoring and measuring change to evaluate their success is devised. The 'act' stage then follows the selected plans and the monitoring strategies for evaluation are put in place.

As climate change effects will be diverse, the most appropriate responses will often be on multiple levels (Tompkins and Adger, 2004), making monitoring even more difficult. **Jones (2009, p.239) suggests a list of five useful questions to guide the crucial monitoring and evaluation process**:

1. What would we expect to see if management was working well? And the converse question: What would we expect to see if management was not working well?
2. What could we monitor or measure (or photograph, or map, or survey) to reveal the outcomes that are being delivered?
3. Where would we realistically expect to see improvements or changes if management was working well? And conversely: How would we expect to see things getting worse or changing if management was not working well?
4. How will the findings of monitoring and evaluation be reported and/or used?
5. Who will be responsible for doing the monitoring, evaluation and reporting?

These monitoring and evaluation questions show why adaptive management is a good strategy when managing assets in uncertainty. It accepts where knowledge is limited and there is a need to act on incomplete or imperfect information (Panel on Adaptive Management for Resource Stewardship, 2004) and is flexible and adaptable when actual changes vary from predicted scenarios. It also encourages discussion and is compatible with an integrated approach to management, as many of the measures will have cross-sectoral applications or impacts. An example of adaptive management in use on The Tidelands of the Connecticut River Habitat Restoration Project is described below.

Case Study: Adaptive Management for The Tidelands of the Connecticut River Habitat Restoration Project, United States of America (Franklin et al., 2007)

The Tidelands of the Connecticut River Habitat Restoration Project has reported a positive experience of adaptive management that has improved their knowledge and practice of controlling the common reed (*Phragmites australis*). The wetlands where the Connecticut River meets Long Island Sound range from fresh to saline. They provide many ecosystem services, including flood storage, upland buffering, water quality improvement, resource production, recreation, transportation, and aesthetics. The common reed is an invasive species that threatens native biodiversity and the health of the ecosystem by achieving near exclusive dominance in the less saline areas. The Habitat Restoration Initiative Committee decided to proceed sequentially. As restoration was completed at one site, it was started at another. Regular monitoring was an important part of the plan to evaluate the effectiveness of the measures and to ensure native species were not harmed in the process. This adaptive management approach has led to treatment practices evolving to become more effective and less expensive.

6.5 Scenario Planning for Climate Change

Scenario planning considers a range of possible future outcomes, and plans are devised around these. It has its origins in the work of Herbert Kahn who began producing forecasts based on multiple future scenarios in response to difficulty creating accurate single forecasts (Kahn and Wiener, 1967).

Scenarios are brief narratives of hypothetical future events (Peterson et al., 2003). These are **designed to inform policy under a range of possible circumstances**, leading decision makers to work towards greater resilience in the face of future change. The creation of the scenarios is of crucial importance to the success of the scenario planning approach. It is necessary to create structurally different scenarios rather than simply variations of one theme, and there is always the possibility of overlooking a critical uncertainty that could undermine the entire decision-making process (Moore et al., 2013).

Scenario planning is particularly suited to climate change as it can incorporate average projections along with extreme events that would prove highly disruptive (Moore et al., 2013). It can also include quantitative and qualitative data to give a broader view of predicted scenarios.

Peterson et al. (2003) identified **six steps in scenario planning**:

(1) Identification of a focal issue, for example climate change
(2) Assessment of the system, including people, institutions, ecosystems, linkages and uncertainties
(3) Identification of alternatives, which must be plausible and relevant
(4) Building scenarios, typically three or four
(5) Testing the scenarios for consistency, against stakeholder behaviour, expert opinion or against other scenarios
(6) Policy screening to test how various policies would perform under different scenarios.

The inclusion of stakeholders in the process ensures that a variety of views are reflected and discussed, although the success of stakeholder involvement in scenario planning is dependent on the knowledge and understanding of the stakeholders, as well as their ability to consider other perspectives beyond their own pre-existing assumptions (Peterson et al., 2003). These are difficult to measure or mitigate.

Moore et al. (2012) tested and evaluated scenario planning at The Futures of Wild Marin scenario workshop, held in Marin County, California, in January 2011. Participants from 14 public agencies and non-profit private agencies developed and discussed 8 scenarios. They were consulted on the exercise at the end of the day. Their recommendations were for more scientific input in creating the scenarios, as well as an initial presentation on local climate change and existing management responses to inform participants. This supports Peterson et al.'s (2003) claim that scenario planning is dependent on the knowledge and understanding of the stakeholders participating in it. Nevertheless, the participants supported the method, having "affirmed the usefulness of this exercise for beginning an important collaborative discussion about climate change planning" (Moore et al., 2012, p.3).

6.6 Selecting a Planning Approach for Maintaining Assets in Climate Change

Adaptive management and scenario planning both have their strengths, limitations and areas for improvement. Many evaluations have been conducted on adaptive management. Lee (1999) appraised adaptive management using the Brewer (1973) framework to examine its conceptual, technical, equity and practical strengths and limitations. **Lee arrived at three conclusions regarding the application of adaptive management** in natural resource management and biodiversity conservation. The first conclusion was that **adaptive management has been more influential as an idea than it has as a practical means of understanding the behaviour of ecosystems under human influence**. There exists extensive literature on the development of the concept to support this statement. The second was that **adaptive management required the depth of discussion described above to ascertain the planning and evaluation questions, but in practice this has typically not been happening**. Finally, Lee **praised the efficient and effective social learning that is facilitated by adaptive management as of strategic importance in managing ecosystems towards sustainability**. The apparent overarching conclusion from Lee's analysis is that adaptive management in principle is a valuable process for managing ecosystems for long-term sustainability, but in practice it is not being applied to its full advantage.

Allen and Gunderson (2011) likewise recognised that the practice of adaptive management was having mixed success and not matching its potential, so they analysed the general sources of failure. They describe these sources of failure as their **nine pathologies**. These were:

(i) lack of stakeholder engagement
(ii) experiments are difficult
(iii) surprises are suppressed as externalities
(iv) prescriptions are followed
(v) action procrastination: learning and discussion remain the only ingredient
(vi) learning is not used to modify policy and management
(vii) avoiding hard truths: decision makers are risk averse
(viii) the process lacks leadership and direction
(ix) focus on planning, not action.

Allen et al. (2011) further criticise the "inconsistent and even contradictory approaches and definitions of adaptive management" (p.1342) as hindering its practical development. This is a view echoed by Gregory et al. (2006) who conclude that many of the issues with adaptive management stem from its use in improper contexts and weak implementation or definition. They devised a set of criteria for evaluating the appropriateness of adaptive management. These fall into four categories: the spatial and temporal scale of the problem, the relevant dimensions of uncertainty, the associated suite of costs, benefits and risks, and the degree to which there is stakeholder and institutional support. The proposed criteria are reproduced as **Table 7**.

Topic-area consideration	Criteria questions
Spatial and temporal scale	
Duration	Is the project timeline to obtain verified results compatible with management decision-making requirements?
Spatial extent and complexity	If spatial extent or complexity is large, are there opportunities to apply AM on a subset of the problem and scale up?
External effects	Have potential issues related to background trends and cumulative effects of management actions been addressed in the AM design?
Dimensions of uncertainty	
Parameter uncertainty	Has the AM design been pared down to focus on only those uncertainties most likely to influence management decisions?
Structural uncertainty	Are there profound structural uncertainties? If so, how will surprise outcomes be managed?
Stochastic uncertainty	How do low-probability random natural and other causal events affect the AM design and expected outcomes?
Confidence in assessments	If the confidence in the proposed AM design is low, can expert judgment or other techniques help?
Costs, benefits, and risks	
Specifying benefits and costs	Can all the costs and benefits (and risks) be documented and communicated in a manner understandable to all stakeholders?
Magnitude of effects	Will the information collected through AM have sufficient predictive ability to make a difference to managers?
Multiple objectives	Does the design and assessment of AM plans explicitly address the multiple goals of stakeholders (rather than only scientists)?
Perceived risks of failure	Can stopping rules and clear thresholds identify and/or minimize the perceived risks of failures, to species and to institutions?
Stakeholder and institutional support	
Leadership	Is there explicit policy guidance and leadership support for AM? Will stakeholders see AM as an effective way to deal with uncertainty?
Flexibility in decision making	Is there sufficient management flexibility (and continuity) to incorporate new information in revised experimental designs?
Avoidance of taboo trade-offs	Does the proposed AM design involve any trade-offs that might be considered taboo by some stakeholders?
Institutional capacity	Are sufficient analytical skills available (staff or contractors) to design, evaluate, and monitor AM plans?

Table 7: Criteria for evaluating the appropriateness of adaptive management (Gregory et al., 2006, p.2414).

Scenario planning has received less critical evaluation than adaptive management. It is regarded as simpler and more cost effective than adaptive management, which is particularly time-consuming, complex and expensive to implement (Prato, 2006). The success of scenario planning, however, is dependent on the quality of the scenarios that are used and their plausibility to the participants: "Without buy-in to the scenarios, scenario planning becomes a mere exercise in imagination" (Moore et al., 2013, p.8). It relies on the knowledge and understanding of the participants (Peterson et al., 2003; Moore et al., 2012). Furthermore, Moore et al. (2012) found that **scenarios alone are insufficient for climate change planning** as they are no more likely than the changes predicted by climate models, and suggest they must be combined with scientific climate models for the exercise to have value. It is also difficult to evaluate the success of scenario planning, unlike adaptive management (Moore et al., 2013).

The two management approaches that have been discussed here are both suitable for situations of high uncertainty. **Adaptive management may be an appropriate approach to managing individual assets for climate change, particularly in managing biodiversity changes, where it has already been proven successful** (McLennan, 2012; Franklin et al., 2017). Allan et al. (2011) see the value in adaptive management in helping mitigate specific climate change impacts, such as shifting species distribution and habitat loss, as well as managing natural recreational activities. On this scale, the issues meet the criteria of high uncertainty and high controllability. Invasive species are likely to respond in ways that are qualitatively predictable (Hellman et al., 2008) and it has already been shown that recent climate trends for species range match climate change predictions (Parmesan and Yohe, 2003). Scenario planning, on the other hand, is not often directly applied to biodiversity conservation, with the focus of most applications of scenario planning being on social dynamics (Peterson et al., 2003). **Scenario planning may be more useful when there is little or no opportunity to manipulate systems, and where a broader, more holistic approach is required**. Adaptive management is not recommended by some for application in situations of high uncontrollability, where scenario planning is considered more appropriate (Peterson et al., 2003; Gregory et al. 2006) although, where uncertainty can be reduced, Moore et al. (2012) suggest this should be carried out and adaptive management used.

Scenario planning and adaptive management **can also be used in combination**, which may be the most robust approach. The Southwest Climate Change Initiative is planning for climate change impacts on natural resources in Utah, Colorado, Arizona and New Mexico using the Adaptation for Conservation Targets (ACT) Framework developed by Cross et al. (2012). This method combines the iterative process of adaptive management with a scenario planning exercise. The scenario planning is used to create positive conversations and start the flow of ideas, then the adaptive management evaluates and refines them in practice. This may also be the approach that is most consistent with integrated management, by incorporating the public participation and holistic view of scenario planning, while using adaptive management to refine practices until they are functioning optimally for individual assets.

If the literature that has been reviewed agrees on one thing, it is that climate change requires parks and reserves to build on their adaptive capacity. Taking action to protect assets, alongside identifying and improving areas that are most favourable for to take advantage of climate change opportunities will make ecosystems and communities more resilient. At present, there is a lot of uncertainty

surrounding the effects of climate change, particularly on a local scale. Waiting for greater certainty about climate change, however, may be damaging and costly. There is a need to act now on both short- and long-term goals to mitigate or alleviate the natural and socio-economic consequences of climate change.

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