



CLIMATE CHANGE, WORLD HERITAGE AND TOURISM

CHANGEMENT CLIMATIQUE, PATRIMOINE MONDIAL ET TOURISME

10^e séminaire de la Chaire UNESCO et du Réseau UNIWIN-UNESCO « Culture, Tourisme, Développement »
Université Paris 1 Panthéon-Sorbonne

En collaboration avec :
Le CENTRE du PATRIMOINE MONDIAL DE L'UNESCO,
ICOMOS France,
ASSOCIATION DES BIENS FRANÇAIS DU PATRIMOINE MONDIAL

Lundi 16 décembre 2019
UNESCO



Sous la direction de
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Université Paris 1 Panthéon-Sobonne
Paris, 2020

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Aerial view of Skara Brae, one of the six sites of Heart of Neolithic Orkney (HONO) World Heritage
(Credit: Historic Environment Scotland)

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Ouverture

Mechtild RÖSSLER

Director of the UNESCO World Heritage Centre

Dear colleagues,

Ladies and gentlemen,

Je vous souhaite à tous la bienvenue à l'UNESCO pour le dixième séminaire annuel de la Chaire UNESCO. Permettez-moi tout d'abord de remercier Madame Maria Gravari Barbas, directrice de la Chaire UNESCO *Culture, tourisme, développement* de l'Université Paris 1 Panthéon-Sorbonne. Nous célébrons le dixième anniversaire de notre séminaire conjoint sur les opportunités et les défis du tourisme et du patrimoine mondial avec l'ICOMOS et l'Association des biens français du patrimoine mondial, que nous remercions également pour leur soutien.

This year's seminar will examine one of the most important issues facing our planet: climate change.

The UN Climate Change Conference COP25 ended with only a partial agreement to ask countries to come up with more ambitious targets to cut greenhouse gas emissions in order to meet the terms of the 2015 Paris accord. This underscores the difficult path ahead and the need for urgent and sustained efforts to reduce these emissions.

COP25 closed with an alarming message calling for immediate action.

Climate change is one of the fastest growing threats to World Heritage sites globally. Virtually all are affected by these changes, but many are facing severe climate impacts including coastal flooding and erosion, more intense weather events such as hurricanes and typhoons, and increased risk of damaging wildfires.

In 2019, 22 state of conservation Reports from 21 States Parties highlighted climate change as a pressing threat to the World Heritage property in question – the largest ever recorded in our long-term reporting and monitoring system. Which is actually the top of the iceberg only!

Most World Heritage sites are also important tourist destinations, and many are among the most iconic places on the planet, helping to drive economic development and tourism.

However, global growth in tourism brings significant issues.

At a worldwide scale, tourism is a major factor contributing to climate change. Carbon emissions from tourism, including air travel, are expected to double in the next 25 years. Climate change poses a risk to the integrity and safeguarding of World Heritage properties, endangering those values what makes them attractive to tourists.

Climate change-related impacts also pose a real threat to culture. We know that several Small Island Developing States may soon be uninhabitable, overtaken by rising seas. The uprooting of communities due to climate change threatens entire ways of life, including the practice and transmission of living heritage. Oral traditions, performing arts, social practices, festive events and traditional knowledge – particularly crucial knowledge about the environment, are all vulnerable in the face of climate change.

Safeguarding this living heritage is particularly vital for confronting the climate crisis, because intangible cultural heritage practices have proven to be highly effective tools for helping communities prepare for, respond to and recover from natural disasters and emergencies.

For World Heritage, site managers are confronted with assessing risk and managing environmental change, often with few resources and little scientific information about local climate scenarios. Climate change can also impact the safety, quality of experience and number of visitors to sites, and the tourism sector itself is affected and threatened by climate change.

Growing water scarcity, more extreme weather events, security and safety concerns, rising insurance costs, and more generally the damage caused to World Heritage properties by climate change are weakening established tourism models and, with them, the local economies that depend on tourism.

Where visitor numbers are already overwhelming site services and management, or where tourism development is uncontrolled, climate change can exacerbate the problems caused by unsustainable tourism.

Many of these issues were addressed in our seminal report in 2016 World Heritage and Tourism in a Changing Climate with UNEP and the Union of Concerned Scientist. We are very pleased to have Adam Markham, the lead author of the report and Helena Rey who spearheads UNEP's work on sustainable tourism with us today who will discuss the report and the policy recommendations which are becoming more and more relevant today.

Faced with these issues, we will hear today how the managers of World Heritage sites are setting up new measures to both mitigate and adapt to these phenomena. These include projects to assess risk, minimize the impacts of climate change by increasing site resilience, and launching initiatives to adapt to changing conditions.

To provide Member States with the best advice and the most up-to-date knowledge, the World Heritage Centre is currently updating the 2007 "Policy Document on World Heritage and climate change" with inputs by the Advisory Bodies and States Parties' consultation which will be presented to the World Heritage Committee in Fuzhou, China, next year.

UNESCO and UNWTO just successfully completed a global conference on culture and tourism and put forward the Kyoto declaration which focused on cultural transmission, community and capacity building, and how the tourism and culture sectors can work more collaboratively together and increase public-private partnerships, while also ensuring a more sustainable future.

The importance of enabling local stakeholders to have a greater voice in how tourism is managed was particularly stressed and all participants agreed to strengthen engagement of all stakeholders and to ensure that tourism is developed in line with the Sustainable Development Goals targeted investments need to be made.

All of this will need to be strengthened and scaled up as we mitigate and adapt to a changing climate in terms of community, resilience and heritage protection.

Thank you again for your participation in today's seminar. It was not easy to get to UNESCO today, but we look forward to some very fruitful discussions.

Ouverture

Jean-François LAGNEAU

*Architecte en chef des Monuments Historiques
Inspecteur général des Monuments Historiques honoraire
Président, ICOMOS France*

Force est de constater que la notion et les pratiques du tourisme ont quelque peu évoluées au cours des siècles passés. Du voyage initiatique réservé à une élite, il s'est progressivement étendu à un nombre de plus en plus important, favorisé en cela par l'évolution des modes de transports.

Du fait de cette sorte de démocratisation, le tourisme peut parfois comporter une connotation négative jusqu'à être considéré dans certains cas comme une plaie et ses opérateurs comme des prédateurs.

On parle alors de tourisme de masse et de « marchandisation de la culture » avec tout le mépris condescendant possible.

Rappelons que connaître et respecter l'autre dans toute sa diversité est le premier objectif de la Convention du PM.

Depuis Mexico en 1999, au sein d'ICOMOS nous essayons de démontrer que tourisme et culture ne sont pas opposés et que, au contraire, ils peuvent et doivent se valoriser mutuellement. Mais pour cela, il faut chercher à canaliser l'engouement qui se généralise pour le patrimoine et les sites, et équilibrer cette soif de connaissance avec le respect des territoires et de leurs habitants.

Cette approche n'est pas exempte de difficultés et nécessite une rigoureuse méthodologie ainsi que bien des actions pédagogiques.

Avec ICOMOS, certaines institutions s'emploient ardemment à la tâche, comme le Réseau des Grands Sites de France ou encore l'Association des Biens Français du Patrimoine Mondial, pour ne citer que celles qui nous sont le plus proches.

Sur le plan universitaire, des formations sont très concernées, voire totalement dédiées au tourisme durable, et nous ne pouvons que les féliciter et les encourager en ce sens.

Mais une autre difficulté devient de plus en plus présente et préoccupante, et vous lui consacrez votre journée : le changement climatique

Nous savons déjà tous que l'augmentation des gaz à effet de serres, liés à l'activité humaine, est bien une réalité. La pollution, le dérèglement climatique qui en résulte, auront des impacts sur nos monuments, nos sites et nos paysages. Dans les prochaines années, ils vont devoir faire face à des situations que nous connaissons mal, que nous n'imaginons peut-être même pas, entraînant des facteurs de risques importants pour leur préservation.

Les conséquences immédiates pour le tourisme seront de deux ordres. D'une part, certains sites risquent de perdre leur attrait actuel (climat, dégradations diverses, risques environnementaux, voire sociétaux...). D'autre part, le touriste lui-même, facteur important de l'émission des gaz à effets de serre, sera contraint, volontairement ou non, de modifier ses habitudes de vie et ses modes de déplacements. Il en résultera forcément des conséquences sur l'activité économique des territoires concernés et donc sur leurs patrimoines.

De nombreuses initiatives sont en marche. Je citerais l'une d'elle que nous avons étudié récemment : celle du Parc Naturel Régional du Morbihan qui, pour lutter contre le recul du trait de côte, a entrepris un travail de sensibilisation de la population et de gestion des flux touristique et a mis en place des systèmes de mobilité douce.

Toutes ces mesures propres à un site particulier, tendent à organiser un tourisme durable, ici un slow tourisme, qui permettra en se généralisant d'atténuer les conséquences du changement climatique.

D'une manière plus générale, ICOMOS travaille sur la mise en place d'axes méthodologiques pour un tourisme durable et nous réfléchissons aux actions suivantes :

- Intégrer nettement les risques liés au changement climatique dans les projets de tourisme, sans chercher les minimiser.
- Placer avant tout l'authenticité et l'intégrité du patrimoine au cœur du développement du tourisme culturel,
- Favoriser l'appropriation par les habitants de leur patrimoine et de leurs projets de développement touristique. Ce sont eux qui le connaissent le mieux.

Mais pour arriver à cet objectif, nous sommes bien conscients que de nombreuses actions pédagogiques sont encore nécessaires : pour les sites du Patrimoine Mondial, elles doivent être impérativement intégrées dans leur plan de gestion.

Chaque site, qu'il soit naturel ou monumental, doit faire l'objet d'un programme de sensibilisation et de communication face aux risques qui le menacent, sans omettre de parler des causes liées au changement climatique. Il s'agit de faire connaître la signification de sa VUE et les justifications de sa conservation aussi bien aux communautés d'accueil qu'aux visiteurs.

C'est à vous tous, issus de formations diverses, qu'il appartient de trouver les moyens de concilier vos objectifs, quelques fois opposés et divergents, pour arriver à ce tourisme durable et respectueux que nous appelons de nos vœux.

Je vous souhaite d'excellents travaux qui, j'en suis sûr, contribueront à aller dans cette voie.

N'oubliez pas que nous nous devons de transmettre notre patrimoine à nos enfants.

Je vous remercie

Introduction et mots de bienvenue à l'occasion du 10^e séminaire de la Chaire UNESCO « Culture, Tourisme, Développement »

Maria GRAVARI-BARBAS

Directrice de la Chaire UNESCO « Culture, Tourisme, Développement »

Université Paris 1- Panthéon Sorbonne

Coordinatrice du Réseau UNITWIN UNESCO « Culture, Tourisme, Développement »

Quand nous avons lancé en 2010 le premier séminaire de la Chaire UNESCO « Culture, Tourisme, Développement » nous ne pensions pas que cet événement constituerait le point de départ d'une collaboration étroite et particulièrement fructueuse avec un ensemble de fidèles partenaires. A l'occasion de ce 10^e séminaire de la Chaire UNESCO, il convient de revenir sur le cadre de cette collaboration, ses ambitions et ses résultats.

Notre intention au départ était de créer une plateforme de rencontre et de discussion entre les chercheurs de l'Université Paris 1 Panthéon-Sorbonne, établissement tutelle de la Chaire UNESCO « Culture, Tourisme, Développement », et en particulier les chercheurs de l'Institut de Recherche et d'Etudes Supérieures du Tourisme (IREST) ; les chercheurs du réseau UNITWIN-UNESCO « Culture, Tourisme, Développement », coordonné par Paris 1 Panthéon-Sorbonne, réunissant en 2019 28 universités dans 23 pays et 4 continents ; les gestionnaires français et internationaux des sites du Patrimoine mondial, confrontés à des problématiques de gestion patrimoniale dans leurs sites ; les experts français et internationaux de l'ICOMOS et du Comité International de l'ICOMOS du Tourisme Culturel (ICTC) ; et, bien entendu, le Centre du Patrimoine mondial de l'UNESCO.

Parmi les partenaires de ces événements, le rôle du Centre du Patrimoine mondial de l'UNESCO doit être souligné car sans son active participation en tant que co-animateur de cette initiative il aurait été impossible d'envisager, et encore moins de mener à bien ce projet pendant dix ans de façon ininterrompue. Les directeurs successifs du Centre depuis 2010, Francesco Bandarin et Mechtild Rössler, ont accueilli et accompagné les séminaires de la Chaire UNESCO avec une particulière bienveillance. Peter Debrine, directeur de programme pour le tourisme au sein du Centre du Patrimoine mondial de l'UNESCO, a joué un rôle particulièrement déterminant dans l'organisation des séminaires et, au-delà, dans la définition des thématiques et l'identification d'intervenants-clés.

L'Association des Biens français du Patrimoine mondial a également accompagné ces séminaires dès leur première édition. Chloé Campo, déléguée générale de l'association, a mobilisé le vaste réseau des sites du Patrimoine mondial en France, ce qui a permis d'associer les gestionnaires des sites et d'aborder les problématiques de chaque séminaire depuis l'angle de vue des gestionnaires. Au fur et à mesure des séminaires, d'autres associations de biens du Patrimoine mondial d'autres pays européens ont été associés aux séminaires, en particulier en Allemagne, Espagne et Italie.

Au cours des dix dernières années nous avons ainsi établi des partenariats solides avec plusieurs structures gestionnaires des sites du patrimoine mondial en France et ailleurs. En effet, un des objectifs fondamentaux de la Chaire UNESCO et du réseau UNITWIN UNESCO « Culture, Tourisme, Développement » est de créer un pont entre l'Université, les institutions et les acteurs du terrain. Nous espérons en effet que nos recherches et réflexions au sein des équipes de recherche des universités du réseau UNITWIN trouveront écho auprès de ceux qui gèrent les sites du Patrimoine mondial au quotidien.

La Chaire « Culture, Tourisme, Développement », au carrefour des disciplines, des approches et des secteurs.

La Chaire « Culture, Tourisme, Développement », créé en 1998 au sein de l'Université Paris 1 Panthéon Sorbonne, est une des plus anciennes Chaires Unesco en France dans le domaine de la culture. Elle est associée à plusieurs programmes de formation de l'Institut de Recherche et d'études Supérieures du Tourisme (IREST) de l'Université Paris 1 Panthéon-Sorbonne et en particulier au Master 1 et 2 « Gestion et Valorisation Touristique des Territoires » dont l'objectif est de former des professionnels maîtrisant les outils du développement touristique local permettant au tourisme d'être véritablement un partenaire des sites du patrimoine et un facteur de développement local.

Le tableau ci-après donne un aperçu détaillé des thématiques des 10 séminaires annuels de la Chaire UNESCO organisés depuis 2010. Les thématiques sélectionnées chaque année nous sommes intéressés par des thématiques d'actualité et parfois brûlantes, telle que celle du rapport entre touristes et habitants, organisé en 2013 avant que le terme de « Overtourism » ne fasse pas partie de notre vocabulaire usuel.

Les thématiques des séminaires de la Chaire UNESCO 2000 - 2019

<i>Année de l'organisation</i>	<i>Titre du séminaire</i>
2010	Villes françaises du patrimoine mondial et tourisme. Protection, Gestion et Valorisation
2011	Mesure et évaluation du tourisme sur les sites du patrimoine mondial : enjeux et outils
2012	Sites du patrimoine mondial et gouvernance touristique
2013	Touristes et habitants dans les sites du patrimoine mondial
2014	Tourisme et diversification économique dans les sites du patrimoine mondial 2015
2015	Les paysages culturels vivants et le défi du tourisme
2016	Sites européens du patrimoine mondial et tourisme : Défis et perspectives
2017 ¹	Tourisme et technologies de l'information et de communication dans les sites du patrimoine mondial de l'UNESCO
2018	Patrimoine matériel et immatériel dans les villes du patrimoine mondial : défis et perspectives du tourisme
2019	Changement climatique, patrimoine mondial et tourisme

Les séminaires ont donné pour la plupart lieu à des publications². Au fur et à mesure de années, les séminaires de la Chaire ont ainsi abordé des questions importantes et d'actualité, telles que celle du problème de la mesure du tourisme et de ses impacts du tourisme, le problème de la monoculture touristique dans certains sites, de la difficile préservation des aspects immatériels du patrimoine matériel, des spécificités du tourisme dans les sites du Patrimoine mondial en Europe, ou bien le défi du suivi et de la gestion du tourisme dans les paysages culturels de l'UNESCO. Ils ont donné à voir les positionnements d'acteurs institutionnels, professionnels et universitaires vis-à-vis à aux défis des sites de Patrimoine mondial émergés au cours de la

¹ Le séminaire 2017 a été coorganisé par les Chaires « Culture, Tourisme, Développement », Université Paris 1 Panthéon-Sorbonne et « ICT to develop and promote sustainable tourism in World Heritage Sites »

² Les actes des séminaires de la Chaire UNESCO sont disponibles sur [le site de la Chaire](#)

Les actes des séminaires des années 2010-2016 ont été co-édités par Maria Gravari-Barbas et Sébastien Jacquot.

dernière décennie.

La Chaire coordonne également le réseau UNITWIN UNESCO « Culture, Tourisme, Développement » qui réunit aujourd'hui 28 universités dans le monde. Le réseau UNITWIN Unesco met en place un large éventail de programmes de formation, tels qu'un module d'enseignement offert par plusieurs universités du réseau sur « Patrimoine Mondial et Tourisme » ainsi que, depuis 2018, le MOOC « Gestion Touristique des sites du patrimoine mondial de l'UNESCO³ ». Le MOOC, préparée en partenariat avec la Chaire « *ICT to develop and promote sustainable tourism in World Heritage Sites* » de l'Université de la Suisse Italienne à Lugano, a atteint le chiffre d'environ 10 000 inscrits en provenance de différents horizons académiques et professionnels. Une troisième version du MOOC sera proposée à partir de Janvier 2021. Les activités de la Chaire et du réseau sont donc entièrement orientées vers des thématiques en rapport avec le Patrimoine mondial de l'UNESCO, dans une approche résolument interdisciplinaire et intersectorielle.

Sites du Patrimoine mondial, tourisme et changement climatique

Alors que la perspective du Développement durable et des *Sustainable Development Goals* est présente depuis le début de façon transversale dans les séminaires de la Chaire, la question du changement climatique n'avait pas été jusqu'alors traitée frontalement. En particulier, la question particulièrement épineuse du changement climatique en rapport avec le Patrimoine mondial et le tourisme représente un des plus importants défis auxquels sont confrontés les sites du Patrimoine mondial. Ce 10^e séminaire de la Chaire UNESCO vient ainsi combler une véritable lacune. Son organisation a été possible grâce à la participation de deux principaux partenaires du rapport « *World Heritage and Tourism in a Changing Climate* » publié par l'UNESCO et l'UNEP en 2016. Adam Markham et Helena Rey ont ainsi accepté de coanimer le séminaire apportant ainsi une précieuse expertise sur la question, à un moment propice permettant de réinterroger les conclusions du rapport de 2016.

La question centrale du 10^e séminaire de la Chaire UNESCO, celle du rapport entre le tourisme et le changement climatique dans les sites du patrimoine mondial, est double :

Il s'agit d'un côté de cerner l'impact du changement climatique sur le tourisme. La remontée du niveau des eaux risque par exemple de faire disparaître plusieurs sites du Patrimoine mondial proche des côtes. Des phénomènes climatiques extrêmes provoquent et provoqueront des dégâts considérables sur d'autres sites du Patrimoine mondial. Les efforts nécessaires de médiation pour que ces évolutions soient comprises et accompagnés par les visiteurs mais aussi par les populations locales sont particulièrement considérables.

De l'autre côté, il s'agit de se pencher sur les façons dont le tourisme est lui-même facteur de changement climatique qui impacte les sites du Patrimoine mondial. Il s'agit donc d'aller au-delà du constat des dysfonctionnements du tourisme sur certains sites (l'over-tourisme et ses symptômes directs ou indirects) pour réfléchir sur la façon dont les sites du Patrimoine mondial peuvent devenir des sites pionniers dans la réflexion sur la lutte contre les effets du tourisme sur le changement climatique.

Nous espérons aller au-delà du constat de l'impact du changement climatique dans les sites du Patrimoine mondial sur le tourisme, afin d'explorer des possibilités de mesures d'atténuation qui pourraient être testés dans certains sites du Patrimoine mondial. Ceci impliquerait que le complexe système d'acteurs qui intervient dans la mise en tourisme des sites du PM (transport, hôtellerie, restauration...) soit véritablement conscient de cette nécessité et devienne partie-prenante de ces efforts.

Peut-on imaginer des sites du Patrimoine mondial à « impact positif » ? Des sites exemplaires eux-mêmes en termes de (non) impact climatique ? Et quels en seraient les moyens et les outils ? Comment peut-on engager les acteurs locaux et les populations locales dans les multiples efforts contre le Changement climatique ?

³MOOC "Tourism Management at UNESCO World Heritage Sites":

(vol1): <https://www.fun-mooc.fr/courses/course-v1:Paris1+16008+session01/about>

(vol 2) : <https://www.fun-mooc.fr/courses/course-v1:Paris1+16012+session01/about>

Donnons-nous le temps de réfléchir tous ensemble aujourd’hui sur ces questions.

En conclusion de cette brève introduction, il convient de remercier l’ensemble des co-organisateur dont l’investissement s’est renforcé au cours des dernières années, ainsi que l’ensemble des intervenants de ce séminaire qui ont accepté de mettre à disposition des étudiants, doctorants, chercheurs, institutionnels et gestionnaires des sites du Patrimoine mondial présents dans la salle, leur si précieuse expertise.



Allocutions d’ouverture, 10^e séminaire de la Chaire UNESCO « Culture, Tourisme, développement ».
De gauche à droite : Peter Debrine, Maria Gravari-Barbas, Mechtild Rössler, Jean-François Lagneau, Adam Markham
(Photo : Michel Tiard)

World Heritage Climate Change and Tourism: Impacts & Responses

Adam MARKHAM

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ICOMOS Climate Change & Heritage Working Group
IUCN Protected Areas & Climate Change Specialist Group*

Introduction

In 2007 UNESCO released the first major report on climate change and World Heritage and it is still extremely relevant today.

Another key document was commissioned from the Australian National University by the Australian Government in 2009. For the first time a country reviewed all its World Heritage sites to assess the potential risks to them from climate change.

Then in 2016 UNESCO, together with the Union of Concerned Scientists (UCS) and UN Environment Program (UNEP), published the report *World Heritage and Tourism in a Changing Climate*, which analyzed 35 sites⁴ in 31 countries. These sites were chosen because they give a good representation of the different types of climate impacts affecting sites in all types of environments and in all regions.

One of the conclusions of this report was that climate change is the fastest growing threat to World Heritage sites globally. And yet most of “state of conservation” reports talk of increasing landslides, flooding or storms, but they are still not identifying these events as driven or worsened by climate change.

Probably every World Heritage site is impacted by climate change, but this doesn’t mean that all are threatened by it: some are more at risk than others, so we need to better understand what the risks are, and prioritize among sites for which we need to take action, locally and internationally.

We are facing an unpredictable future, which means that we can no longer rely on the climate and weather patterns of the recent past for planning World Heritage management decisions. For example, the US National Park Service recently issued guidelines to all of its coastal site managers, warning that they should be planning for hurricanes at least one category higher than they have historically experienced. This is based on what we climate science is telling us about increasing intensity of North Atlantic storms.

In this context, it is important to understand that we will see widespread degradation of Outstanding Universal Value (OUV) in World Heritage sites, and eventually some of them may even lose their OUV: how can we deal with that within the World Heritage Convention? That is a question that the World Heritage Committee and the States Parties will have to grapple with.

Climate change adds to, and worsens, existing threats, including tourism pressures. This will require us to deal with major new management and interpretation challenges.

The Intergovernmental Panel on Climate Change (IPCC) Assessment Report released in 2013 included four keys findings:

- There is 95% certainty that human activities are responsible for global warming

⁴ Rapa Nui/Easter Island (Chile), Rock Islands (Palau), East Rennell (Solomon Islands), Shiretoko (Japan), Yellowstone (USA), Galapagos, (Ecuador), Ouadi Qadisha (Lebanon), Sagarmatha, (Nepal), New Caledonia (France), Venice (Italy), Ilulissat Icefjord (Greenland).

- Carbon dioxide is at an unprecedented level not seen for at least the last 800,000 years
- Sea level is set to continue to rise at a faster rate than over the past 40 years
- Over the last two decades, the Greenland and Antarctic ice sheets have been melting and glaciers have receded in most parts of the world

Government decisions on climate policy are often based on IPCC reports. However, these reports are always a few years behind the science, because they work with peer-reviewed scientific articles that are published one or two years before the IPCC conclusions come out, and the science is moving very fast. So, for example, one of the biggest uncertainties is how fast the Greenland ice sheet is going to melt, and that in turn will influence the rate of sea level rise. The most recent projections show faster melt rates than it was projected in the last IPCC report.

Figure 1 shows the probability's strength of climate change's impacts, according to IPCC report on the implications of not meeting the Paris Agreement goals. On the right side there are events that are high certainty, such as extreme heat, drier soils, high tide flooding and sea level rise. On the left there are more complex issues, like wildfires, that are undoubtedly worsening in many countries but are also linked to land use and forest management grazing, and tornadoes and thunderstorms where we so far know little about the relationship to climate change.

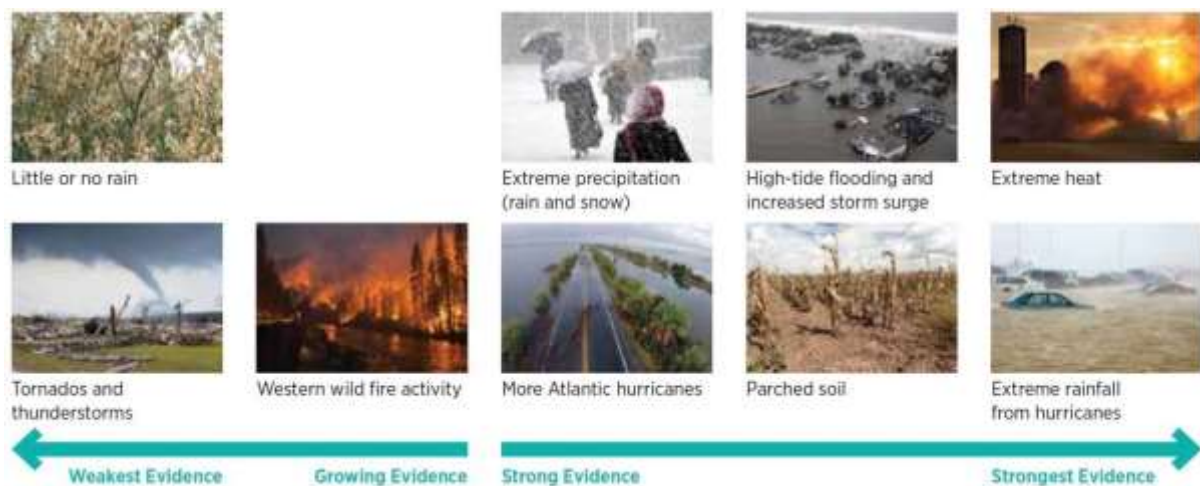


Figure 1. Strength of evidence for some of the most significant impacts of climate change (source: IPCC/UCS)

Under the “Paris Agreement” 2015, most countries agreed to try to keep the global warming below the 2°C, and hopefully below 1.5°C, but today we have already reached 1°C. The Arctic is warming at twice that rate, and some areas of the Arctic even at four times that rate. Despite the fact that global warming is happening extremely rapidly, there was no sense of urgency or ambition in the statements that came out of the last Conference of Parties to the UN Framework Convention on Climate Change (UNFCCC), COP25, held in Madrid in December 2019.

Climate Change Risks to Tourism

Climate change poses risks to the tourism sector, primarily by causing direct damage to World Heritage sites that may prevent visitation, reduce people’s interest in visiting them or reduce visitor satisfaction.

There is also a growing risk of dangerous extreme events (e.g. hurricanes, cyclones, typhoons, floods, landslides, heatwaves, droughts), which affect the sites but also tourism infrastructure such as airports and hotels, and lead to increased insurance costs, both for individual tourists and for tourism businesses. Coastal tourism is at greatest economic risk.

Tourism, especially long-distance air travel is also a major driver of climate change. According to a recent study

(Lenzen et al., 2018), which analysed the global carbon footprint of the sector including food production, travel, accommodation etc, tourism it is now responsible of 8% of global carbon emissions.

Tourism itself it is expanding: its expenditure doubled from 2009 to 2013 and it is rapidly growing. International travel represents 23% of tourism emissions, while carbon growth from tourism is 3% annually. China is the country with the highest rate of carbon growth (17.4% annually). The key countries and regions driving tourism emissions are North America, North Western Europe, Russia, India, China and Japan (fig.2).



Figure 2. Global Carbon Flows from Tourism (Source: Lenzen et al., 2018)

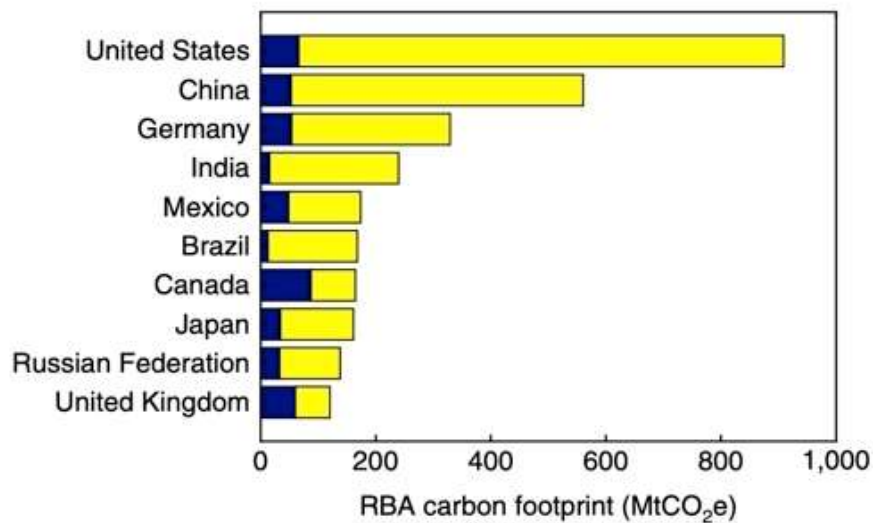


Figure 3. Per Capita Carbon Footprints for Tourism (ibidem). Yellow: domestic tourism. Blue: international tourism

Some WH sites are affected by over-tourism or unsustainable tourism, causing problems not only to properties but also to local communities, while affecting the quality of visitors' experience (fig.4). In the past few years, many local communities have started to protest against over-tourism, especially in the cities, where tourism is pushing local costs for accommodation and food higher (fig. 5).

Even sites that do not receive so many visitors can see real impacts from tourist footfall, causing erosion that sometimes forces damage to, or the closure of paths leading at the sites, as for example at Lake District (UK) and in Birka (Sweden). At the Ring of Brodgar, in the Orkney Islands (Scotland, UK), which will be treated in more detail by Ewan Hyslop from Historic Environment Scotland in another talk, is interesting because increased rainfall due to climate change, together with growing numbers of tourists (many from cruise ships) is causing the closure of the main path around the site more and more frequently (fig.6).



Figure 4. Two examples of over-tourism: Great Wall, China (left), and Dubrovnik, Croatia (right)



Figure 5. Anti-tourism in Barcelona, Spain (Credit: Wiki Commons)



Figure 6. A sign at the Ring of Brodgar, Scotland, explaining that climate change is a cause of the path closure (Credit: Historic Environment Scotland)

Some Examples of Climate Change Impacts on World Heritage Sites

Coral Reefs

In 2017 UNESCO released its first study on Impacts of Climate Change on World Heritage Coral Reefs (Heron et al., 2017), which was updated in 2018. The study analyses WH Coral Reefs from 2014 to 2017, concluding that twenty-five of twenty-nine WH properties (86%) experienced bleaching stress caused by warming water, and many twice or more. If climate change continues at the current rate, these properties will severely bleach twice-per-decade by 2040. Coral reefs need time to recover from bleaching events, so the more often they are damaged, the less resilient they become. According to the latest IPCC report, 90% of living coral reefs will be lost if we do not limit ocean warming to 1.5°C.

More than 300.000 people live close to coral reefs, and many of them get most of their protein from fish dependent on these ecosystems. Tourism in these areas is worth \$35.8 billion annually, and it represents more than 15% of tourism revenue in at least 23 countries. For example, Australian Coral Reefs, including the Great Barrier Reef receive 7.9 million visitors a year, representing 3.1% of GDP. The Great Barrier Reef brings in \$8 billion and supports 46,000 jobs. These figures show dramatically how the loss of coral reefs can directly impact the economy.

Glaciers

According to another 2019 study (Bosson, Huss & Osipova, 2019), twenty-one of forty-six WH glaciers could be lost by 2100: this again poses the question of what will happen to the OUV label of the sites once the glaciers disappear.



Figure 7. Grosser Aletschgletscher, Switzerland (Source: Bosson, Huss & Osipova, 2019)

Because of the loss of ice, more and more ancient artefacts are surfacing on the mountains in many parts of the world. A new scientific discipline has even developed to study them: ice patch archaeology.

In Jotunheimen National Park (Norway) an ice tunnel of 70 meters has been built in the Juvfonne ice patch, where over 700 objects have been displayed dating from up to 6000 years ago, that have emerged as the ice melted (fig.8). It is a very positive and interesting way of interpreting and communicating the climate impacts on the site.



Figure 8. The ice tunnel in Jotunheimen National Park, Norway (Credit: Oppland County Council)

Sea-level Rise, Sea Warming and Coastal Erosion

A 2019 study on Mediterranean WH sites (Reimann et al., 2019) identified forty-two of forty-nine WH as already at some level of risk from coastal erosion (fig. 9), and the number is roughly the same for sea level rise.

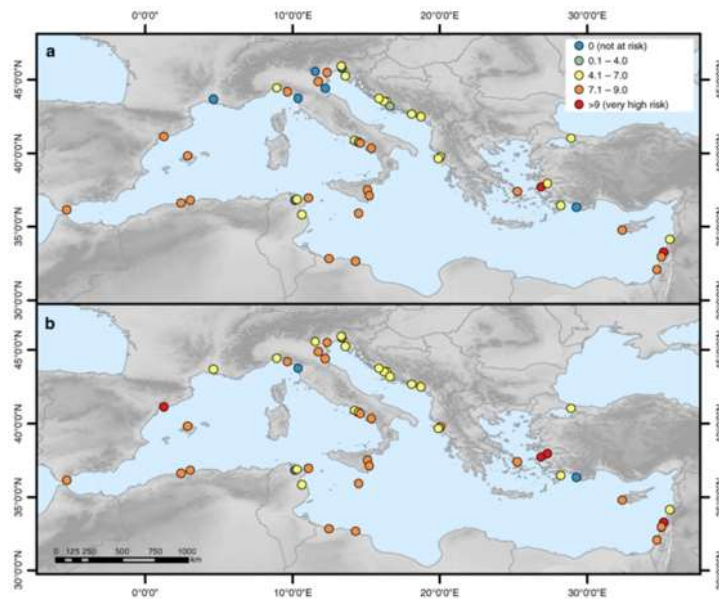


Figure 9. Flood risk index at each WH site under current and future conditions. a in 2000 and b in 2100 under the high-end sea-level rise scenario (Source: Reimann et al., 2019)

An example is the island of Delos (Greece), mythical birthplace of Apollo, sea level rise is causing water coming up through the porous limestone substrate and damaging the ancient Greek ruins by capillary action.

Marine archaeologists point out that ocean warming and changing salinity are causing the geographical range of shipworms in the Baltic Sea and in the North Atlantic to expand. These wood-boring molluscs are a threat to hundreds, if not thousands of ancient wooden shipwrecks lying on the sea floor.

Most of the famous Moai statues of Rapa Nui (Easter Island) are located in coastal sites and are threatened by sea level rise, coastal erosion and more intense storms (fig.10)



Figure 10. Moai statues on the coast of Rapa Nui, Easter Island (Photo: Adam Sanford)

In East Rennell (Solomon Islands), sea level rise is increasing salinity in the lagoon, affecting both the biodiversity and the taro gardens of the communities that live around the lagoon

Hội An (Vietnam) is an exceptionally well-preserved example of a South-East Asian trading port from the 15th to the 19th century, counting at least 800 ancient wooden buildings. Nearby beaches are eroding at up to 20m per year and the whole area may be severely inundated once a year within a decade (fig.11).



Figure 11. Flooding in Hội An, Vietnam (Credit: UNESCO).

Arctic Archaeology

In the Arctic at least 180,000 archaeological sites are at risk (Hollason et al. 2018), including four WH sites: Ilulissat Icefjord and Kujataa (Greenland), Putorana Plateau (Russia) and Lapponian Area (Sweden). This is due to causes including thawing permafrost, warming soils and coastal erosion. Figure 12 shows a team of archaeologists analysing a site in Greenland where organic archaeological material such as bones, wood and animal skins have rotted away as the previously cold or frozen soil warmed.



Figure 12. Archaeologists in Greenland (Source: Holleson et al. 2018)

Wildfires

In January 2019, Tasmanian Wilderness WH site (Australia) was ravaged by wildfires that killed 1000-year-old trees. Vegetation in this area is not fire-adapted and it can take decades or longer to recover from wildfires (fig. 13 A).

Bandelier National Monument is not a WH site but is a National Park located in New Mexico (USA). In 2011 a massive fire burnt 156,000 acres, becoming the largest wildfire in the State's history. Archaeological sites, such as the 700-year-old remains of a small pueblo, were severely damaged (fig. 13 B). In the West of the United States the ecosystems are mainly fire-adapted, but the fire season is now seven weeks longer than it was in the 1970's. Moreover, with the drying of soils fires are becoming larger and more severe.



Figure 13 A. Tasmanian Wilderness, Australia
(Photo: Dan Broun)



Figure 13 B. Remains of an ancient pueblo at Bandelier National Monument, USA (Photo: Rory Gauthier, USNPS)

Often a fire is followed by extreme rainfall events, and because the trees are no longer there to prevent the water from rushing down the slopes, this causes flash floods and soil erosion. At Valles Caldera National Preserve, in New Mexico (USA), archaeological resources have been damaged by such floods, including deposits of worked obsidian. In two years, floods have transformed what were just deer tracks in the forest into huge furrows that are now visible from satellites in space (fig.14).



Figure 14. Erosion at Valle Caldera National Preserve, New Mexico (USA). (Photo: Adam Markham)

Land Subsidence Due to Changed Rainfall Patterns

In Angkor (Cambodia) tourist number nearly doubled from 2010 to 2014, to 2.3 million a year. A recent paper (Chen et al., 2017) underlines that the water pumping from the ground for the needs of tourist infrastructure is causing land subsidence. This, combined with the decreasing rainfalls that make the soil drier, is predicted to increase the instability of the ground under the ancient temples. Some of them are already cracking and need to be supported (fig. 15).



Figure 15. Two temples in Angkor that required to be supported because of land subsidence (Photos: Fulong Chen)

An Example of Sustainable Tourism in Uganda

Sustainable tourism at a local level can help make World Heritage sites more resilient to climate change. For example, the Ugandan NGO « [Conservation Through Public Health](#) » (CTPH) is working to increase community health and promote sustainable tourism and agriculture at the Bwindi Impenetrable National Park (Uganda), one of three Africa forests where mountain gorillas still survive. Even though there are not many scientific studies on direct climate risks in this area, extreme precipitations and landslides are clearly on the rise. And gorillas may be at risk from changes in vegetation affecting food availability. Poaching is a continuing threat and as we have learned during the COVID pandemic, diseases transmitted from humans could also threaten large primates such as gorillas

The organization provides veterinary care to gorillas caught in poachers' traps or that become ill. It also trains volunteers from local communities in avoiding human-gorilla conflicts, since the forest is surrounded by densely populated cultivated lands. CTPH also works in the villages to improve hygiene and reproductive health, and provide women with micro-loans to set up small business. Moreover, the NGO is working with local farmers on an organic coffee cultivation project that brings income directly to local farmers: the coffee is bought by the CTPH at premium prize and marketed as "Gorilla Conservation Coffee".

The NGO runs its own low-cost ecolodge, the "Gorilla conservation Camp". Tourists can visit all the projects complex, from the veterinary clinic to the village health projects and sustainable coffee plantations, and can observe gorillas in their natural environment (fig.16).



Figure 16. Top left: a farmer and a CTPH project manager in a Bwindi coffee plantation. Bottom left: silverback mountain gorilla. Right: tourists on a gorilla trek (Photos: Adam Markham)

The Climate Change Vulnerability Index

One of the recommendations of the 2016 UNESCO/UNEP/UCS report was the need to undertake a comprehensive global review of the climate vulnerability of World Heritage sites, identifying those that are most at risk and assessing the climate threats to their OUV, integrity and authenticity.

It is also necessary to understand how to prioritize our efforts in those sites, identifying which ones needs help more urgently, where can we can we learn most about what is going on with climate change, where are the solutions that can be applied to other sites.

Other recommendations for revising WH policies came up from an expert workshop on the WH Climate Policy held in Vilm, Germany, in 2017. One was to consider establishing a "Climate change vulnerability index" (fig. 17), in order to compare the risk of different properties. The Climate Vulnerability Index (CVI) has been developed by researchers at James Cook University with support from UCS, Historic Environment Scotland (HES) and others. It is a science-based rapid assessment methodology designed specifically for World Heritage, which is standardized, repeatable and transparent.

Pilot CVI workshops have been held in Shark Bay (Australia) in 2018, and in Heart of Neolithic Orkney (UK) in 2019. Several more are planned, including for the Vega Archipelago (Norway), the tri-national Wadden Sea property (Netherlands, Denmark, Germany), Sukur (Nigeria) and San Juan, Puerto Rico (USA).

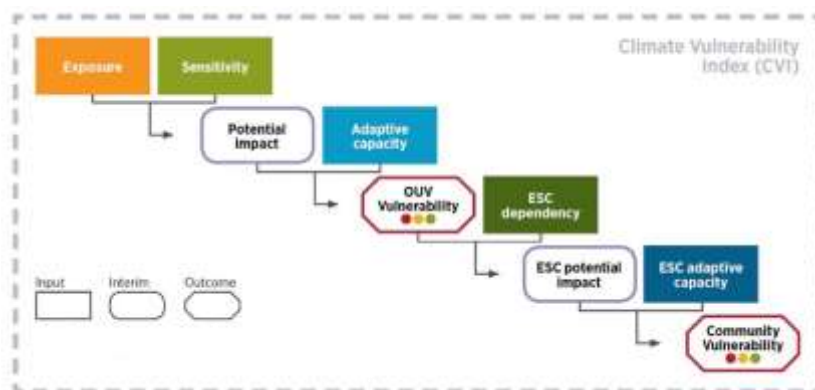


Figure 17. The CVI framework to undertake rapid assessment of climate change vulnerability of WH sites and associated communities (ESC=economic-social-cultural)

Using World Heritage to Increase Ambitions on Climate Change

Another important issue identified in the Vilm workshop was the need to recognize the potential of World Heritage to speak to and engage broader audiences. This recommendation came from the workshop because if you look at IPCC reports, many climate impacts are mentioned that refer indirectly to WH sites, but in almost no case it is noted that these sites are on the UNESCO World Heritage list. People around the globe care about World Heritage, so if we shine a spotlight on the risks so many iconic and important sites are facing, we may perhaps be able to help inspire a greater level of international ambition on climate change solutions.

In the new statement of IUCN/UNESCO/ICCROM/ICOMOS/ICIMOD on “[World Heritage and the post-2020 Global Biodiversity Framework](#)” impacts of the climate change were unfortunately not mentioned, but, as in the Vilm workshop, it is underlined that we should leverage the influence, engagement and widespread popularity of World Heritage to catalyse transformative behavioural change and to increase understanding of the importance of biodiversity as an essential part of our shared heritage.

The Climate Heritage Network launched in Edinburgh in October 2019 is a step in this direction. The network aims to mobilize sub-national entities and civil society organizations working in the culture and heritage sectors in support of climate action and effective policies.

Conclusion: Lessons for HW Management

In conclusion, let me refer to the “The future of our past” a major new report from ICOMOS that was launched at the WH Committee meeting in Baku (Azerbaijan) in 2019. It provides an overview of all the issues related to climate change and cultural heritage, including a comprehensive table showing how all types of climate impact can affect everything from built heritage and museums to cultural landscapes and intangible heritage. One of the recommendations of the report is that understanding and responding to climate change must become a baseline competency of heritage management, as are sustainable development principles.

And finally, I want to say that there are some lessons for WH management strategies that we must all learn.

We need to:

- Manage for change, not just static or historic conditions.
- Assess and understand climate risk and vulnerability.

- Integrate climate change into planning (and to do that we need a global network of climate scientists available to advise site managers and planners).
- Embrace uncertainty, but plan for the most plausible, science-based scenarios.
- Use the best available climate science for your site or region
- Integrate local, traditional and indigenous knowledge and communities (as in CTPH Uganda example).
- Develop better strategies for climate interpretation and education at sites: it is important to explain to visitors what the effects of climate change are, to make them aware of the impact.

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Première Table Ronde

L'adaptation du Patrimoine Mondial et du tourisme au changement climatique

Modérateur:

Peter Debrine, UNESCO World Heritage Centre

Intervenants:

Pierpaolo CAMPOSTRINI, Managing Director, CORILA (Consortium for Managing Scientific Research on Venice Lagoon System): *Venice, climate changes and the difficult balance among tourism, citizenship and safeguarding*

Adam WILKINSON, Director, Edinburgh World Heritage: *Building a grass roots approach to adaptation and mitigation in a tourist destination*

Matthias RIPP, World Heritage Coordinator of the "Old Town of Regensburg with Stadtamhof": *Responding to climate change through a World Heritage Management Plan - lessons from Regensburg*

Ewan HYSLOP, Head of Technical Research and Science, Historic Environment Scotland: *Building resilience to climate change impacts at the Heart of Neolithic Orkney World Heritage Site*

Introduction

Peter DEBRINE

UNESCO World Heritage Centre

Good morning everyone, and thank you Adam for framing the issues so well.

UNESCO engages with tourism primarily through the lens of our cultural conventions whose aim is to safeguard and protect heritage, but we recognize its benefits to local economic development and its important contribution in supporting the creative industries.

Tourism is growing exponentially, and with growth comes challenges.

As Adam demonstrated, most World Heritage destinations are becoming so popular that sites are being overwhelmed and communities are pushing back. On the one hand it is a question of numbers and management.

But their needs to be a recognition of a shared responsibility to face the challenges and identify solutions including policy levers, private sector engagement, community engagement and empowerment.

We could argue that the solutions to overtourism are also solutions for climate change.

The identification of knowledge gaps and issues in relation to different types of cultural heritage is crucial to the development of appropriate strategies to adapt to climate change, including with respect to heritage tourism.

Our task is to identify value and need centered approaches of different stakeholder groups that encourages sustainable planning through an adaptive process that is both holistic and continuous.

Do we need a new model of climate change response combined with contemporary sustainable development? How can we improve communication more effectively to illustrate the potential for cultural heritage to help address the challenges of climate change and its impact to tourism?

How can heritage drive climate action and support equitable transitions and solutions by communities towards a low carbon, resilient future?

What is the value of traditional knowledge and sustainable traditional practices that support climate action through the tourism value chains and heritage conservation including traditional building materials, construction design?

What is the role of cultural tourism into climate action plans, adaptation frameworks, and National Determined Contributions?

How can we better coordinate cultural heritage safeguarding and climate action by promoting strong linkages to urban and territorial planning policies and impact assessment processes in terms of sustainable tourism?

What are the difficulties in implementing planning time scale for climate change impacts on cultural heritage due to the long-term nature of the planning cycles involved?

What is the role of monitoring and how can UNESCO and its Advisory bodies respond better to the challenge in terms of protecting heritage?

We are now going to hear from a distinguished group of panelists who will focus on case studies underscoring the impacts to sites and ideas and approaches to climate adaptation and resiliency through management, planning stakeholder engagement:

Pierpaolo CAMPOSTRINI, Managing Director, CORILA (Consortium for Managing Scientific Research on Venice

Lagoon System): *Venice, climate changes and the difficult balance among tourism, citizenship and safeguarding.*

Adam WILKINSON, Director, Edinburgh World Heritage: Building a grass roots approach to adaptation and mitigation in a tourist destination.

Matthias RIPP, World Heritage Coordinator of the “Old Town of Regensburg with Stadtamhof”: Responding to climate change through a World Heritage Management Plan- lessons from Regensburg.

Ewan HYSLOP, Head of Technical Research & Science, Historic Environment Scotland: Building resilience to climate change impacts at the Heart of Neolithic Orkney World Heritage Site, Scotland.

Venice: Climate Changes and the Difficult Balance among Tourism, Citizenship and Safeguarding

Pierpaolo CAMPOSTRINI

Director, Consortium for Managing Research Activities in the Venice Lagoon
Procuratore di S. Marco

Introduction

The site "Venice and its lagoon" was included in the UNESCO World Heritage list in 1987, satisfying all the six criteria and, in addition, it was considered as "Outstanding Universal Value" meeting also the conditions of "integrity" and "authenticity". It is not necessary to mention here the uniqueness of its cultural values, consisting of historical, archaeological, urban, architectonic, artistic heritage and exceptional cultural traditions, integrated into and extraordinary and outstanding environmental, natural and landscape context.

For the same reasons, Venice is one of the most popular tourist destinations in the world. However, Venice is not a large city, nor in its physical dimension, nor in number of inhabitants.

While the WH site, i.e. the whole lagoon, is quite wide (600 km², fig. 1), the physical dimension of what is considered the centre of Venice, i.e. the six "sestieri" plus the Giudecca island, is quite small (fig. 2)

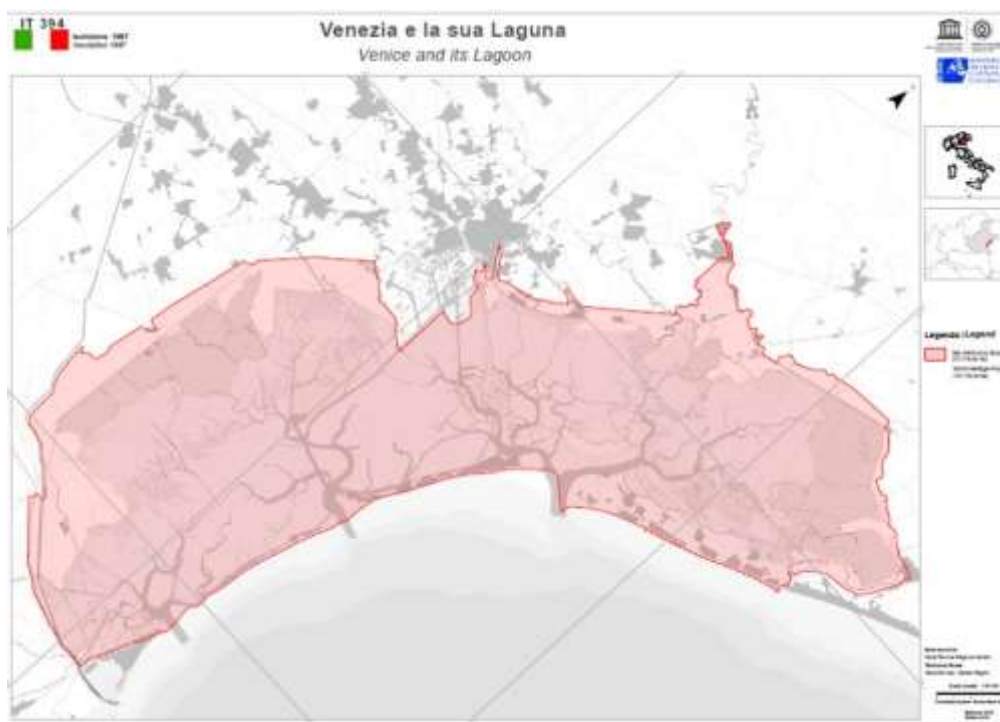


Figure 1. The UNESCO World Heritage site Venice and its lagoon (Source: UNESCO/MiBACT – Ministry of Culture, Cultural Heritage and Tourism)



Figure 2. The "centre" of Venice (Source: Google Maps)

In fact, the surface of the "centre" of Venice is just 7 km², less than the surface of the first five arrondissements of Paris considered together. The area of all the 20 Paris arrondissement is 105.4 km²

Moreover, the number of Venice's inhabitants is small and, since many years, still decreasing (59.000 versus the 160.000 of the previously mentioned portion of Paris) (fig.3).

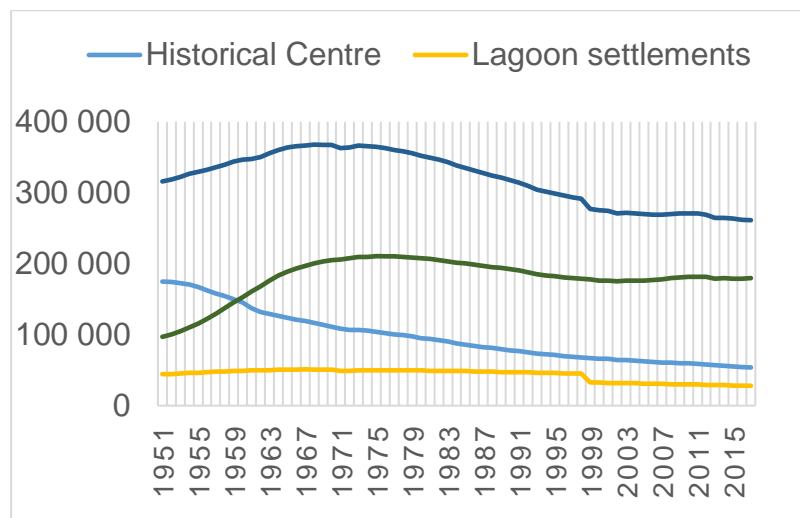


Figure 3. Residents in the Municipality of Venice from 1951 to 2017 (Source: Municipality of Venice)

In the last years Venice emerged also as the capital of the new phenomenon called overtourism⁵. A clear measure of this phenomenon is the ratio among inhabitants and visitors. When this ratio falls below a certain level, the city itself loses its main characteristics, assuming those of an amusement park.

Apparently in Venice the decrease of inhabitants is corresponding to the increase of tourist presences, suddenly augmented after the year 2000 (fig 4). This is surely due to a number of reasons: a significant contribution came by the possibility of a tourist location given to private houses (fig.5) that previously belong to the market of long-term rental, now almost disappeared in the city.

⁵ Bertocchi et al, 2019

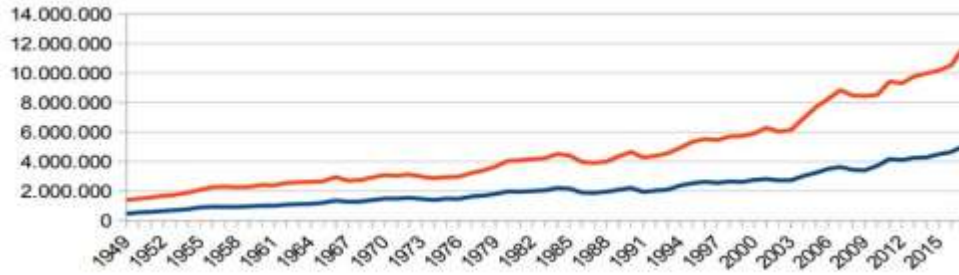


Figure 4. Tourist load in Venice: arrivals (blue), presences (red) (Source: Municipality of Venice, 2017)



Figure 5. Airbnb accommodation in Venice (Source: Insideairbnb.com, 2019)

The increase in tourist load produces an "increase in degradation" in the historic city, specifically in:

- increase in organic load (increase in waste production)
- increase in the transport of people and goods (overload of water traffic, problem of wave motion on buildings)
- increase in the transit of boat and ships in the Venice's canals
- increase in "tourist commuting" from Mestre to Venice, with possible overloading of the road/railway bridge and interchange stations

In this situation, one of the main indications for policy strategies aimed to balance the positive presence of tourist with the need to maintain the "city status" for Venice is the evaluation of the Tourist Carrying capacity (TCC). A number of recent studies⁶ proposed different kind of thresholds, suggesting the optimal ratio to be: one resident – one visitor. Other authors proposed draconian measures to push back Venice to a supposed "original" status.

Climate Change Effects

In November 2019 an unprecedented series of extreme meteorological events hit the North Adriatic Sea, causing repeated flooding of Venice. The level of the tide in the city reached the second height ever (187 cm on the mean sea level), but it was also the first time that three events over 140 cm occurred within a 24h window. The city's local defenses were overtopped by the level of lagoon water, while the main protection system (MOSE), still under construction, was not in a condition to operate (fig.6). The 2019 was the year with the largest number ever (26) of events and the maximum number of hours (50) with the tide level over the threshold of 110 cm (the quote when more than 20% of the city pavements are flooded).

⁶ Van der Borg, 2017



Figure 6. The MOSE barriers (Source: [Consorzio Venezia Nuova](https://www.conorziovenezianuova.it/), 2019)

In the following figure, the values of the annual mean sea level and of the numbers of tidal flood events are plotted against time in the period 1872-2019 (fig. 7). The increase of events in the last 50 years and in particular in the last 20 is amazing. There are little doubts that the cause of this sharp increase is due to climate change.

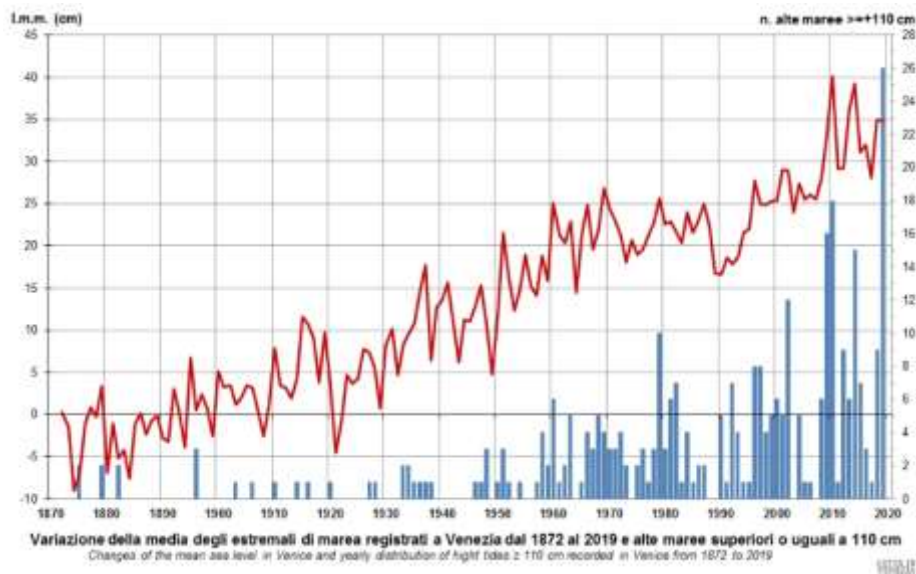


Figure 7. Sea level rise and flooding events in Venice from 1872 to 2019 (Source: Municipality of Venice)

In the post-event analysis of the 12th of November⁷, the Institute of Marine Science of CNR (National Research Council) evidenced the unprecedented series of factors that led to the sudden and unpredicted rise of the level of the water in the lagoon and its repetition (at a lower, but still high level) in the following hours (fig.8).

⁷ Ferrarin et al., 2019

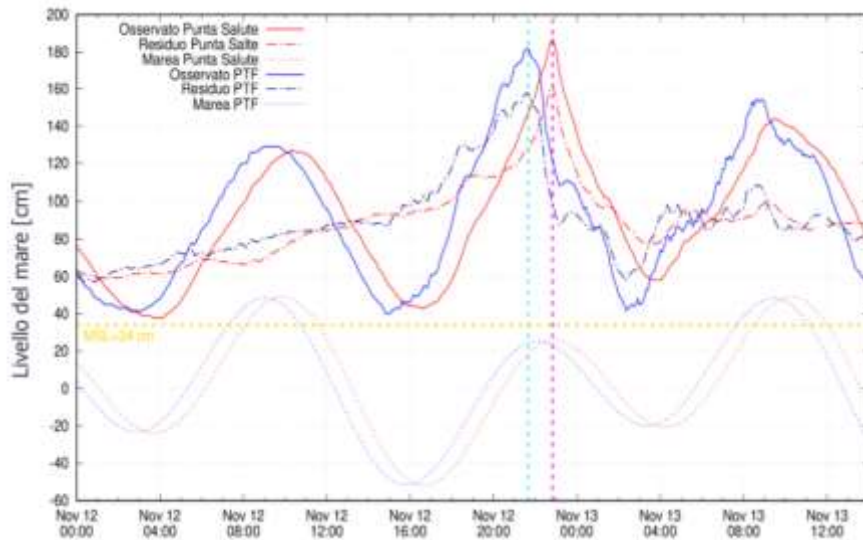


Figure 8. Graphs of the actual water level at the CNR platform in the sea (continuous blue line) and in the city (continuous red line) compared with the astronomic tide (dotted lines). (Source: Ferrarin et al., 2019)

Damages to the Cultural Heritage and Flooding Protection Systems

These events caused major damages to the city activities on the ground floor (housing, shops, restaurants, hotels, workshops, etc). The cultural heritage patrimony was severely damaged, in particular the nine centuries old St. Mark's Basilica, and further damages are attended to become evident in the next weeks, due to the crystallization of salt present in the sea water. A very strong wind, occurred in the same moment, caused other damages to the roof lead-plates, too.

The 12th of November the water of the lagoon entered for the second time in the history inside the main part of the St Mark's Basilica, producing the most visible damages. The water flushed with violence into the Crypt, with the risk of a complete filling of it, which could have leads to disastrous consequences.

The pressure due to salty water invasion is enormously grown in the last 50 years, leading to an evident acceleration of the aging processes (figures 9 to 11). Correspondingly, the need for restoration activities increases, and in some case material substitutions (e.g. marble column bases) are compulsory.



Figure 9. The salty water infiltrates by capillarity the tiles of this mosaic located 12 m off the pavement



Figure 10. The effects of increased pressure by salty water, air pollution (SOx), and more intense use on the basis of two marbles columns of the St Mark's Basilica front



Figure 11. One of the columns of the Basilica's front in 1921 (left) and today (right)

At the same time, an immediate prevention from further tide flooding is a bare necessity, for tide of any level. Having in mind that the altimetric level of the narthex (the atrium, fig. 12) is 66 cm, the lowest in the city of Venice, recent works designed by the Procuratoria di S. Marco and realised by the State are able to defend it up to 88 cm of tide level. The MOSE system, expected to protect the whole lagoon over 110 cm, will be finished hopefully in a couple of years. The “sealing” of the Piazza S. Marco up to 110 cm will take longer times, 3 years at least, for complete the defense. Therefore, the Procuratoria di S. Marco proposed a provisional defense project, with glass fences, which could be built in six months around the front façade of the church. The project is presently under evaluation by the competent Authorities.



Figure 12. The narthex (atrium) of the St Mark's Basilica flooded. On the night of the 12th November the level of the water overcame the four visible steps, flooding also the main Basilica's floors

New Instruments for Regulating Tourist Access in Time of Climate Change

The increase of tourists and the climate change adaptation measures could lead also to an inevitable reduction of the “visiting times” of cultural assets in Venice. This may lead to different negative phenomena, including presences’ rebound and instabilities.

It is therefore necessary to accompany the limits with tools/services able to improve the quality of “visiting experience” by means of new solutions. Examples of the main instruments follows.

- Booking and regulation of visits (scheduling of time slots, annual intervals)
- Introduction of new technologies (e.g. "virtual reality" and "augmented reality") for a better preparation off-site and in-site. Use of urban wi-fi for updated real time communications to all city users
- Managing of tourist routes throughout the historic center (compared to the overcrowding of some routes)
- New civil work rules for private tourist accommodation offer (e.g. need for waste sanitation, limits in a condominium)
- Inclusive approach to sensorial disadvantages (e.g. blinds, etc)

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Building a Grass roots Approach to Adaptation and Mitigation in a Tourist Destination

Adam WILKINSON

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Key points

- Academics and practitioners need to work together to be more realistic around what is achievable in terms of adaptation and mitigation when it comes to the historic built environment
- Visitors use the same infrastructure of residents – so it is necessary to work on reducing both resident CO₂e and visitor CO₂e
- We need to share our knowledge and experience far beyond our World Heritage Sites – with other WHSs and cities – if we are to achieve real and positive impacts

Introduction

Edinburgh is a small to medium sized city on the northern fringes of Europe, at the same latitude of Moscow. Its population of circa 500 000 is well educated and young, with high levels of employment. In the course of a year, the city officially has around 5 million visitors per year, though many suspect the figure to be much higher.



Figure 1. A view of Edinburgh World Heritage Site from the north-west, showing the geometric patterns of the New Town, and the volcanic crag and tail of the Old Town, with the castle at its peak

The Old and New Towns of Edinburgh World Heritage Site sits at the heart of the city, taking in the mediaeval Old Town, high on a volcanic ridge, the 18th and 19th century New Towns, over the Waverley Valley on a ridge to the north. The site includes around 4000 buildings, 25,000 residents, 70,000 daily commuters, the heart of the Scottish economy, its political institutions, universities, the festivals and all the visitors.



Figure 2. Aerial view of Old and New Towns of Edinburgh World Heritage Site

At the heart of the OUV of the World Heritage Site is the juxtaposition of the two distinct urban forms of the Old and New Towns, including the exceptional completeness of the New Towns, and the dramatic skyline of the Old Town. The key management challenges relate to it being a living world heritage site – an urban landscape – with a range of pressures for change.

The management of the site is shared between three organisations – The City of Edinburgh Council, Historic Environment Scotland and Edinburgh World Heritage. All have distinct roles within the management system, with Edinburgh World Heritage focusing on the state of conservation, learning programmes and capacity building, with sustainability as a golden thread running through.

Scotland and Edinburgh have ambitious targets in relation to reaching Net Zero, with Edinburgh targeting 2030 with a hard date of 2037. In considering the sources of emissions, Edinburgh divides them into domestic, industrial, commercial and transport related (fig.3). Proposals to meet the targets are divided up in Edinburgh into those which are considered cost effective, cost neutral or which have “technical potential” – i.e. will not produce a positive return, but will help meet the target. Projections demonstrate how targets might be met but it is easy to be skeptical: for example, transport remains stubbornly high and Edinburgh’s airport continues to grow at a spectacular rate; while 48% of all domestic buildings in Edinburgh and 90% within the World Heritage Site are pre-1950, meaning that proposed measures to reduce emissions from them might be considered at best hopeful.

The points around housing and transport are particularly relevant to Edinburgh’s visitor economy. Recent figures show that 29% of residential properties in the Old Town are listed on Airbnb for short term letting (fig. 4). Experience shows that visitors have different patterns of building use and higher comfort expectations than Edinburgh’s residents, who are used to the city’s inclement weather and generally avoid over-heating their accommodation. Similarly, a successful visitor economy is fed by a successful airport, which has seen an increase of over 2.5 times since 2000 (fig.5).

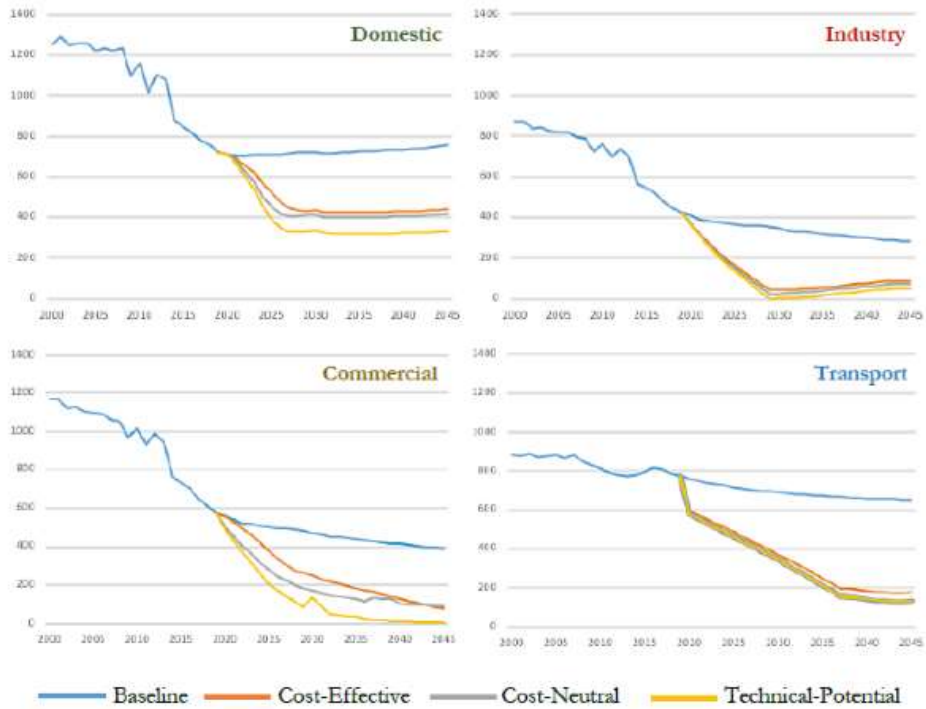


Figure 3. Analysis of sources of emissions and related costs, as basis for proposals to meet the Net Zero target (Source: [Jacobs](#), credit: City of Edinburgh Council)

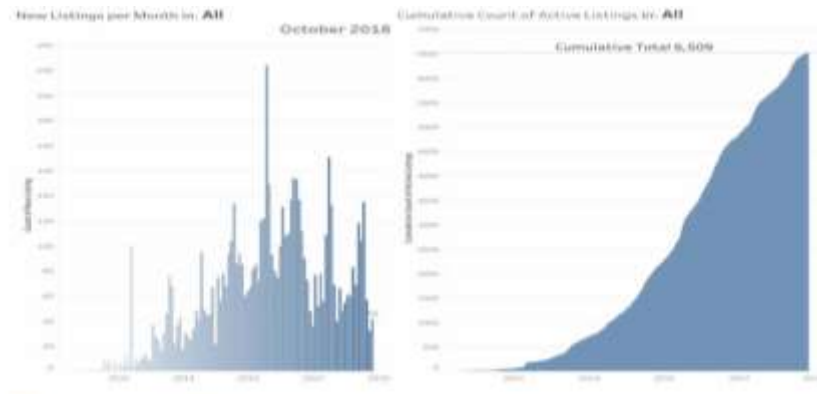


Figure 4. Edinburgh Airbnb listing from August 2009 to November 2018 (Analysis: Dan Cookson. Source: [InsideAirbnb.com](#), 11/18/2018)

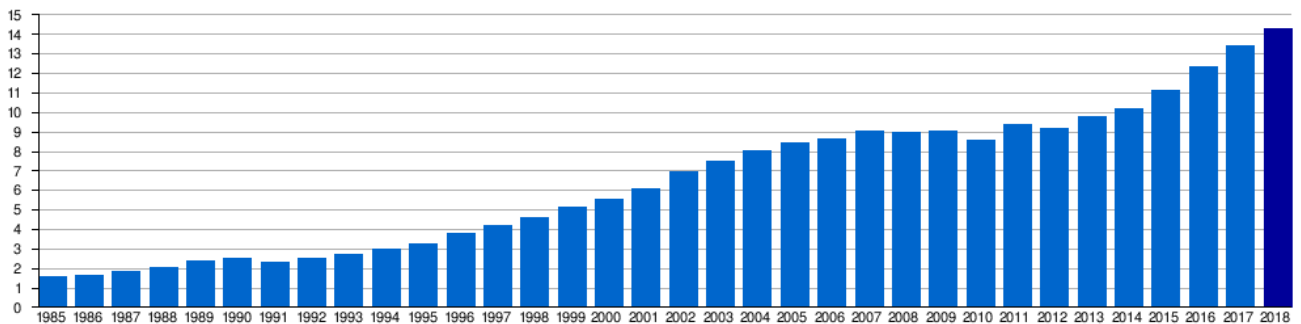


Figure 5. Edinburgh Airport passenger numbers from 1985 to 2018 (Source: UK Civil Aviation Authority)

EWH’s focus in relation to sustainable tourism has been to focus on the built fabric, as in relation to World Heritage this is where the greatest potential for a conflict in values lies and so where most work is required to negotiate the conflict and come forward with acceptable solutions. Around 2008/9 EWH worked with a local

environmental charity, Changeworks, to understand how the city's historic building stock could work to both adapt and mitigate climate change, with the help of a housing cooperative that was willing for us to experiment on its housing stock. This led to two publications giving practical advice, related to relevant policies governing the historic environment.

Across Edinburgh there has been an attempt to coordinate the many different groups whose work touches on climate change issues, primarily through *Edinburgh Adapts*, a local forum with the City of Edinburgh Council at its centre. This led to a climate adaptation plan for the city, with actions shared out amongst all the members. The most recent outcome of this from EWH's point of view was a guide to building maintenance in a changing climate – practical advice for building owners. However, in the intervening period, EWH has carried through a number of projects supporting community resilience and OUV while supporting adaptation/mitigation, on the grounds that what is good for residents will be good for visitors. These have included bringing unused urban spaces back into use as community gardens (teaching food growing skills), and practical training for house owners on historic window repair and draft proofing (fig. 7 A and 7 B).



Fig. 6 A. A previously unused space converted by the community into a food garden

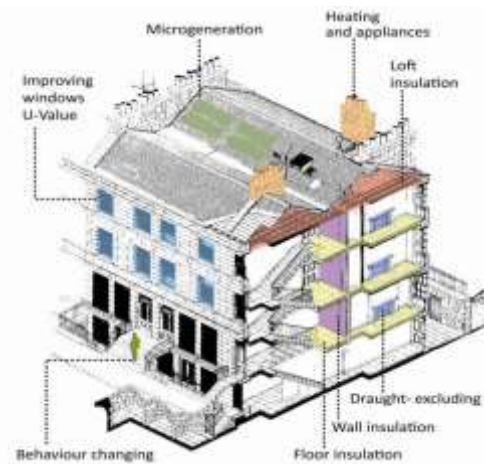


Fig. 6 B. A range of measures can be applied to a traditional Edinburgh tenement but critical to them is behavior change

EWH's main current project in relation to sustainability and climate change is a pilot project on the adaptation of a post-war listed building. This is viewed as important as it represents hard-to-treat buildings of the most unloved sorts, where the desire to invest to reduce CO₂e will be lowest. The housing block in question dates from 1969 and contains 12 residential and 2 commercial units (fig.7). The commercial units contain shops focused on the visitor economy, and some of the residential units are listed on Airbnb. The block suffers from serious condensation issues that affect health, with large seasonal variations on temperature and humidity. The programme brings together conservation and energy efficiency at design stage, which a view to avoiding one conflicting with the other, as often happens when these activities occur sequentially. The project is funded through European Funds, EWH's own conservation grants, Scottish Power Energy Networks and contributions from the owners, with a total cost in excess of £1m. The entire process is being carefully recorded for academic and practical use, including both energy and social monitoring.

In relation to commercial units, we work to support shop owners in the restoration of their shop fronts. Many of these benefit greatly from the visitor economy, and their conservation and repair provide opportunities to increase energy efficiency, improve internal conditions and external appearance, increasing footfall and income. A current example is a food outlet, Franco's fish and chip shop, which has an inappropriate front (fig.8). The restoration of its shop front includes double glazing, subtly included in the historically accurate restoration (fig.9).



Figure 7. EWH promoted a project to improve energy efficiency of this 1969 building



Figure 8. One of the building's commercial units



Figure 9. The restoration of the shop improves both energy efficiency and external appearance (Copyright: Ogilvy Chalmers)

A forthcoming project aims to assess the risks and vulnerability of the Outstanding Universal Value of the Old and New Towns of Edinburgh to climate change. This will deploy a number of methodologies to understand the impacts at a grass roots level, including the CVI approach deployed in Orkney, with a view to informing future policy and action, while building up a constituency for action. The project aims to ensure replicability in order that it can be of assistance to other historic urban areas.

In all of this work, Edinburgh World Heritage acknowledges that we are only attempting to address a small part of a wider problem. The World Heritage Convention points us to the importance of sharing our knowledge and experience with other cities and World Heritage Sites. With the support of the UK Government’s Cultural Protection Fund, EWH and our Turkish partners, KMKD, have been running a programme in two cities in south-east Turkey, Mardin (fig. 10) and Antakya, to support the identification and prioritisation of heritage in danger, community engagement, energy efficiency and urban security, with a view to preparing them for the return of tourism as the area stabilises. This has included the conservation and repair of a traditional house in Mardin (fig. 11), with the inclusion of energy efficient measures as a demonstration of how the houses of the old city can be brought back into economically viable use, meeting the needs of modern life and supporting both local community and the visitor economy.



Figure 10. A view of the city of Mardin, Turkey

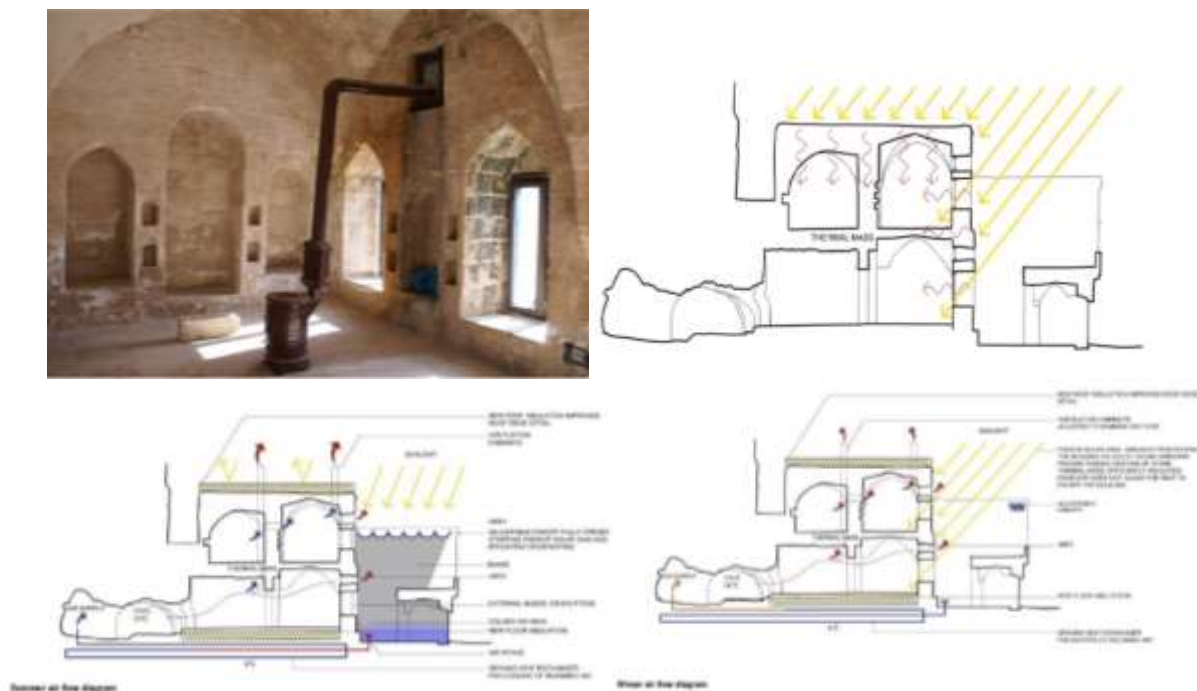


Figure 11. Conservation of a traditional house in Mardin, with the inclusion of energy efficient measures

Integrating Climate Change with Sustainable Urban Development in the World Heritage Management Plan of the City of Regensburg

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Figure 1. A view of the Old Town of Regensburg with Stadtamhof (Photo: Matthias Ripp)

Introduction: The Challenge of Climate Change for Urban World Heritage Sites

Today, World Heritage cities can be understood as systems that, but for a few insular exceptions, are part of much larger societal systems (Ripp 2018). These are complex and consist of transportation, migration, economic, and cultural networks, to name a few.

The same 21st century trends and challenges facing society also affect World Heritage cities. Urban development is influenced by controlling factors represented by trends in local populations, housing, traffic (Dumas, Ripp et.al. 2013), and tourism (Gravari-Barbas and Guinand 2017), as well as by issues around sustainable urban management (Städtetag 2019, p. 4). However, the greatest challenge affecting urban heritage systems is, unquestionably, climate change because of its breadth and depth. Respective authorities, decision makers and communities place safeguarding urban heritage, and managing

the resultant effects of climate change, high on their agendas. UNESCO World Heritage cities are usually part of a dense and valuable historical urban fabric, which includes urban functions and local communities that are either directly affected by climate change, or indirectly by preventative and adaptive measures.

Contrary to the popular belief that urban heritage is a rigid, unchangeable and inert part of urban environments, it can also be precedent setting for adapting to change (Ripp and Lukat 2017). Resilience through design and construction, through the use of suitable materials, and through adaptations, all within the parameters of planning, can be strengthened by urban heritage rather than limited (Ripp and Lukat 2017). The numerous effects of climate change directly challenge UNESCO World Heritage cities around the world. Extreme weather events are appearing with increasing frequency and intensity in the form of storms, heavy rains, floods, flash floods and droughts as well as the rise and/or fall of moisture levels in soils. These effects threaten archaeological remains and historical buildings. UNESCO World Heritage cities in particular will have to develop special programs to protect their Outstanding Universal Value (OUV) from these events given their sometimes fragile historical urban fabric (City of Regensburg, et al. 2009).

Demands will be placed not only on cities, public administrations and institutions, but also on building owners, who will be obliged to protect the OUV of their properties from these dangers.

For instance, direct strategies and tools to lower carbon-dioxide emissions in World Heritage cities, such as the use of energy-saving building materials which preserve the authenticity and integrity of respective sites, would mitigate the dangers and maintain the OUV.

Indirect measures, too, are gaining new and greater importance in combatting climate change, but also present potential conflicts: for example, the introduction of more plants and greenery in historical urban areas could negatively affect the authenticity and integrity of sites. In light of this, the increased greening of historical urban areas needs to be re-discussed and compromises, and resolutions regarding the preservation of historical monuments might have to be made. Appropriate measures as such could significantly improve urban living conditions (Städtetag 2019, p.8/9).

Migration, cultural diversity and integration are also issues that are becoming more important to World Heritage cities, in part because of climate change. Cities in particular have usually been places of long-term immigration and are consequently characterized by a diversity and mixing of cultures and lifestyles. The resultant cultural diversity presents opportunities and possibilities of cultural exchange which are enormously enriching and need to be consciously and purposefully embraced and promoted by various civic institutions (Städtetag 2019, p.11).

The challenges faced by World Heritage cities are complex, diverse, and dynamic and so are the opportunities. They call for local administrations to be flexible, adaptive and systemic in their understanding of urban heritage, qualities not easily found within the sometimes rigid and inflexible structures of the local administrations (Mühlmann, Ripp et al. 2012).

When a historic town or city district is recognized as a UNESCO World Heritage site, the distinction necessitates the highest international level of preservation. Urban sites, more than any other World Heritage sites, are especially challenged to withstand and balance the tensions between tradition and modernity—a task is the preservation of the heritage and the development of a vibrant city. The World Heritage designation opens up new economic prospects, specifically in tourism, although this too has drawbacks, for example in the impact large numbers of visitors have on a site. However, new impulses do arise to integrate urban development—something that would not only benefit World Heritage cities, but other modern cities as well. These can heighten a city's own profile, develop a shared identity that draws on both European and global contexts, and promote social cohesion. In view of the current challenges of globalization, climate change, immigration and social segregation, delivering these outcomes is very important (Städtetag 2019, p.1).

As with all modern European cities, cities with historical centres need to respond to technological and societal changes. However, this response is not easy to implement in urban areas that have protected World Heritage inventories. Then again, this might even be desirable in order for the OUV and the authenticity of a site to be respected. Urban planning and design require careful consideration of the World Heritage sites, and need to deliver practicable solutions that enhance the livability of the site for local communities.

Currently, numerous cities are pursuing climate-friendly environmental policies by providing green electricity to public consumers, refurbishing buildings for energy-efficiency, and improving transport systems and the like. In combating climate change, UNESCO World Heritage cities require adaptive measures of energy management that preserve the authenticity and integrity of respective sites. Reference to combating climate change, the opportunities and challenges, as well as the possible mitigating measures can be made in the position paper of the Association of German Cities (Deutscher Städtetag, Städtetag 2019) and the Civil Protection Manual of the German Commission for UNESCO (Deutsche UNESCO-Kommission e. V. 2017). Improving the energy efficiencies of existing historical buildings by using compliant materials places exacting demands on urban renewal and is often associated with much additional expenditure. Existing old buildings must specifically qualify for retrofitting. Solar power, for instance, can only be minimally used due to frequently protected rooftop landscapes. Similarly, standard measures of insulating are also restricted. It follows that innovative solutions need to be researched in the areas of civil engineering, material technology and conservation. The findings should then be centrally managed and made easily accessible. At present, the German Centre for Half-timbered Construction — a registered society (Deutsches Fachwerkzentrum Quedlinburg e. V.) — has made important contributions to the research and the provision of examples in renovating — respectful of heritage, ecological and environmental values (Weller et al. 2013). These contributions aid in the refurbishment of architectural monuments for energy efficiency. However, there is a growing level of insecurity on what types of interventions are or are not possible for heritage buildings, because a number of court decisions have amended the stringent regulations prohibiting the use of solar energy systems on listed buildings (Breithaupt 2012).

As a member of the Canada-based Organisation of World Heritage Cities (OWHC), the City of Regensburg identified, already early on, that climate change is one of the most pressing and time sensitive challenges facing heritage cities globally. In 2008 at the Regional Conference in Regensburg the topic of discussion was 'Earth, Wind, Water, Fire – Environmental Challenges to Urban World Heritage', and it was here that the 'Regensburg Recommendation' was released. The Recommendation addresses the effects environmental issues have on built cultural heritage: "We emphasize the importance of safeguarding the world's cultural heritage for present and future generations, highlight that climate change and environmental challenges like storms, flooding, fire, earthquakes, weathering, erosion and landslides pose one of the most important threats to World Heritage cities, especially given the more frequent extreme weather situations, emphasize that the loss and deterioration of the built cultural heritage due to natural disasters and climate change affects all people and recall that the safeguarding of the urban cultural heritage is the shared responsibility of citizens, local and regional authorities, national governments and international organizations" (City of Regensburg et al., 2009, p.1).

In the case of the UNESCO World Heritage city, 'Old Town of Regensburg with Stadtanhof,' developing an integrated World Heritage Management Plan (Mühlmann, Ripp et al. 2012) was seen as a strategy to balance conflicting needs, and to define appropriate actions and interventions in response to climate change.

An Instrument for Sustainable Urban Development and Safeguarding Urban Heritage: The Integrated World Heritage Management Plan

Shortly after Regensburg's inscription on the World Heritage list, city council decided to redevelop the Management Plan for the site. Eight issues were identified and defined as key fields for action: tangible cultural heritage, culture and tourism, economic development, housing, mobility, urban planning and development, environment and leisure as well as awareness raising and research.

Members of the Management Plan working group developed specific principles, objectives and key measures for each field of action. This integrated method of developing a management plan was later inspiring by many other cities.

The integrated approach of the Regensburg Management Plan attempts to balance the safeguarding of the

UNESCO World Heritage site Regensburg with the sustainable development of the area (either socially, economically and/or environmentally). At the same time, it aims to secure a multifunctional, vital and attractive old town for residents and visitors alike and tries to manage the [conflicting] needs and interests of all stakeholders concerned (e.g. residents, visitors, conservators). Following the framework of the EU funded project HerO, a local working group was established (City of Regensburg and Ripp 2011). This multidisciplinary group embodied all of the relevant stakeholders in Regensburg including local municipal authorities such as the PR and Tourist departments, as well as external cooperation partners. Appropriate steps were taken to analyze all pertinent and existing concepts, plans, studies and instruments for Regensburg. Furthermore, an overall vision for the site and the development of basic principles and objectives—regarding building preservation, the retail industry, tourism, etc.—were conjointly elaborated. What followed was the development of an ‘Action Plan’. As an important part of the Management Plan concrete measures to support the objectives were defined. The process of open civic participation followed. Eventually all of the measures and actions were approved by city council to meet its obligations and challenges.

It is worth noting the preface of Regensburg’s Management Plan, which states: “World Heritage Cities such as Regensburg are presented with enormous challenges today. Current developments such as increasing commercial competition, global climate change and demographic changes in addition to new, structural and technical requirements on buildings and infrastructure are unique in scope and place particular demands on all cities with historical inner-city areas” (Mühlmann, Ripp et al. 2012, p. 10).

The intent of the Regensburg World Heritage Management Plan is to be practicable. It formulates principles, aims and structures. It provides measures for protection and conservation, as well as actions for the use and development of the World Heritage asset on location (i.e. the Old Town with Stadtamhof). The measures and actions are scheduled over the course of five to ten years. The Management Plan itself sets out to continually improve the resilience of the World Heritage asset and its location. As a consequence, a management system with special structures and procedures has been set up that secures and continually optimizes the protection, conservation, utilization and development of the World Heritage site. What is more, a dedicated monitoring system is prescribed—one that verifies the implementation of measures taken and that provides expedient feedback to develop the Management Plan further. (Mühlmann, Ripp et al. 2012, p. 10 ff)

The Role of Climate Change in the Management Plan

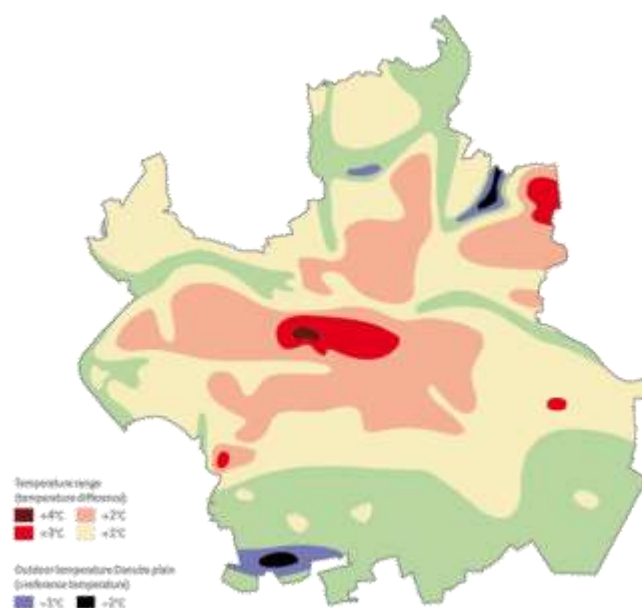


Figure 2. Distribution of Temperatures in the City of Regensburg during cloudless

At present, annual atmospheric and meteorological records clearly indicate that the Earth is warming and that global climatic changes are caused by man. As a result, World Heritage cities around the globe are affected, and are vulnerable to floods, landslides and climatic events (Bigio, 2014). The extent to which this will affect ecosystems, and thereby human societies, is still to be discovered and fully understood. Protecting climate and adapting to climate change are two of the greatest challenges facing societies politically, scientifically and commercially in the 21st century. Hence, it goes without saying that adapting to climate change is also a great challenge to the 'Old Town of Regensburg with Stadthof'.

Environmental Factors

To enhance the resilience of the historical urban fabric, special attention has been given to the assessment of specific urban vulnerabilities. Vulnerability and adaptation assessment are important to local administrations working on World Heritage cities as this provides them with the knowledge needed for defining priorities and for integrating these priorities into current programmes and budgets. In order to minimize risks to the built heritage, it is necessary to analyze areas that could be potentially affected. The following environmental forces are identified as being of particular significance in Regensburg's Site Management Plan: flooding caused by the town's proximity to two rivers; acid rain caused by air pollution— which corrodes historical limestone monuments; and global climate change—which calls for initiatives to adapt to changing climatic conditions.

A. Flooding

Because it is on the confluence of the Danube and Regen rivers, the Old Town of Regensburg has been afflicted by regular flooding (fig.3). A one-hundred-year flood can see river waters rise five meters above normal in Regensburg. This not only endangers humans and animals but also listed historical buildings and the urban landscape of Regensburg. A study was conducted that provided the necessary basis to help develop a flood control system, known as the 'Blue Plan'. The Plan was prepared by the Water Management Office of Regensburg. It considers the latest mitigating measures and identifies all low-lying areas in Regensburg that are at risk of being flooded in a one-hundred-year flood.



Figure 3. Flooding is a serious threat to the 'World Heritage Site Old Town of Regensburg with Stadthof'
(Photo: Susanne Hauer)

Since the year 2000, the State of Bavaria, in conjunction with the City of Regensburg, has been working on a flood control system. In 2003, the conceptualization of this project was realized in an interdisciplinary

competition, which focused on finding technical and design solutions that protect the municipal area from floods. An 'optimization phase' followed the competition. Two promising draft proposals emerged out of this planned phase and they were examined for their feasibility in 2005 and 2006. Another 'optimization phase' ensued wherein the conceptual basis for a technical flood control system was set for the City of Regensburg. The envisioned system drew primarily on stationary and/or mobile solutions. (Mühlmann, Ripp et. al. 2012).

B. Air Pollution and Rising Temperatures

Next to the threat of floods is air pollution. It poses a rather distinct challenge to local communities as well as to conservators as limestone—an important [structural] component of the listed historical buildings and monuments—is susceptible to corrosive agents. Of particular concern are airborne contaminants such as sulphur dioxide (SO₂) and nitrogen dioxide (NO₂). These pollutants cause acid rain, which in turn are especially corrosive on sandstone and limestone structures and can accelerate the weathering and damage of the World Heritage assets. Air pollution linked to sulphur dioxide abated significantly in the 1990s, and since 2000 has remained relatively low.

However, the threshold of 40 micrograms per cubic meter of nitrogen dioxide pursuant to the "39th Regulation Concerning the Implementation of the Federal Emissions Control Act" (39th BImSchG – Verordnung zur Durchführung des Bundesimmissionsschutzgesetzes) is still being surpassed (Deutscher Bundestag 2010). Measures to reduce NO₂ concentrations are set out in the City of Regensburg's regional Air Purification Plan, dated December 2010 (Mühlmann, Ripp et al. 2012, p. 20).

The last few years have seen the development of a new method of limestone conservation and it has been successfully applied to three of the most important historical structures in Regensburg: the Porta Praetoria, the Stone Bridge and St. Peter's Cathedral. This method will continue to be used in the future. At the same time, climate change is becoming more noticeable in Regensburg. In the last decade of the 20th century, the annual average temperature rose from 7.9 to 8.9 Celsius degrees. Even though the ambient air temperatures in the city's core and surrounding areas are still comfortable, heritage managers will have to specifically address the following questions in the future: will the city's micro-climates remain pleasant? and how can the World Heritage area adapt to the effects of climate change? As a first form of defense, it seems only appropriate to protect and expand the city's green spaces. Secondly, it is important to raise awareness within the community of the effects of climate change and to promote environmentally friendlier lifestyles (Mühlmann, Ripp et. al. 2012; p.19).

C. Strategies, Interventions and Actions that Address Climate Change

Because of the specific parameters associated with the World Heritage asset (i.e. historical architecture, protected historical buildings and monuments, and high building density) there are few possible structural interventions for climate protection and site adaptations.

'Experimental Residential and Municipal Building Construction' (Ex-WoSt – Experimenteller Wohnungs-und Städtebau), is an initiative that explores this matter further and is directed by the Federal Ministry for Transport, Building and Urban Development (BMVBS). One research area specifically focuses on 'Urban Strategies for Climate Change – Municipal Strategies and Potentials' (Urbane Strategien zum Klimawandel-Kommunale Strategien und Potenziale) (Bundesministeriums für Verkehr 2010). The research aims to determine how climate change, particularly the greenhouse effect, directly impacts Regensburg's World Heritage asset. It will also initiate appropriate guidelines and design typologies that will be part of a larger plan for adapting green areas and outdoor spaces to climate change.

Green areas and outdoor spaces (e.g. public streets, squares and open spaces, inner courtyards, parking facilities and riverbanks) present significant opportunities to this end. It is vital to secure and expand these areas and design them with the future in mind.

The task at hand is immense and is challenging because Regensburg's [built] heritage is characterized predominantly by stone (fig. 4). A certain resourcefulness will be required to inlay stone surfaces with green spaces.

An equally important task lies in heightening stakeholder awareness of the threats and effects of climate change on the World Heritage ensemble.



Figure 4. Regensburg is a city made of stone (credit: City of Regensburg)

Excerpt: Field of Action – Environment and Leisure

The principle behind this Field of Action is: “Green spaces are a fundamental element of life in the World Heritage area. Green spaces and riverbanks constitute a valuable asset worthy of protection within the World Heritage area and the buffer zone. They provide space for residents and guests to relax, contributing enormously to the attractiveness of the World Heritage area. They also ensure better air quality, producing a pleasant microclimate within the World Heritage area and are therefore an important factor in adaptation to climate change” In terms of sustainable development, a balance needs to be held between the preservation of historical assets and environmental interests (Mühlmann, Ripp et al. 2012, p. 68).

Additional proposed measures include the expansion of green areas and the exploration of potential green spaces and water areas that are accessible to the public within the World Heritage city (table 1). A ‘Green Model’ is to be developed that takes into consideration the current situation and proposes temporary green spaces. Other aims include the conservation of night sky dark zones, especially within the river landscapes, park areas and the green belt: lighting will not be allowed here so that flora and fauna can flourish. This is part of another proposed measure to protect the flora and fauna unique to the World Heritage area. However, suitable near-ground illumination is to be considered along the main connecting corridors close to the river according to the city illumination plan.

All of these measures are currently being implemented or have already been completed. In 2015, the City of Regensburg published the Interims Report which detailed the situation of all of the measures mentioned in the Management Plan. At the time 44 of the 62 measures were being executed or had already been implemented. The measures were also evaluated in regard to their effectiveness and sustainability (City of Regensburg, 2015, p.28).

Objectives	Measures	Comments
I. Expansion of green spaces The green areas will be secured and expanded where possible.	1. Development and implementation of a programme to promote de-paving. Installation of greenery and vegetation in private courtyards and public spaces, improving the urban climate and supporting »adaptation to climate change« <p style="text-align: right;">(B)</p>	<ul style="list-style-type: none"> • <i>Building upon the research project »Urban strategies on climate change – communal strategies and potentials«</i> • <i>Taking garden areas and trees into consideration in restoration concepts</i> <p><i>See Residential concerns Objective III.1</i></p>
	2. Advising private individuals on green spaces installation in courtyards, facades and rooftop gardens (facing inner courtyard)	<ul style="list-style-type: none"> • <i>Building upon the research project »Urban strategies on climate change – communal strategies and potentials«</i> <p><i>See Residential concerns Objective III.1</i></p>
	3. Continuing the existing concept to maintain the public and private tree stock in the World Heritage area and preparation of maintenance concepts or an action programme for endangered trees <p style="text-align: right;">(B)</p>	<ul style="list-style-type: none"> • <i>Taking garden areas and trees into account in restoration concepts</i>
II. Qualitative upgrading A quality upgrade will be conducted to transform green areas, the green zones alongside the river and the Oberen Wöhrd into leisure and relaxation space, taking flood protection measures into account.	1. Implementation of the riverside concept plus extension and upgrading the riverbank promenades design, including the Wöhrde area (city/river landscape) <p style="text-align: right;">(B)</p>	<ul style="list-style-type: none"> • <i>Taking account of spatial requirements for flood protection</i> <p><i>See Tangible cultural heritage Measure V.1 and Urban Planning Measure I.1</i></p>
III. Temporary green spaces High quality, short-lived green installations in the World Heritage area add to its attractiveness and will be promoted where possible, taking traditional urban planning situations into account.	1. Preparation of a concept in which areas in the World Heritage area are capable of having temporary greenery installed	
<i>See Culture and Tourism Objective I and Urban planning Objective II</i>		
IV. Increasing energy efficiency The energy efficiency of the World Heritage area and its buildings will be increased, e.g. through use of innovative energy supply concepts and individual solutions for the energy-efficient restoration of buildings with World Heritage compatible techniques.	1. Implementation of the research project »Urbane Strategien zum Klimawandel – Kommunale Strategien und Potenziale« (Urban Strategies for Climate Change – Municipal Strategies and Potential) <p style="text-align: right;">(B)</p>	<ul style="list-style-type: none"> • <i>Development of measures for managing heat islands</i> • <i>Examine renewable energy use</i> • <i>Energy extraction from waste water at Donaumarkt</i>
	2. Establish a central advice desk relating to energy-efficient restoration of historical buildings, for example at the energy agency <p style="text-align: right;">(B)</p>	<ul style="list-style-type: none"> • <i>Cross-topic advice Building law, conservation of historical monuments, renewable energies</i>
	3. Control of heat radiators prohibition <p style="text-align: right;">(B)</p>	<p><i>Measure has already been implemented in public area, more action required in private area</i></p>
<i>See awareness raising and research Objective V</i>		

Table 1: Objectives and measures related to climate change in the Management Plan for Regensburg. The measures marked with a circled 'B' emerged from the public participation process (Mühlmann, Ripp et al. 2012 p. 69)

Over the past decade the City of Regensburg has gone through great lengths to apply and adapt the Management Plan to the current situation. One key measure successfully implemented was the ‘use of renewable energy resources in the World Heritage zone’. In this case it was about the recovery of energy from channelized wasted water and the production of energy from sewage. The city took the opportunity to make use of this regenerative energy when the landmark Presidential Building was being renovated to become the ‘Haus der Musik’. From a preservationist’s point of view, it was challenging because no changes could be made to the external facades, not even the attachment of insulating elements. Furthermore, no photovoltaic or solar thermal installations could be considered.

Example: The House of Music / ‘Haus der Musik’

The House of Music (fig.5) provided an opportunity to use energy from sewage— an ideal resource for the efficient operation of heat pumps that can regulate temperatures from 12° to 20° C year round and can eliminate the use of electrical air conditioners during the hot summer months. Moreover, they can provide heat during the winter by drawing warmth from the channelized sewer network below Schottenstraße.

Enough heat can be generated to meet the requirements of the entire building complex. The energy contained in the wastewater is decoupled by means of heat exchangers. In using this regenerative energy source, CO2 emissions are significantly reduced without having to change the exterior facades of the heritage building.

This technology has not only been used in the House of Music, but also in the Museum of Bavarian History, which opened in 2019 (City of Regensburg, 2015, p.23).



Figure 5. The House of Music (Credit: City of Regensburg)

Conclusions

The 2030 Agenda for Sustainable Development—adopted in 2015 by all of the United Nations member states—provides a shared road map for world peace and prosperity now and into the future. At its core are 17 Sustainable Development Goals (SDGs), which urgently call developed and developing countries to be global partners of action (fig.6). The SDGs recognize that ending poverty and other deprivations goes hand-in-hand with strategies that improve health and education, reduce inequality and spur economic growth—all the while tackling climate change and protecting our marine and terrestrial flora and fauna. In essence sustainability is also the prerogative of the Regensburg Management Plan: it is the starting point for developing the city's heritage (Ripp, Hauer et al. 2019).



Figure 6. The Sustainable Development Goals stated in the UN 2030 Agenda (Source: UNESCO)

World Heritage sites have to face the challenges of preparing and adapting to climate change. Their significant yet sometimes fragile structural fabric calls for the development of special programs to combat the effects of climate change. This also applies to historical cities in general. Demands will be placed not only on civic facilities, public administrations and institutions, but also on property owners, who will be obliged to protect themselves from the dangers of climate change. It follows then that renewable energy and energy efficient measures be earnestly applied. Currently, numerous cities are pursuing climate-friendly environmental policies by providing green electricity to consumers, refurbishing buildings for energy-efficiency, improving public transport systems and more.

In combating climate change, UNESCO World Heritage cities require adaptive measures of energy management that preserve the authenticity and integrity of their respective sites. The matter is becoming more and more pressing as observed climate changes increase across the world. In response to these observations the City of Regensburg now has a Manager for Climate Resilience, installed in 2019. Even still, combatting the effects of climate change requires a cross-sectoral approach enforced by citizens, politicians and non-governmental organizations (NGOs).

Resilience seems to be the concept most appropriately applied in dealing with the rapid changes associated with climate change. In contrast to sustainability it specifically addresses adaptation and incorporates a more flexible approach (Ripp and Rodwell 2016).

In the near future ethical issues are expected to come up relating to climate change. This will be particularly the case when a balanced approach in addressing the effects of climate change and safeguarding urban heritage is challenged by ever more severe climate events. For example, if there is a rising number of deaths resulting from hot temperatures within cities, the preventative discourse will reach new levels. More meta-level debates will take place, raising ethical questions and discerning what is valued. In addition to the issues around adaptation to climate change, the transition of society to a low-carbon-based economy also has serious implications for urban heritage, which [in the end] would be best managed within an integrated approach (Calthorpe 2011).

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Building Resilience to Climate Change Impacts at the Heart of Neolithic Orkney World Heritage Site

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Figure 1. Aerial view of Skara Brae, one of the six sites of Heart of Neolithic Orkney (HONO) World Heritage (Credit: Historic Environment Scotland)

Introduction

In this presentation I will describe some of the climate change impacts at the Heart of Neolithic Orkney World Heritage (HONO) Site and how we are managing these, particularly in the light of rapidly increasing visitor numbers. I will describe some of our site management actions which are designed to increase the resilience of sites; and I will highlight the role of science, technology and research in trying to identify solutions.

The HONO property is composed of 6 individual sites, the largest of which are the Skara Brae domestic settlement, standing stone circles at Ring of Brodgar and Stones of Stennes, and the underground burial chamber and tomb at Maeshowe.

Orkney is in a remote and highly exposed situation off the north of Scotland, located between the Atlantic Ocean and the North Sea. It comprises c.70 low lying islands –the World Heritage Site (WHS) is on the largest of these, known as Mainland. The WHS boundaries are very tightly drawn around the 6 individual sites or monuments but enclosed within 2 buffer zones; one is coastal for the Skara Brae site, the other is an inland lake situation (figs. 1, 2 & 3). All the monuments that make up the WHS are Properties in Care, looked after by Historic Environment Scotland on behalf of the Scottish Government.



Figure 2. The four main HONO's sites: from top left, Skara Brae domestic settlement, Ring of Brodgar, Stones of Stennes, and the underground funeral chamber and tomb at Maeshowe (Credit: Historic Environment Scotland)



Figure 3. Map showing location of the HONO World Heritage site and its buffer zone

Climate Change Impacts

A map showing changes in winter rainfall in Scotland over the last 50 years shows increased rainfall levels of over 100% in places (fig. 4 A). In the north of Scotland winter rainfall has increased by >70% since the 1960s. Climate change projections to the year 2100 for summer precipitation and winter precipitation show that, under a high emissions scenario, winter rainfall will continue to increase through this century, whilst summer rainfall is likely to decrease (fig. 4 B).

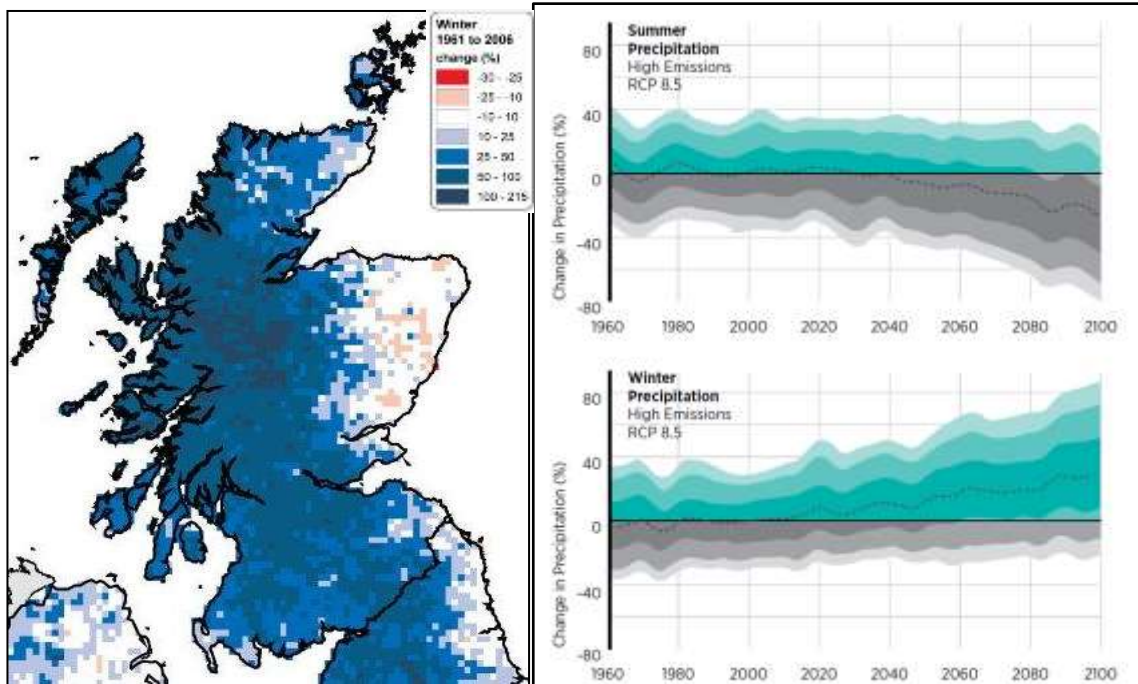


Figure 4 A. Observed trend (winter): change in average total precipitation 1961-2006 (Source: SNIFFER Climate Trends Handbook 2006)

Figure 4 B Projected trends: change in precipitation to 2100 (Source: UK Met Office UKCP18)

Footpath management at Ring of Brodgar

In terms of visitor management, the Ring of Brodgar has an access path bringing visitors from the car park to the site, an inner path directly around the stones, and an outer path on the outside of the ditch. Visitor numbers have increased in recent years, and this is putting pressure on the site and requiring more intensive site management (fig. 5). In particular, cruise ship visitor numbers are doubling around every 4 years (fig. 6). An important aspect of these visitors is that they visit Orkney in only a few months in the summer, so that all the footfall impact is concentrated into a short period. This is having a physical impact on the sites – particularly with increasing rainfall and increasing frequency of extreme weather events. For example, in the last ten years in Scotland our wettest days have been 17% wetter, and heavy rainfall events in the north of Scotland have on average 36% more rain.

In the last few years we have undertaken a programme of footpath repairs using an engineering approach, in order to increase resilience (fig. 7). This design is specific to the site and uses a specially grown local grass type above a permeable layer which has built-in drainage. The work has been carried out in a series of stages on small sections of the inner path over a number of years. Following each stage of work, the new area is left to stabilize for a period of time before it is reopened to visitors. The project has been successful so far, but only just – it is stressed by high visitor numbers in combination with extreme weather events, both in dry spells and in wet weather.



Figure 5. Combined impact of tourists and increased rainfall at Ring of Brodgar site (Credit: Historic Environment Scotland)

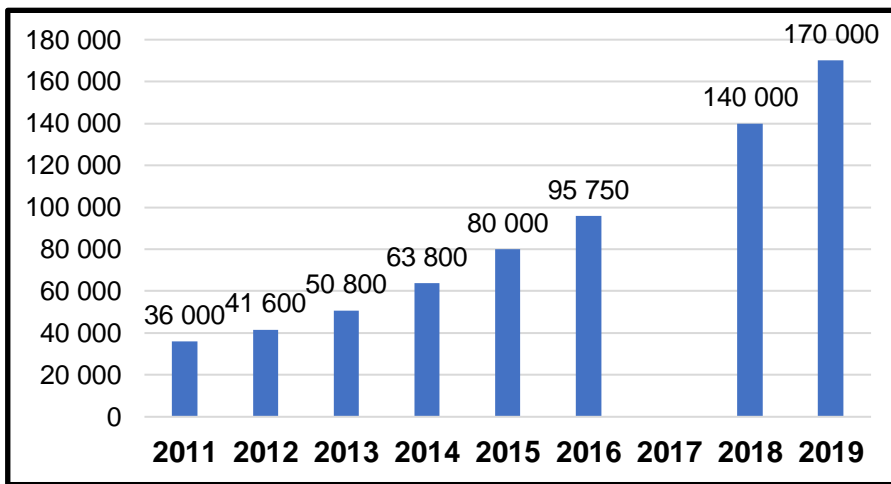


Figure 6. Annual Cruise Ship Passengers in Orkney from 2011 to 2019 (Source: Orkney Island Council)
Note: 2019 is estimated figure.

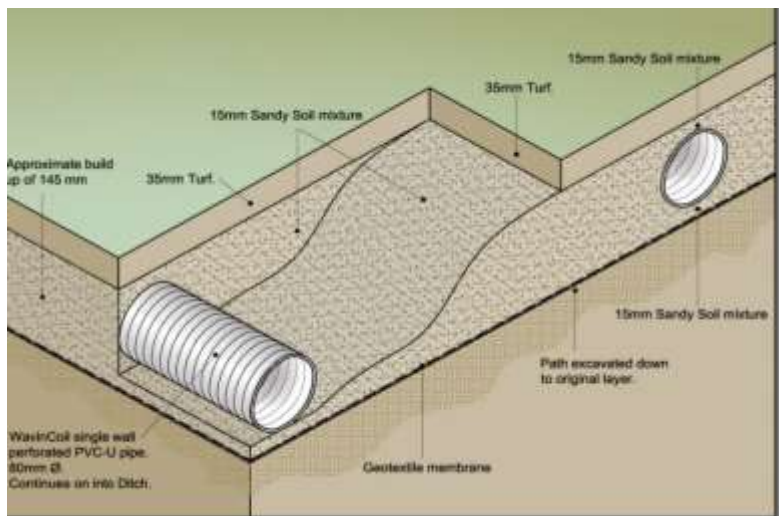


Figure 7. Engineered footpaths: pipe laid across width of path to drain into external ditch (Credit: HES)

We now have a programme in place of continual monitoring and review by site staff with periodic closure of the inner ring path in order to allow recovery. We are still challenged –this summer (2019) was the 2nd wettest summer on record in Scotland, and so we closed the inner footpath more than ever before –almost every few weeks, to allow the grass the rest. Visitors can still come to the site, but using the outer path only –and therefore cannot get close to the stones. This is not ideal, because we want visitors to have the best experience possible, but there is risk of exposure of the subsoil and unacceptable levels of ground erosion.

Rising sea levels at Skara Brae

Sea Level Rise (SLR) in Scotland is already significant and of increasing concern. Globally, sea level has risen by 16-21 cm over the last century and is accelerating. In the last few decades in Scotland we are seeing an annual sea-level increase of between 3 and 6 mm. Graphs of SLR show the steady actual increase in the north of Scotland observed over the past 100 years, with a projected dramatic increase over the next 80 years (fig. 8). Under a high emissions scenario SLR in Orkney could be anything between 40 cm to 1 metre. We are working on the assumption of a 1 metre SLR by 2100 –current scientific evidence suggests this is becoming more likely; for example if the Western Antarctic Ice sheet collapses in the next few years then global SLR could be between 3 to 5 metres by the end of this century.

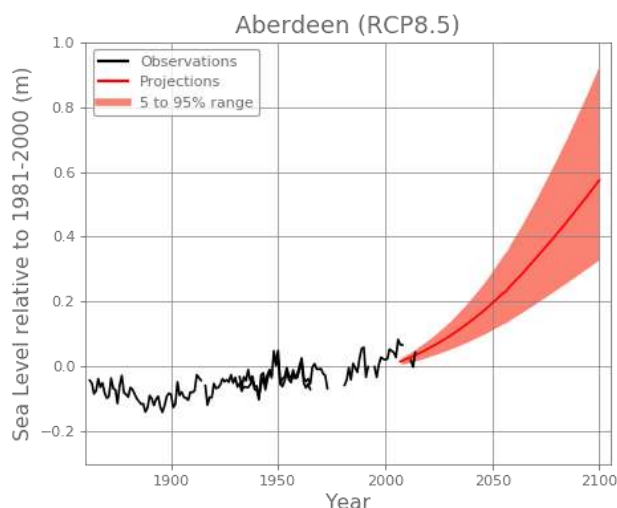


Figure 8. Sea level rise in north Scotland (high emissions scenario) (Source: UK Met Office UKCP18)

Skara Brae sits directly on the coast. It is protected by a concrete sea wall. If it was not protected, then most of the site would already have been lost to the sea. It is becoming increasingly challenging to manage the site as the adjacent soft coastline is eroding at an accelerating rate, and the hard defenses are being undermined at the edges, and at the leading edge or foot of the wall.

Historic Environment Scotland undertakes terrestrial laser scanning every 2 years to monitor the stability of the site and the wall and to help determine erosion rates. We are seeing complex patterns with loss of height on the beach (essentially a steepening) in front of the wall, and a height increase in front of the soft coast. There is some undermining of the wall footings, but otherwise the wall itself is stable. The soft coast is eroding at a rate of about 40 cm per year –and this rate has doubled in the past 4 years. If it continues at this rate, we can project the future position of the coastline which indicates substantial loss (figs. 9 & 10). Of course, with global SLR accelerating the rate of erosion is likely to be more than 40 cm per year and it is likely that the amount of loss will be significantly higher.



Figure 9. Illustration of potential coastal retreat at Skara Brae based on annual loss of 0.4 metres (Data source: [Dynamic Coast](#))



Figure 10. Erosion of soft coast adjacent to Skara Brae. The protective sea wall and coastal defenses can be seen in the background (Credit: Historic Environment Scotland)

Fluvial flooding risk at Skara Brae

At Skara Brae it is not just coastal erosion that we need to manage. There is also a risk from fluvial flooding from inland rainfall events. We have produced flood risk maps which indicate potential impacts, not to the site itself but to the access paths, and visitor centre and car park (fig.11). In such high rainfall situations, we may need to close the site to visitors and there is a risk of damage to infrastructure. We have therefore undertaken a programme of works to address this at Skara Brae and have made significant improvements to ground drainage in order to increase capacity and allow flood water to escape away from the site.



Figure 11. Coastal flood (green) and fluvial flood (blue)
 (Crown copyright [& DB right] 2019 OS 100017908, ©Oceanwise, ©SEPA FRM maps)

This work stems from our Climate Change Risk Assessment of all the 336 Properties in Care throughout Scotland, which we published in 2018. We have screened all of the sites in our care for 6 different environmental hazards and produced a risk score for each site. This work indicates that 53% of the 345 sites that we look after for the Scottish Government have a High or Very High risk from one or more of the hazards, in a way that we consider unacceptable. The study is being used to prioritise our continual maintenance programme in order to ensure that our resources are targeted effectively. It is important to note that it is not just Orkney, and it is not just our World Heritage Sites that are at risk from climate change impacts.

Less known impacts and the need for research

There are likely to be climate change impacts that we do not yet know about, nor understand well. The examples given above are impacts for which we have good knowledge and can quantify the risks. For example, temperature is increasing in Scotland and will continue to do so –we will have hotter drier summers and warmer wetter winters (fig. 12). But we do not know what effect this might have on the monuments if we have more extreme wetting and drying events –this could drive increased rates of stone decay. In truth we need to improve our knowledge, and there are research gaps and opportunities to better understand these potential impacts.

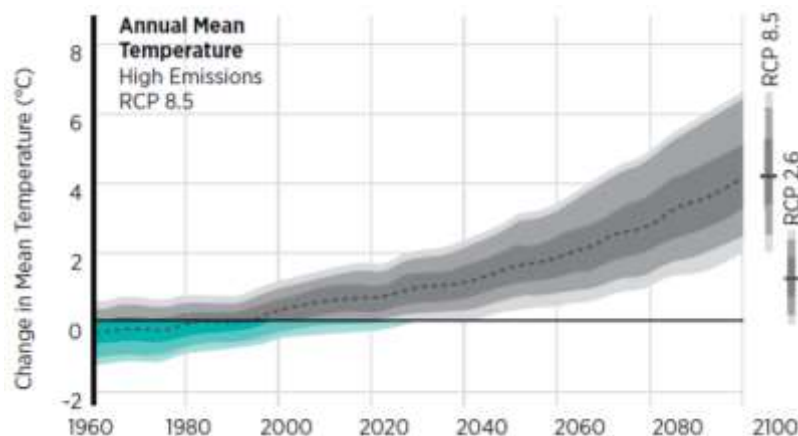


Figure 12. Climate change projections for Scotland (UKCP18). (Source: UK Met Office UKCP18)

If we plot changing environmental conditions in Scotland over the last 50 years onto a graph of stone decay mechanisms (Peltier 1950)⁸ related to rainfall and temperature, we can see a significant trend – a shift into a different type of decay mechanism (fig.13). It so happens that this particular diagram was developed in the USA back in the 1950s for a very specific environment and it may not be directly applicable to Scotland in terms of the exact position of the decay field boundaries, but it does indicate the potential for risk, and a need for research to understand this better. Historic Environment Scotland currently has two PhD students working on aspects of this; one on stone weathering and the other looking at the effect on soils. We need more research, and there is a need to prioritise research funding in this area.

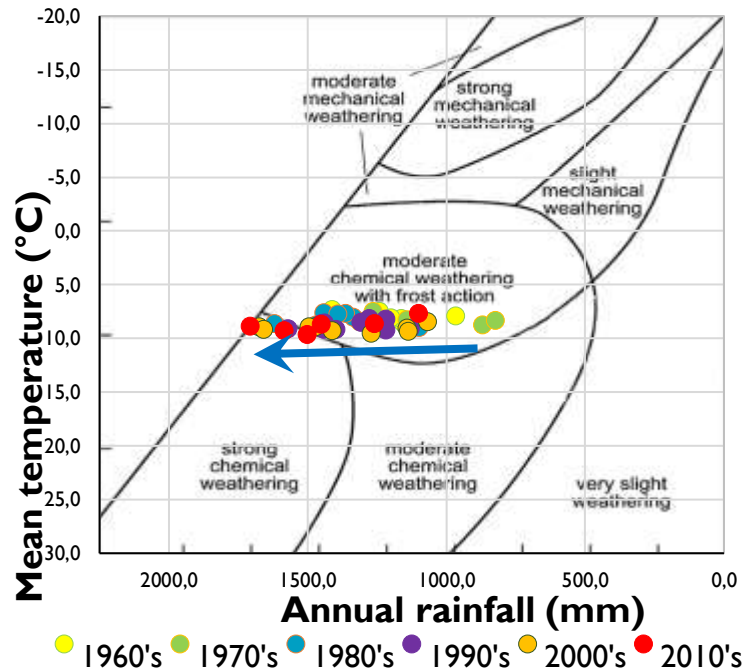


Figure 13. Stone weathering chart showing changing rainfall patterns in Scotland (modified after Peltier 1950)

The impact of climate change is not just on the physical fabric of the Orkney WHS –it also has Social and Economic consequences. Earlier in 2019 Historic Environment Scotland helped to pilot a new global risk assessment approach for WH sites – called the Climate Vulnerability Index (or CVI). It is a rapid assessment method of climate change vulnerability for both natural and cultural WHS and associated communities (fig. 14).

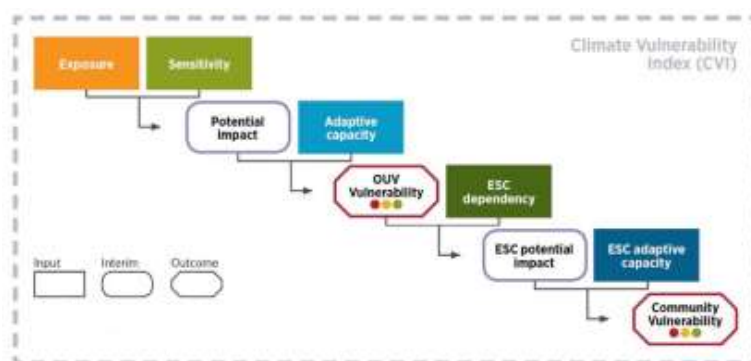


Figure 14. The CVI framework (Source: ‘Climate Risk Assessment for Heart of Neolithic Orkney World Heritage Property’, Historic Environment Scotland)

⁸ Peltier, L. C., “The Geographic Cycle in Periglacial Regions as it is Related to Climatic Geomorphology”, Annals of the Association of American Geographers, Taylor & Francis, 1950

One aspect that is particularly important is that it quantifies both the Vulnerability to the Outstanding Universal Value and also the Community Vulnerability. And whilst in Orkney we already have a good understanding of the climate change impacts to the physical fabric of the sites, we did not understand well how climate change affect the Economic, Social and Cultural dependencies. This has proved an important exercise, and we are plan to extend the CVI approach to our other 5 Scottish WHS, starting in 2020.

Finally, it is important to remember that we have a responsibility to hand these sites on to the next generation. If we don't acknowledge the urgency of the need to deal with the impacts of climate change then we will fail to do that.

Acknowledgement: This work uses information from several organizations and individuals, including staff of Historic Environment Scotland (in particular Stephen Watt, David Harkin, Dr Mairi Davies) and Scotland's Coastal Change Assessment: Dynamic Coast (Dr Alistair Rennie).

Transforming Tourism: Value Chains through the Integration of Climate Change Strategies

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Introduction

My presentation will focus on how tourism value chains could be transformed via the integration of Sustainable Development Goals (SDGs)⁹ and the role of the private sector in supporting the 2030 Sustainable Development Agenda and Climate Change commitments.

As highlighted by previous speakers, tourism and world heritage sites face economic, social and environmental challenges. To combat them, the Sustainable Development Goals (SDGs) define global priorities and aspirations for 2030, as well as set the roadmap of what government, private sector, and the society in general need to achieve through 17 goals and 169 targets.

The SDGs identify clearly tourism in 3 targets that I will further describe later (fig. 1).



Figure. 1 The three SDG's target of the 2030 Agenda concerning tourism

Tourism is clearly mentioned in 3 SDGs targets, specially highlighting its role in growth, jobs creation, and close linkages with oceans and culture.

Many relevant other international agreements took place in the last decade bringing the governments, and civil society to agree on ambitious climate, finance and disaster risk targets.

The 2015 Paris Agreement has been a turning point for businesses, where its clear role to support fighting climate change has been highlighted. Businesses in all sectors have begun to realize the urgency and magnitude with which they must integrate corporate sustainability targets with long-term financial goals. For tourism, although international aviation and shipping was not covered in the final agreement, there is a clear request for all public listed companies and governments to start report on their emissions.^s

⁹ The [Sustainable Development Goals](#) are a universal call to action to end poverty, protect the planet and improve the lives and prospects of everyone, everywhere. The 17 Goals were adopted by all UN Member States in 2015, as part of the [2030 Agenda for Sustainable Development](#) which set out a 15-year plan to achieve the Goals.

In adopting the Paris Agreement in December 2015, 195 countries acknowledged the importance of reducing greenhouse gases to a level that will keep global average temperature rise since pre-industrial times well below 2C. Achieving this goal is vital for the future of World Heritage Sites. Together, these two international accords provide a new framework to guide governments in responding to climate change and steer them towards sustainable development. If implemented, they can support an enabling framework to protect World Heritage and tourism destinations for future generations

During the recent concluded UNEA, ministers of environment have also agreed that reducing single-use plastic products by 2030, waste management, reducing waste generation, reuse and recycling, and defining sustainability criteria in the infrastructure development process are priority resolutions which also affect the tourism sector and world heritage sites.

All these conferences highlight that the solutions we saw in the past, tourism businesses and WHsites working in isolation will no longer work to meet a systemic change on the way we produce and consume. Partnerships are a central requirement for better decision making, using our resources more wisely through the concept of circular and sharing economy, development of innovation, new technologies that support livelihoods and inclusive business models in WH sites. Figure 2 shows the contributions of tourism, buildings and food to global CO₂-eq. emissions. Latest research shows tourism represents 8% of global emissions, which corresponds to 4.5 GtCO₂-eq. per year. Other cross cutting sectors such buildings, and food to the tourism economy are also a great part of emissions. The United Nations World Tourism Organization projects international tourist arrivals to increase from 1.1 billion in 2014 to 1.8 billion in 2030. A 169% increase in emissions is predicted between 2010 and 2050.

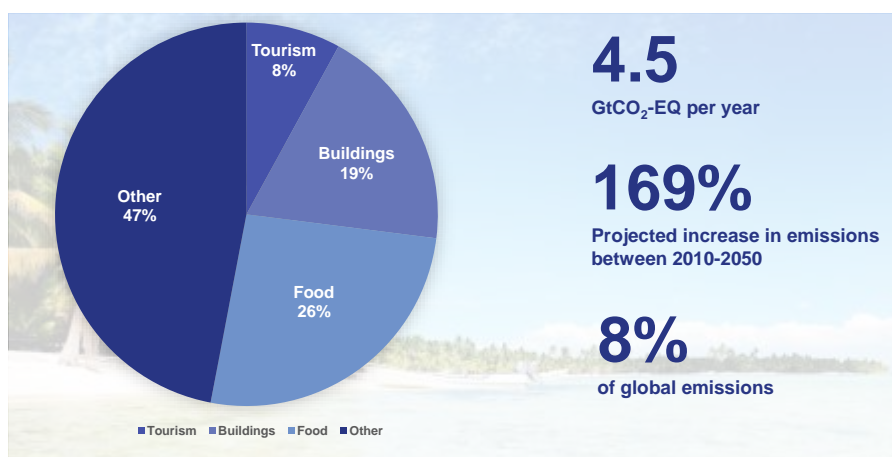


Figure 2. Contribution of tourism, buildings and food to global CO₂ -eq emissions
(Source: Lenzen et al. 2018, Lucon et al 2014, Poore and Nemecek 2018)

Tourism has major impacts on the global and local environment, such as through pollution and waste, depletion of natural resources like water, energy and land as well as increasing greenhouse gas (GHG) emissions. In many cases, unsustainable tourism can endanger the very basis of its own success: healthy ecosystems and habitats of flora and fauna. The evolving demand contributes to environmental degradation and pollution.

There are more than 1 000 WH properties in 163 countries and many of them are important tourist destinations. At its best, tourism drives economic development and brings needed financial and social benefits, but, rapid or unplanned tourism developments, or excessive visitor numbers, can also have a negative effect on the properties. Climate change is likely to exacerbate existing stresses and bring direct impacts of its own. Sea-level rise, higher temperatures, habitat shifts and more frequent extreme weather events such as storms, floods and droughts, all have the potential to rapidly and permanently change or degrade the very attributes that make World Heritage sites such popular tourist destinations.

At individual level, tourism emissions are higher than in other sectors (fig.3), meaning that major efforts in driving consumers to better consumption patterns and lifestyles is essential to transform the sector.

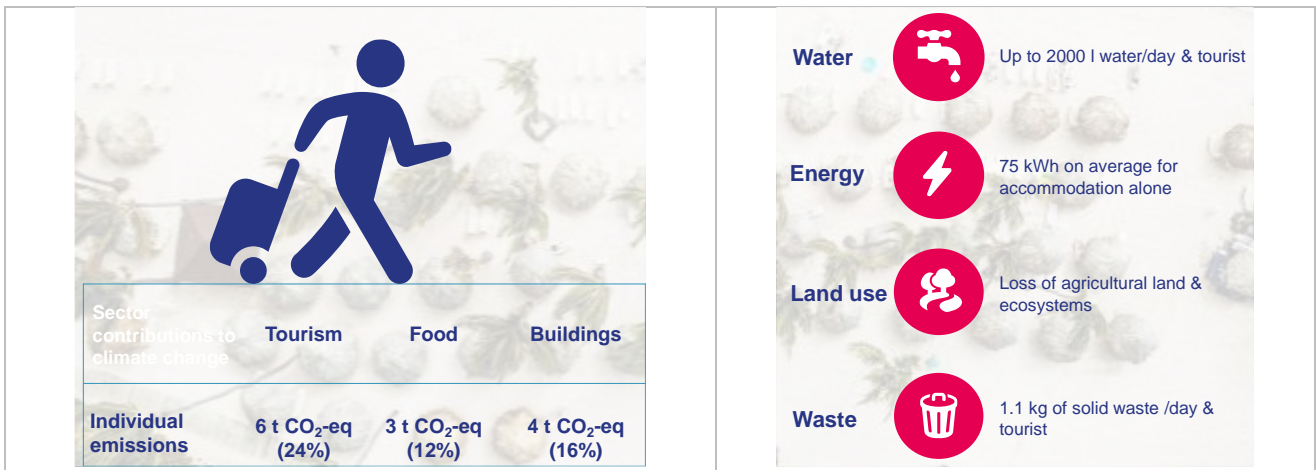


Figure 3. Tourism’s contribution to climate change at individual level (Sources: UN Environment Programme, 2019 [left], Gössling et al. 2012, World Bank 2012 [right])

Despite a significant increase in the number of sustainability reports in Travel & Tourism (from 1 in 2000 to 170 in 2016 according to the World Travel and Tourist Council, 2017), compared to other sectors, only few companies set reduction targets and report on indicators (fig.4). Most commonly reported indicators are:

- Energy use and conservation
- GHG emissions and emission reduction
- Environmental impact mitigation efforts
- Workforce data
- Approaches to child labour
- Climate change risks

	Tourism	Other sectors
Set a GHG target	11 %	46 %
Set a water target	9 %	36 %
Set an energy target	6 %	26 %

Figure 4. Source: WTTC, 2017

The Transforming Tourism Value Chains Project

Transforming the tourism value chains to low carbon and resource efficient operations requires an increase in sustainable consumption and production practices. The lessons learned of working in collaboration with destinations to develop country roadmaps to low carbon development could be inspiring for implementation in world heritage sites. To support measuring and reporting the tourism emissions, the project “[Transforming tourism value chains in developing countries and small island developing states](#)” was developed by UN Environment with financial support from the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMU).

The project aims to reduce greenhouse gas emissions and improve resource efficiency throughout the tourism value chain in four countries, in which tourism plays an outstanding role for the national economy: Dominican Republic, St Lucia, Mauritius, Philippines (fig. 5). It relies on a life-cycle perspective to identify the critical areas

where action is needed and adopts a value chain approach to bring multiple actors from the sector and other related sectors. It seeks to achieve its goals through the development of a sectoral roadmap, policies, and monitoring and reporting tools and frameworks, and the sharing of knowledge and experience.



Figure 5. The four countries concerned by the Transforming Tourism Value Chain Project

The project's approach and focus areas will be accompanied by case studies highlighting the potential for sustainable procurement practices to drive the change needed to attain the ambitious Agenda 2030. Furthermore, these case studies exemplify the importance of measuring and reporting impacts to estimate the benefits (economic, social, and environmental) of sustainability interventions and to inform decision-making of business managers, industry representatives, and government officials.

A mapping and analysis of the tourism value chains has been carried out in the selected project countries identifying all relevant stakeholders, their activities, products and services, upstream and downstream relationships.

Assessing Tourism's Environmental Footprint in the Dominican Republic

An assessment of environmental hotspots (areas of significant impact) associated with the tourism sector revealed that most impacts related to the provision of services (e.g. water and energy supply); the built environment in the tourism sector (e.g. powering and cooling hotels and restaurants); and the production, and consumption of food and beverage products (fig.6).

Scope 1: within the business e.g. construction of buildings

Scope 2: impacts related to purchased or acquired electricity, heat and cooling

Scope 3: impacts related to production of products/services purchased.

The roadmap is based on an analysis of the tourism value chain, meaning not only the activities that happen within the hotels and restaurants, but also including all the activities that supply them with energy and materials; for example those that produce the food, and the waste that is created in the process. A notable exclusion from the analysis is international travel. The analysis revealed that many environmental impacts related to tourism happen outside hotels; for example, 57% of greenhouse gas (GHG) emissions are associated with food served by the hotels, as is most of the water used. Inside the hotels, energy used in cooling and air-conditioning is the most significant source of GHG emissions.

Hotspots for the Dominican Republic

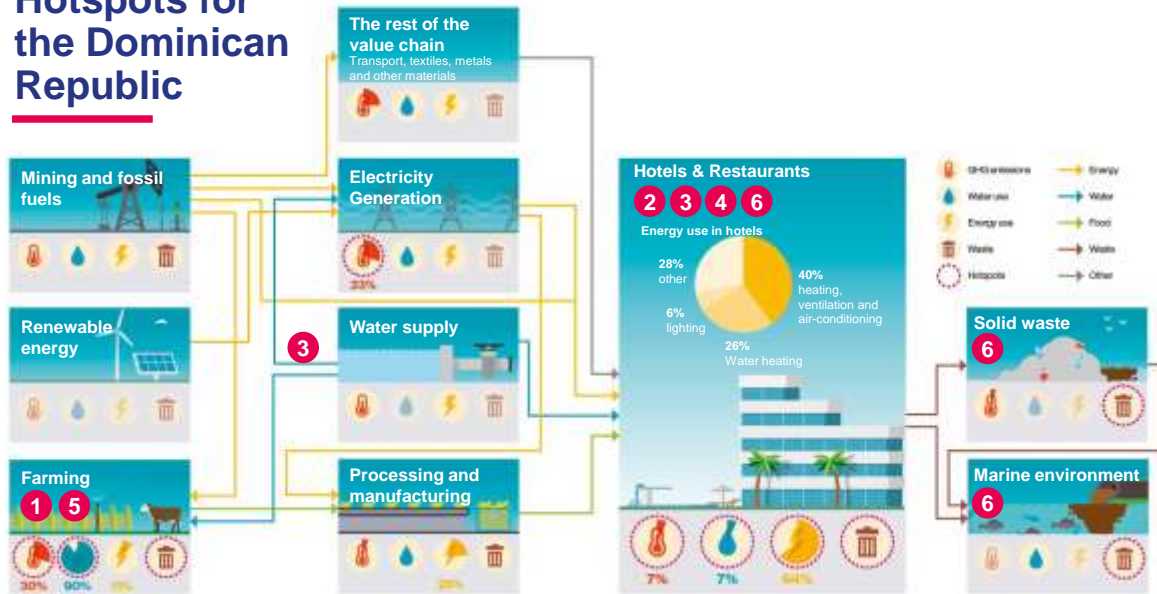


Figure 6. Hotspots for the Dominican Republic

If this methodological approach is used in WH sites, it will be very likely that the greatest sources of emissions will be outside the operations of the heritage sites, likely food, energy production and transportation of tourists. This analysis generated the development of a sectorial roadmap that identify solutions and approaches to reduce emissions and improve resource efficiency in the hotel sector. These solutions are highlighted in the graphic below.

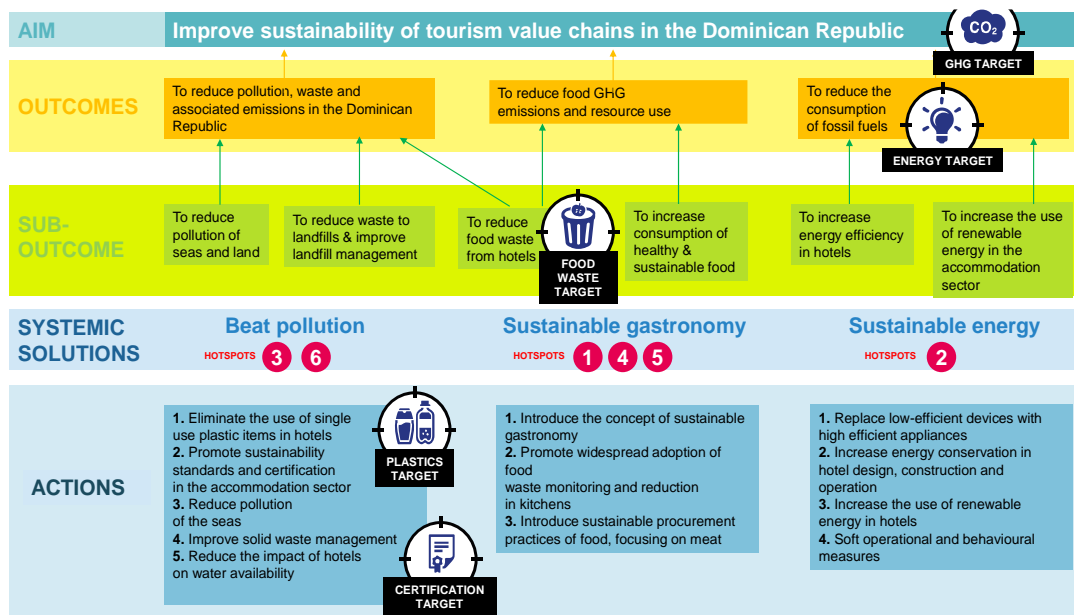


Figure 7. Improve sustainability of Tourism Value Chain in the DR: outcomes, systemic solutions, actions

Sustainable Cooling

This approach also highlights critical areas for targeting, for instance sustainable cooling. In fact, in this country hotels account for 43% of commercial energy demand and 40% of this energy use can be attributed to heating, ventilation and air conditioning. Collaboration from individual businesses, sectoral organizations, and public institutions need to be in place to achieve a systemic solution.

To deliver these targets, the Dominican roadmap for the accommodation sector proposes 3 systemic solutions:

1. Beat pollution: To reduce marine and land-based pollution and reduce the consumption of materials and waste arising from tourism. This includes: putting in place the mechanisms for hotels to collect environmental data relating to environmental permits and sustainable hotel certification schemes, eliminating problematic single use plastics in products and packaging by procuring more sustainable alternatives, enforcing and enhancing regulatory frameworks, looking at the role of financial incentives to reduce pollution and introducing innovation (e.g. to replace single use plastics), improving waste management and recycling systems This should all be driven forward and underpinned by a nationwide uptake of best practice sustainability certification for hotels.

2. Sustainable gastronomy: The second systemic solutions will start by measuring and reducing food waste in hotels, introducing the concept of sustainable gastronomy, by training chefs and hotel managers on the topics of food sustainability, encouraging the adoption of sustainable procurement practices when buying food and sustainable dining.

3. Sustainable energy: The third systemic solution aims to increase energy efficiency and the use of renewable energy in hotels. This includes the establishment of government policies and financial measures to support and incentivize the use of energy-efficient equipment and renewable energy technologies; the establishment of regulatory framework, including standards and certification schemes (such as energy audits and rating schemes); the identification of energy-efficient products and services available on the market to encourage the procurement of energy-efficient equipment by tourism businesses, and the implementation of training and awareness-raising programmes in energy management and renewable energy.

This will, in turn, require tourism businesses and their value chains, supporting trade bodies and government, ministries, departments and agencies to join hands to develop an implementation plan to support transforming the tourism sector to more sustainable operations. These implementation plans will:

- Prioritize coordination of Support Activities
- Engage additional key stakeholders
- Establish Thematic Working Groups
- Inform Capacity Building Plan
- At destination level: drive stakeholders to action

Conclusions

Identifying priorities for action and measuring the benefits of these actions rely on measuring and reporting mechanisms to be in place, especially at the individual business level. It is important that world heritage centers and heritage sites measure its impact and contribute to low carbon development, and resource efficient tourism operations. The following points summarize the main insights to measure and report impacts to inform decision-making.

Multiple un-harmonized reporting mechanisms:

Reporting mechanisms range from mandatory (legal obligations, investor reports) to voluntary (certification schemes);

Reporting mechanisms differ in the indicators and metrics used, as well as in the level of detail on which performance/compliance is assessed

(Action/Recommendation) efforts focused on streamlining reporting processes and metrics (e.g. Certification requirements ≈ local environmental licensing requirements; Key Environmental Indicators)

Concerns with data confidentiality:

Tourism businesses are very cautious on what information they share and who they share it with, to mitigate reputational and compliance risks.

(Action/Recommendation) need for clear data management processes and accountability

Sustainability business cases are not documented and reported:

Missed opportunities exist to make the link between environmental performance and business performance (e.g. improved energy efficiency and reduced operational costs; or more rigorous sustainable procurement procedures and enhanced relationship with local producers)

(Action/Recommendation) tools and trainings can help bridge gap between business manager and environmental manager (e.g. Cost-benefit analysis of reducing GHG footprint from food—link to GACMO tool¹⁰; Training on Sustainable Procurement practices)

Standards and regulations drive reporting:

Regulations and standards make it easier for business to report, as they provide guidance on what, when, and how to report; as a consequence, businesses ensure they have the right organizational structure and procedures to deliver these reports (E.g. In Dominican Republic, large tourism companies required to submit bi-annual reports to the Ministry of Environment are also more inclined to opt for certification schemes to support to this task).

Measurement leads to better strategies and practices:

Monitoring should not be a burden but a mechanism to provide business insights; in this way companies can focus on the areas where they face the highest risks (reputational, financial); and/or where they can capitalize on opportunities (customer satisfaction, community engagement).

E.g. TUI pushing for sustainability certification due to evidence of certified hotels out-performing non-certified hotels.

When a measurement and reporting regulation is put in place, companies are forced to think out of the box and even work together. This is the case of the International Tourism Partnership, a network of large hotel chains that developed carbon and water tools to support its members to monitor its emissions, and to find solutions for sustainable procurement challenges.

Finally, most sustainability issues require systemic change, and systemic change requires collaboration among stakeholders. Businesses need to speak with one voice with value chains businesses and affected stakeholders to tackle sustainability challenges. We have learned that tourism destinations that managed to create governance mechanisms to engage business and tackle sustainability challenges are more competitive in the market and better in managing and planning tourism.

¹⁰ The GACMO hotel mitigation tool is built on the original GACMO tool, an Excel-based bottom-up tool with activity data, energy use and GHG emissions covering all sectors to describe past emissions and future scenarios used by the government to develop sectoral and national mitigation scenarios. Methodologies and calculations are based on IPCC methodologies. USERS: the tool is targeting hotel/accommodation and MICE businesses SECTORS: the tool covers energy and food activities around those businesses (identified as hotspots).

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Deuxième Table Ronde

Changement climatique et Patrimoine Mondial: enjeux d'interprétation et de médiation

Modérateur:

Adam Markham

Directeur adjoint du programme Climat et énergie de l'Union of Concerned Scientists

Intervenants:

Adine Gavazzi, UNESCO Chair "Anthropology of Health - Biosphere and Systems of Healing", University of Genoa: *The Ancestral Landscape Renaissance of "La Fiesta del Agua". From Climate Change Resilience to Sustainable Tourism in Lambayeque (Peru)*

Céline TASTET, Entente Interdépartementale des Causses et Cévennes, Université Paris 1 Panthéon Sorbonne et Muséum national d'Histoire naturelle : *Changement climatique, tourisme et patrimoine agropastoral. Réflexions à partir du site Causses et Cévennes*

Pascale MARCOTTE, Laurent BOURDEAU, Chaire de recherche sur l'attractivité et l'innovation en tourisme, Université Laval : *De Lunenburg à Québec. Changement climatique, mondialisation, tourisme et patrimoine mondial*

Silvia AULET, Université de Gérone : *Reconversion écologique pour lutter contre le changement climatique : le cas du Monastère de Poblet*

Lionel IZAC, Administrateur, Centre des monuments nationaux, Oppidum et musée d'Ensérune, Cité antique de Glanum : *Parcs archéologiques, espaces naturels sensibles et tourisme : la cité antique de Glanum et l'oppidum d'Ensérune*

Philippe MORGE, directeur des Grands Sites Patrimoniaux au Département du Puy-de-Dôme : *Tourisme, environnement, agriculture : bâtir un écosystème vertueux dans un site patrimoine mondial*

The Ancestral Landscape Renaissance of "La Fiesta del Agua". From Climate Change Resilience to Sustainable Tourism in Lambayeque (Peru)

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Abstract

The community-based revival of an ancient water-related tradition in the Peruvian region of Lambayeque reveals the living memory of a territory, implementing habitat restoration according to indigenous criteria and demonstrating the continuity between the ancestral resources of the place, the history of the landscape and the current management of its resources. Thanks to the event "La Fiesta del Agua" - *Far Ich Lap* in muchik language- the regional awareness of the role of Ancestral Heritage in connection with Climate Change is greatly increasing. The combination of geomorphology, ways of life, pre-Hispanic memory and contemporary recovery generated a recognizable environmental, cultural, economic and social model in six Sustainable Development goals: (3) Health and well-being for the development of medicinal plants and their use, (4) Quality education through the formation of local research, (5) Gender equality in the planning and use of the resources, (6) the river Chancay as part of a greater ancestral landscape (8) forests as a resource for sustainable economic development, (13) the multilayer bio corridor as Climate Change mitigation device and (15) the safeguarding of biotic networks thanks to afforestation adaptable to the extreme manifestations produced by Climate Change. Indigenous Knowledge of biodiversity is the key to safeguarding the highly diversified biotic network of the Andean tropics. The work of the communities and Eco museums in this territory demonstrates that the reconstruction of cultural bio corridors from the coast to the Amazon is the best restoration approach for Cultural and Natural Heritage. The contribution of Ecological reserve of Chaparri in the Chancay Valley, together with the WHS Tentative List "Ceremonial Centers and Forests in the Leche Valley of Túcume, Pomac and Sican", teaches with the Fiesta del Agua an exemplary successful outcome and a replicable model of Integral Renaissance of an Ancestral Landscape.

Introduction

The Fiesta del Agua – *Far Ich Lap* in Muchik language – celebrates a cultural event dedicated to the safeguarding of memory and the enhancement of an ancestral tradition of Peru, still persisting in some valleys and its hydrographic basins, directed towards a better water management in the desert areas of the Peruvian Northern Coast. From the *Hualinas* songs of the Yacu Raymi of San Pedro de Casta, to the cleaning of the ditches of the *Champería* of Huarochirí or Laraos, to the marriage of the waters of the river and the lagoons in the Qocha Raymi of Quispichanchi, the Andean cult of Water and its harvest is kept alive in celebrations of an ancient original memory. In each cultivated valley, the purification of the irrigation canals corresponds to a renovating cleaning and a cultural renaissance of the landscape. It's the result of the millenary design of an extensive cultural geography in the Coast, Andes and Amazonia, which recognizes and respects the most decisive ecology for the life of the regions: the sacred water cycle. The exceptional universal value of this heritage has been recognized by UNESCO in two cases: the pilgrimage to the Sanctuary of the Lord of Qoyllurit'i (2011, 6. COM), that reaches the origin of the waters in the snowy mountains, and the Traditional System of the Water Judges in Corongo (2017, 12 COM), which manages the community supply in the territory.



Figure 1. Over a thousand of archaeological sites and protected natural areas compose an immense cultural landscape (credit: SIGDA)

In the tropical coast of the Andes, the idea of abundance and variety of life is at the origin of the pre-Hispanic ceremonial centers, born in a sandy alluvial plain and surrounded by large rocky outcrops. In this hyper arid landscape, the water produced by the forest's drainage and the in absence of high glacier snowfall, shows the wealth of the nature diversification. Pre-Hispanic societies progressively transformed the landscape from a dry forest to woods animated by lagoons, jaguars, roads and canals (Fig 1). The match of resources of marine and terrestrial life gave life to a unique cultural flowering, which still combines both worlds between different ecological floors, thanks to an attentive water management and the maintenance of their ancestral cult. In the forests, the presence of numerous offering altars reveals the importance of the sacred relationship that several communities maintained throughout the millennia with the sacred mountains, allowing the cyclical generation of the river. In the plains, the presence of temples and settlements connected between them by a network of canals and roads shows a landscape organized around sacred water paths. Their routes flow between the traces of living and still recognizable cultures. In the valleys and river basins between Lambayeque and Cajamarca, the cult of water shows evidence from the lithic and formative ages more than 8,000 years ago, crossing every cultural expression, from Cupishnique, Muchik, Lambayeque, Sicán, Cajamarca, Inca and even the arrival of Christianity (Aimi, Makowski, Perassi 2018). Its presence acquires many ceremonial forms: propitiations, invocations, offerings, sacrifices, ceremonies, cleaning of canals and aqueducts dedicated to the deities or authorities to help stabilize the irrigation and human use cycle. The continuity of the ancestral cycle significantly avoided the extremes of droughts, dominated by god Kon and the one expressed by the El Niño climate phenomenon, corresponding to the god Pachacamac (Narváez, 2000).

From pre-Hispanic Memory to Living Culture

The Chancay / Lambayeque river and its vast and fertile valleys were extensively channeled for irrigation and integrated into the valleys of Zaña, La Leche and Motupe, generating arguably the most productive agricultural network of the South American Pacific coast (figure 2). This development reflected in the economy, agriculture, livestock, metallurgy, architecture, fishing, art, among all cultures of the region (Tellez and Hayashida, 2004). The toponomastic indicates the intense mythic narrative interwoven in the cultural landscape: part of the river route was called Collique, in association with the archaeological site Collud and the current Collique lagoon

and the Collique hill. This geographical set integrated settlements, routes and ceremonial centers in longitudinal form, following the course of the river from its mouth in the Pacific Ocean to the gorge of the valley near Chongoyape (figure 3)



Figure 2. The heritage of the pre-Hispanic landscape planning at Apurlec (Photo: Heinz Plenge)



Figure 3. Agricultural landscape of the Chancay river valley in the Lambayeque region (Photo: Heinz Plenge)

History also follows mythical memory: chronicler Cabello de Balboa, referring to the myth of Naymlap indicates that the ancestor landed at the mouth of the Faquisllanga river (Fernández Alvarado, 2009) successively called elsewhere Collique, Lambayeque and Chancay. The early ethnographer Heinrich Brüning proposed Faquisllanga as the name of a river crab (*Hypolobocera chilensis*). This crustacean, represented in Muchik iconography as a water related deity, also appears as a bioindicator among Amazonian societies. Among the Awajum for instance, the Uncaju (River Crab) it is considered the father and mother of water and life and in the Chaparri Reserve it is recognized announcing rains in rocky outcrops, such as the altar of offerings. Pilgrims, healers and residents traditionally collected water from the sea to invoke rain and maintain a balance in the climate cycle (figure 4). Similar to the *Ukuko* of the Qoyllurit'i is the Andean bear *Chañu*, a recognized character in the Amazon that indicates the presence of water and food.



Figure 4. Offering on a carved river crab-shaped altar at Chaparri (Photo: Heinz Plenge)

Since the ancestral progenitor Naymlap de Lambayeque founded the Temple of Chot, related to the place name of Chota, a water related territorial network was institutionalized. Naymlap mythical offspring spread throughout the valley, especially the right bank of the Chancay. His successor Fempellec angered the gods, who sent a major flood and was executed by the villagers, who tied him hand and foot to throw him into the sea (Narváez, 2002). Since then, a continuity of water management between the cyclical Niño flood and severe draught defined the evolution of spiritual, social and economic power on the land.

According to the pre-Hispanic tradition, still and moving waters are gender related and move alternatively to create the complexity of the water cycle. Masculine rain falls from the sky towards the feminine lagoons, surrounded by the mountains that generate male water springs, reaching females lagoons, creating male rivers finally directed toward a lower and greater female lagoon: the sea, or *Mama Cocha*. From there evaporating moist is driven by the constellations to cross the celestial river of the Milky Way- the Mayu- and returns to the mountains again in the form of rain, thereby generating a complete seasonal cycle (Gavazzi, 2010). In the Moche era during the Equinox and the wet season (September), sacrifices and ceremonies were performed to receive the rains and 4 months later to reduce them (Hocquenghem, 1989). The chronicler Guamán Poma recounts similar activities during the month of November (Guaman Poma, fol. 1162 [1172]). The seasonal arrival of rains in Lambayeque remains an indispensable event for the survival of every form of life. Propitiating the arrival of water and celebrating its presence generates an exemplary storytelling. The sea water is collected by the shores, transferred on a ceremonial path to the altars and lagoons where it is offered to guarantee the maintenance of life (figure 4). The cleaning of the canals, the collection of the medicinal plants in the sacred sites and the preparation of the land to the rains reconnect the communities with the ancestral territory and tell a cyclical history, whose celebrations ensure its balanced repetition.

La Fiesta del Agua regenerates a lively territory from the celebration of its most visible presence: the origin in the purifying lagoons of the heights, the movement of the rivers in the conformation of the valley, the activity of the wild animals in the *jagueyes* of dry forests, the design of the channels in the cultivation plains and in the centers of worship. Maintaining cohesion among all these resources means promoting environmental and cultural values that allow social and economic development in the territory. Faced with the challenges imposed on all ecosystems by climate change, the public assessment of the presence, quality and quantity of water becomes necessary with an event that brings together institutions and communities. The recognition and maintenance of an ancestral geography is part of the cultural identity of the region. In a way similar to the *Corongo Water Judges*, the Irrigation Commissions *Junta de Regantes y Usuarios* of today organize, distribute and use the water in the territory applying ancestral planning criteria (Yapa, 2013). In many villages on the coast and mountains, between September and November, the canals are cleaned before the arrival of the rains (figure 5) (Brüning, 1990). This activity includes festivals, spiritual celebration, gastronomic and agricultural fairs and traditional rituals of the master healers, *Maestros Curanderos*.

These expressions appear inscribed into a wider timeframe. Catholic Ceremonies historically increased in the colonial Zaña when it risked destruction by great floods, and in 1925 the Maestros Curanderos intensified their rituals to save the towns of Chiclayo, almost erased by an intense *Niño* flooding phenomenon. The *Fiesta de la Cruz* on Cerro Chalpón de Motupe still protects surrounding settlements of Olmos, Tongorrape, Chochope, Salas and Penachi from the fire of a volcano, drought and floods. The area corresponds to the northern limit of the hydraulic and agricultural management of pre-Hispanic times, due to the aridity of geoclimatic conditions.



Figure 5. Ceremonial cleaning of the irrigation canals in Tocmoche (Photo: Heinz Plenge)

The nature of geography induces the proliferation of cultural activities focused on the search for a balance between natural resources. Since 2015, after the institutionalization of World Water Day, a group of educators from the San Julián de Motupe Peasant Community in the archaeological complex of Apurlec performs dances connected to pre-Hispanic elements. Around the ancestral mountain god *Apu*, in Chaparrí and nearby areas in the Chancay river basin, farmers from the Muchik Santa Catalina Community of Chongoyape still offer sea water on specific sacred mountain sites invoking water for agriculture, pastures and livestock (figure 6).



Figure 6. Offering of sea water on the carved rock altar of Chaparrí (Photo: Heinz Plenge)

Farfán (2002) records the ritual offerings of seawater in the Sierra de Huaros following a custom that extends southwards to Bolivia, among the Chipaya de Oruro. Community members and anthropologists have

interpreted the myth of the mountain ancestor Chaparrí and his entourage, whose characters are associated with the sacred springs, the management of the strategic places of the administration of the hydraulic system that interconnected the valleys of Zaña, La Leche and Motupe and the destructive message of the gods through a flood. A series of toponyms indicate the idea that the place located in the gorge of the valley became, together with Chota and Udima, a main destination and a landmark in the ancestral pilgrimage to worship the water cycle and the mountain ancestors. Among Lambayeque's most recognized healers – *Maestros curanderos* of the XX century, Don Santos Vera traced his annual pilgrimages to Chaparrí and the high Andean lagoons such as the Huaringas in Piura and Mishaguanga in Cajamarca to find strength, well-being and medicinal plants (Plenge and Williams, 2005). Between the months of September and November on this route, the cleaning of the ditches and canals continues in the middle of a festive atmosphere of the peasants, who exhibit their products, sing and dance with regional meals, *chicha* and aguardiente celebrating the good auspices of the arrival of the rain.

Environmental Context and Climate Change

Because of its geographical conformation, Peru is facing in the next decade (Hutton and Varughese, 2016) severe water scarcity determined by Global Warming and Climate Change. The highest concentration of human population is found in the cities of the coast: Trujillo, Ica, Chimbote, Chiclayo, Piura, Lima. Almost 8 million Peruvians today do not have access to drinking water. In 2017, shortly before *El Niño* Coastal weather arrival, all the lagoons and artificial reservoirs such as the Tarjea, Poechos, San Lorenzo, Gallito Ciego and Tinajones dried up. The discharge of the Chancay River in Lambayeque reached only 0.5 m³ per second, insufficient to supply domestic consumption (Nuñez Juárez et al, 2017).

The population of the greater province of Chiclayo in the Lambayeque Region with almost 900,000 inhabitants (2017), addresses the valley of the Chancay River as the largest and most productive agricultural basin in Peru; as main fertile plain of the economy, it does not receive any tax contribution from mining, fishing, forestry or ecosystem services, as other regions do. In the absence of glaciers, Lambayeque water is eventually generated from rainfall in the Andes caused by the evaporation of the Ocean and the Atlantic Basin. The implementation of the Tinajones Irrigation Project managed by the Regional Government under the auspices of the National Authority of Water (ANA) ensures the irrigation of 60K ha (figure 7). However, almost double of this area was more productive in the past following agroforestry and polyculture principles (Gavazzi, 2014). The actual water resources implemented in monocultures remain scarce and agricultural lands tend to salinize. Originally the entire system of irrigation and drainage canals was made under a different use of land, generating a fertile plain and a wider variety of products.



Figure 7 Ancestral Authorities meet at the Tinajones Reservoir to perform water offerings. (Photo: Heinz Plenge)

The interconnection of lagoons, *jagueyes* – natural drainages of dry forests – canals and rivers formed and intertwined network in which agroforestry of fry wood transformed a very dry plain into the most productive region of the Andean Coast. On the Andean slopes, sacred sites like Mishahuanga Lagoon generated a pilgrimage tradition to understand climate cycles and collect medicinal plants, many of which still visible on the markets: Condor Rastrero, Valeriana, Lirio de Jalca, Culantrillo, Floripondio rojo, Hierba del Carnero, Cucuti, Pimpin, Ornamo, Rosa andina, Guamanripa. Reservoirs such as Boro, Tinajones and water channel distributos systems like La Puntilla (figure 8) still serve as contemporary routes of an ancient management water system. In the natural ecosystem of the dry forest, the reservoirs generated by the soil drainage, as in Chaparri, allow the permanence of wild animals, feeds the forests and generates water for the river. Ancestral maps of this systems were traced on wide rocks, used as altars for offerings related to the water cycle. A widespread system of sub canals originating from Taymi and Racarrumi in Chongoyape allows the formation of many others: Sarrián, Quefe, Ronope, Cois, Chilape, Pulen, Xatupe, Callanca, Muisol, Póemape, all of which connect the agricultural area of the Chancay River. The original flow of 250 km carefully planned since millennia feeds today 3 provincial capitals, 15 villages, 25 agricultural companies and a growing population.



Figure 8. Ancestral authorities converge from different routes at channel distribution La Puntilla (Photo: Heinz Plenge)

The pre-Hispanic landscape planning shows an effective water channeling, thanks to the widespread irrigation network of larger areas than the current ones. The management of the forests of the valleys and basins allows the dosing and stabilization of the virtuous cycle of fresh water, ensuring its regularity, quality and quantity in the valley. The cultural legacy in the contemporary world recognized by traditional tourism enhances aesthetics of artefacts, archeological heritage, goldsmithing and metallurgy, navigation techniques and its adobe architecture. However, its most valuable legacy is to be found in the development of hydraulic techniques and the implementation of a network of canals connecting valleys and contributing to the domestication and dissemination of essential products : potato, peanut, avocado, tomato, cocoa, quinoa, zucchini, beans, cotton, corn, medicinal plants, among which the notorious Quina medicinal plant tree. The extraordinary variety and combination of agroforestry techniques based on these polycultures still represent a current resource of the territory (Jost 2017). Solutions surface from this tradition for climate change adaptation measures that seek sustainability principles, many of which are present in indigenous knowledge of landscape productivity. Sustainability in this sense develops a dynamic social, cultural, environmental and economic balance, in accordance with the Objectives of the UNESCO Agenda for the year 2030.

Itinerary of the Fiesta del Agua

The main route of the Fiesta concentrates on the transferring of seawater from three points along the coast that converge in the reconstruction of an ancestral geography towards La Puntilla, Tinajones and Mishahuanga Lagoon in the Cajamarca Region (Figure 9). The route is traced by messengers returning the water from the ocean to the Mountain Lagoon, thereby reconstituting its natural and cultural cycle in a celebratory context through a cultural biocorridor. The pilgrimage, celebrated after the September equinox before the beginning of the rain season, crosses archeological sites, cities, populated centers, hamlets, communities and agricultural companies. Each stop offers channels ritual cleaning, religious services, ceremonies and a variety of celebrations. The water is transported by messengers in *cantaros* and pumpkins, accompanied by curanderos indicating the main direction of ancestral main characters of the archeological sites, all organized by the site museums. Messengers cross the sacred sites of *huacas* and their water resources, making offerings in reservoirs and lagoons. The Water Commission, *Junta de Regantes*, identified and coordinated the cleanliness of the canals along the roads. The National Water Authority, the police, a medical service and the press accompanied the procession.



Figure 9: Itinerary of the Fiesta del Agua 2019

At dawn of the first day on three shores- Delta Eten, Caleta de San José and Playa de Santa Rosa- a group of young messengers fills with sea water pumpkin bottles and bowls. Called by master healers, the representatives of the Ancient Authorities manifest themselves as actors impersonating museum archeological characters and Ancestral legendary beings (figure 10). They lead the route of water from site to site, meeting schools and representatives of the University. The San José route is accompanied by the ancestral Lady of Chornancap, arriving at the Huaca Chotuna, crossing the city of Lambayeque, meeting school representatives and students of the university Pedro Ruiz Gallo, until the Bruning Museum. The Domain of Chornancap is later connected to the region of the Inca governor of Túcumé at the original archaeological site, and the procession is later received by Lord of Sican and in the Pomac and Sican Forest, until they jointly arrive at La Puntilla dike. The Eten Route crosses the parish of The Sagrado Niño Eucarístico of Eten, the archaeological site of Ventarrón until reaching the region of the *Lord of Sican* of Huaca Rajada and the *Huaca* of Pampa Grande. The Santa Rosa Route crosses Pimentel, follows the Yurtuque canales in the city of Chiclayo and goes to the sites of Pomalca and Pátapo, to the Puntilla channel dirtibutor (Figure 8). The water messengers, Master healers and ancestral authorities are received in the Puntilla at sunset by the communities of Pampa Grande and Pátapo. Seawater is offered by all authorities together in the water distributor channel system.



Figure 10. Water collection of messengers, with ancestor Lord of Sipan and Maestros in the background (Photo: Juan Andres Plenge)

At dawn of the second day, the communities deliver sea water to the Tinajones, a hydraulic reservoir system distributing water to the lower valley (Figure 7): all the representatives of the sacred sites, Huacas, from all over the valley present and receive their pitch to deposit. On this occasion, the Institutional and Ancestral authorities met to sign together the “letter of Tinajones,” a commitment to invest efforts and resources for the realization of the successive editions and to implement the Sustainable Development Goals. At sunset, a delegation reaches the Chaparrí Ecological Reserve to perform offerings on the Route of Los Encantos.

At dawn of the third day, the route continues along the stretch of the Cajamarca bio corridor (figure 11). The dry forest landscape is progressively transformed into middle and high Andean Mountain geography, where mountains emerging around the landmark of Apu Chaparri are recognized as living ancestors.



Figure 11. The Andean ecosystem blending different layers into one bio corridor (Photo: Heinz Plenge)

In Tocmoche a blessing of the ritual of the cleaning of the canals is performed by the *Junta de Regantes*. Reaching the community of Miracosta, the the ecosystems blend different high Andean ecological layers, drifting towards the cold and humid *paramo*. Reaching the last sacred destination at 4100 msm, the messengers make a final offering in the white and black lagoon of Mishahuanga, finally closing the cycle that generates water (figure 12).



Figure 12. Messengers reach the sacred Mishahuanga lagoon to offer the final sea water (Photo: Heinz Plenge)

SDG and Results

The integrated revival of an ancient water festival reveals a powerful instrument of communication and positive integration, whose institutionalization has set classifiable objectives in a social, cultural, environmental and economic plan, in accordance with the implementation of several SDGs: 3, 4, 5, 6, 8, 13 and 15. La Fiesta del Agua implements SDG 3 Health and well-being for the development of medicinal plants and their use while incorporating the healing activities of the *Maestros Curanderos* - master healers - and medicinal plant recollection pilgrimages from the sea following the course of the river to the high Andean springs, *jagueyes* and lagoons. This exchange is reflected in the abundance and variety of remedies and plants on the markets. The participation of schools from twelve different municipalities and the National University Pedro Ruíz Gallo promoted SDG 4 Quality education, through the formation of local awareness on the importance of water for human life (figure 13). The contribution of five museums (Museo Chornancap Chotuna, Museo Bruning, Museo Túcume, Museo Huaca Rajada, Museo Sican) brought to life the memory of cultures of the Chancay valley during their cultural sequence. Among the ancestral characters the *Sacerdotisa* of Chornancap, a woman governor of the coastal part of the region, played a central role in communicating SDG 5 gender equality in the planning and use of the resources and the balanced management of power. Spreading awareness on the accessibility of water and sanitation with the SDG 6 displayed the river Chancay as part of a greater ancestral landscape and its need to maintain a stable and technical provision of a good quantity and quality of water for the valleys. (Figure 16). Establishing a better culture of water management and consumption for domestic use, industry and agriculture means recognizing and communicating with SDG related sustainability policies of farming companies, such as the proposals successfully advanced by Ingleby (2019) at Olmos. SDG 8 allows to look at the traditional agriculture frontier line, conceived as a threat to wild and forest life in a different way. The pre-Hispanic cultural landscape is a result of the modification – not obliteration – of forests as a resource for sustainable economic development, improving quality economy and Sustainable Tourism. The beneficial effects of this approach are reflected in a higher quality agro-export and market development. At the same time, the forest as a water resource and retainer implies the option for community-based fees and payments for ecosystem services.

The ancestral comprehension of multilayer bio corridors as interdependent moving structure of a living ecosystem informs a planning strategy, translating in contemporary terms as Climate Change mitigation Device or SDG 13 action. In other words, the *Fiesta del Agua* revives not only an ancient territorial management, but shows through the Chancay bio corridor the multi climate adaptation abilities derived from its original landscape. Rescue and release of natural springs, *bofedales* and *jagüeyes* guarantee the last places of water

supply for terrestrial wild animals, while assuring the conservation of the regional biodiversity of the dry woods. As a consequence, the levelling and cleaning of the river canals and ditches extends the original agroforestry principle informing a sustainable planning. The safeguarding of the biotic network becomes the implementation of SDG 15, achieved through the integration and conservation of the basins between Lambayeque and Cajamarca. At the same time remote actors of the same territory interact closely, call attention to the implementation of Habitat Restauration projects in the river basins and transform their ancestral memory into a powerful storytelling. La Fiesta del Agua becomes the renaissance of an Ancestral cultural landscape planning, acting from Climate Change Resilience to Sustainable Tourism in the Chancay and La Leche valley.



Figure 13. School children of Tocmoche (Photo: Juan Andrés Plenge)

Acknowledgments

Organizing Committee: President of the Patronate of Chiclayo Italo Lescano, Director of DDC of Ministry of Culture of Lambayeque Alfredo Narvaez Vargas, Mayor of Chiclayo Province Marco Gasco. Artistic and Photographic Direction, Heinz Plenge. Museographic support: Carlos Wester of Brüning Museum and archeological sites of Chotuna-Chornancap, Ceyra Pasapera of Museum Huaca Rajada Sicán, Bernarda Delgado of Museum Túcume and site and Shilrey Bernabé of the Santuario histórico Bosque de Pomac; Carlos Elera of Museum of Sicán; Jorge Oliva and Victor Rangel of National University Pedro Ruíz Gallo; Leopoldo Fernandez of Proyecto Especial Olmo Tinajones. Communities, Schools and Municipalities of the Lambayeque and Cajamarca Region.

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Changement climatique, tourisme et patrimoine agropastoral. Réflexions à partir du site Causses et Cévennes (France)

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Tout d'abord, je vous remercie pour l'invitation et l'organisation de cette journée, sur un thème qui devient de plus en plus important pour un certain nombre de sites inscrits sur la Liste du patrimoine mondial. En effet, le patrimoine en général et le patrimoine mondial avec, peut être affecté de différentes manières par les effets du changement climatique, comme nous pouvons le voir depuis le début de cette journée de la Chaire. Cela est également mis en lumière par les travaux d'experts divers et de l'UNESCO depuis plusieurs années¹¹. Un rapport de l'UICN datant de 2017 faisait à ce titre état qu'un 1/4 des sites naturels inscrits étaient directement menacés. Récifs coralliens et glaciers sont ainsi extrêmement exposés. Mais les effets peuvent également se faire ressentir au sein des biens culturels, et notamment dans les paysages culturels. Cela est d'autant plus vrai qu'un certain nombre de sites sont des espaces multi-fonctionnels et où les valeurs patrimoniales reposent sur des pratiques et des cultures agricoles qui sont elles aussi particulièrement vulnérables à ces modifications climatiques, que celles-ci soient viticoles ou agropastorales par exemple. C'est sur ce dernier cas que vont porter mes réflexions.

Considérons le site Causses et Cévennes, inscrit depuis 2011 au titre de « paysage culturel évolutif et vivant de l'agropastoralisme méditerranéen » (figure 1).

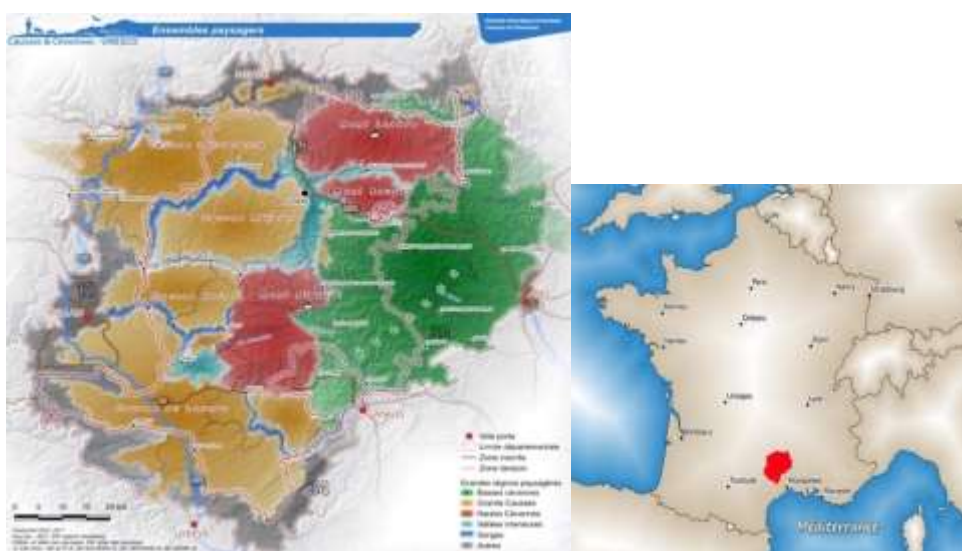


Figure 1. Carte du site patrimonial Causses et Cévennes (Crédit : Entente Interdépartementale Causses et Cévennes)

¹¹Table ronde « Changement climatique : un défi pour le patrimoine mondial », Colloque organisée par l'UNESCO au Palais de la Découverte, Paris, le 28 février 2011. Voir aussi les publications de l'UNESCO en la matière : [Document d'orientation sur l'impact du changement climatique sur les biens du patrimoine mondial](#) ; [Changement climatique et patrimoine mondial](#), rapport 22 ; [Adaptation des sites du patrimoine mondial face au changement climatique – un guide pratique](#), cahier 37 ; etc.

Zone de moyenne montagne située dans le sud du Massif Central, ses attributs patrimoniaux relèvent tant du patrimoine culturel bâti, que du patrimoine naturel et du patrimoine culturel immatériel. Ainsi, les patrimoines valorisés dans le cadre de cette inscription s'attachent : aux grands paysages caractéristiques des causses et des zones d'estive ; aux milieux naturels tels que les milieux ouverts constituant des habitats naturels abritant une biodiversité rare et protégée à l'échelle européenne¹² ; aux éléments structurant le paysage, comme les terrasses ou les grands axes de cheminement qui rythment le paysage ; aux savoirs, savoir-faire et traditions liées à la pratique agropastorale, tels que la transhumance, ou les savoir-faire du fromage. Ces éléments dessinent tout un système-patrimoine composé d'éléments hétéroclites, complexes et en interconnexion entre environnement et activités agricoles (figure 2).

Alors comment le changement climatique affecte-t-il ces patrimoines agricoles ? Et avec quels effets sur le tourisme et la mise en découverte du site ?



La culture pastorale



Les milieux ouverts



Les éléments structurants



Les activités agricoles

Figure 2. Les attributs patrimoniaux du site (Crédit : Entente Interdépartementale des Causses et des Cévennes)

Les changements climatiques sur le site Causses et Cévennes : les causes de la dégradation

Avant toute chose, il faut bien dire que pour le moment, nous ne disposons que de peu de données solides sur les effets du changement climatique dans notre zone, et encore moins à l'échelle du site inscrit. En revanche, quelques rapports,¹³ mais surtout des ressentis et des données phénoménologiques recueillis auprès de la

¹² Comme en témoigne les nombreux sites Natura 2000 du territoire inscrit.

¹³ CGAAER, *Pérennisation des pratiques agropastorales extensives sur le territoire UNESCO des Causses et des Cévennes*, 2016. Programme CLIMFOUREL, 2008, 2009.

profession agricole, nous permettent de dessiner les contours de certains des grands enjeux futurs qui se présentent à notre territoire. De même, des expériences et des recherches menées sur d'autres massifs tels que les Alpes, où les sécheresses à répétition des années 2000 ont entraîné une réelle prise de conscience un peu violente du changement climatique et de ses effets sur les milieux pastoraux.

Les effets du changement climatique n'apparaissent pas aujourd'hui de manière aussi brutale dans les Causses et Cévennes que dans les Alpes. Cependant, plusieurs études et rapports font état de la multiplication des aléas climatiques, ceux-ci comportant principalement des hivers plus doux, l'allongement de certaines saisons (printemps, automne), l'augmentation de la fréquence des épisodes de sécheresse. Ceci a déjà été constaté sur certains causses dans le cadre de recherches menées par le programme CLIMFOUREL (2008, 2009)¹⁴ et rappelé dans un dossier du CGAAER¹⁵ en 2016, et ce alors que le GIEC¹⁶ (2007) annonce comme probable la multiplication de ces épisodes à l'avenir.

Par ailleurs, dans les zones les plus montagneuses, le changement climatique peut se manifester par la baisse de la durée d'enneigement et de gel, le changement des étages de végétation, mais également le déplacement des parasites et mouches qui montent alors de plus en plus en altitude, et avec eux des maladies jusqu'alors absentes dans les hauteurs et qui peuvent affecter les troupeaux.

Tous ces changements engendrés par le changement climatique ont et auront des répercussions sur la biodiversité, sur l'équilibre écologique des milieux naturels mais également sur les ressources en herbe et en eau, celles-ci étant indispensables pour le maintien de l'activité agricole et des patrimoines associés. Ainsi, la baisse et/ou le changement de distribution de la pluviométrie et la question de l'accès à l'eau font figure d'enjeux essentiels pour un paysage agropastoral. L'enjeu de l'eau se pose de manière très concrète et urgente, alors que certaines communes étaient au bord de l'arrêt d'approvisionnement en eau potable au cours de l'été 2018. Le site Causses et Cévennes est donc affecté par les effets du changement climatique, et avec lui, les milieux et les pratiques reconnus d'intérêt patrimonial. Si certaines espèces et milieux sont et seront plus sensibles et vulnérables que d'autres, du côté de la profession agricole la nécessité de s'adapter pour faire perdurer l'activité devient essentielle.

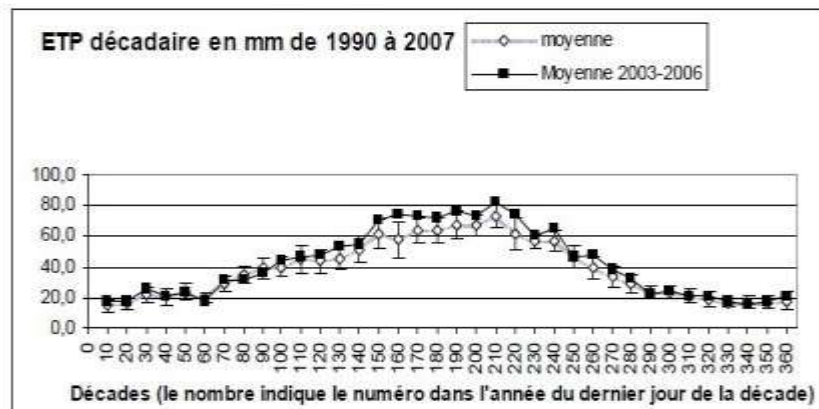


Figure 3. Source : [CLIMFOUREL](#), 2008

Changement climatique et patrimoines agropastoraux, quels impacts ?

Selon le GIEC (2007)¹⁷, l'adaptation au changement climatique implique « l'ajustement des systèmes naturels ou humains en réponse à des stimuli climatiques présents ou futurs ou à leurs effets, afin d'atténuer les effets néfastes ou d'exploiter des opportunités bénéfiques »¹⁸. Nous ne disposons pas d'assez de données pour

¹⁴ CLIMFOUREL, op.cit

¹⁵ CGAAER, op.cit.

¹⁶ GIEC 2007 in NETTIER B., 2016.

¹⁷ NETTIER, op.cit.

¹⁸ IPCC 2001

évoquer en détails les aspects affectant les patrimoines naturels. En revanche, pour ce qui est des systèmes humains, certains ajustements sont déjà observables au sein des exploitations installées sur le territoire des Causses et Cévennes. Ceci témoigne du caractère dynamique et de la capacité de résilience de la culture pastorale. Cependant, les effets du changement climatique et la nécessité de développer des stratégies pour les contrer ne sont pas sans implications potentielles pour les patrimoines valorisés dans le cadre de l'inscription des Causses et Cévennes au patrimoine mondial.

En effet, les systèmes agricoles maintenant les paysages agropastoraux hérités de plusieurs siècles d'agropastoralisme peuvent être mis en difficulté par la multiplication des aléas du climat : les semis sont de plus en plus durs à réussir en raison du manque d'eau au printemps, l'herbe à de plus en plus de difficulté à « se remettre » des épisodes de sécheresse estivale, il y a de moins en moins de ressources herbacées sur certains parcours mais également sur certaines estives, alors même qu'elle constitue habituellement des réserves de ressource estivale. Par ailleurs, on observe également d'importants problèmes d'approvisionnement en eau des cheptels, tandis que certaines sources se tarissent et que des petits ruisseaux s'assèchent.

On observe ainsi déjà plusieurs stratégies mises place par les éleveurs et éleveuses pour faire face aux difficultés entraînées par la baisse de la pluviométrie : la recherche de surfaces supplémentaires (notamment en s'orientant vers le pâturage en sous-bois, même sur les monts, c'est-à-dire sur les zones d'estive), la diminution de la taille des cheptels, le potentiel abandon des parcelles disposant de ressources insuffisantes, etc. Selon une étude menée sur la cause Méjean¹⁹, ces changements de stratégie des agriculteurs peuvent se diviser en trois catégories :

- augmentation des achats liés à l'alimentation, notamment des fourrages, ceci afin de subvenir aux besoins de l'exploitation,
- changement dans la production végétale de l'exploitation, ceci afin par exemple, de cultiver des espèces mieux adaptées,
- transformations dans le troupeau, avec diminution du cheptel, changements dans la période de mise à l'herbe ...

Le paysage culturel étant le reflet des systèmes agricoles passés et actuellement en place, ces changements de pratiques auront nécessairement un impact sur celui-ci. Quant à la question précise de l'eau, celle-ci a plusieurs implications directement liées au changement climatique. D'une part, les dernières lois sur l'eau, établies entre autres pour plus de maîtrise et d'équité dans sa distribution, semblent mal adaptées au contexte méditerranéen marqué par la grande amplitude saisonnière de la ressource. C'est ainsi que les béals, système hydraulique irriguant les Cévennes, attributs du site inscrit, doivent aujourd'hui être mis aux normes et les limites de quantité d'eau prélevé pour respecter le cadre réglementaire et effectuer des prélèvements dans les limites autorisées, ou à défaut cesser de prélever de l'eau (figure 4). Ces mesures rendent ainsi caduque l'utilisation de certains canaux (ceci bien qu'une part a été abandonnée plutôt en raison de la charge que représente leur entretien), aux moments même où les exploitations agricoles en auraient souvent le plus besoin et que leur valeur patrimoniale est maintenant bien reconnue²⁰.

D'un autre côté, pour pallier le manque d'eau, la profession agricole réfléchit à des solutions à plus long terme. Une des pistes évoquées dans les discussions et réunions sur ce thème est la construction de bassins de rétention, accompagnés des systèmes d'irrigation pour distribuer l'eau quand celle-ci vient à manquer, non sans conséquences potentielle sur la qualité de certains grands paysages. Ainsi, nous voyons bien comment les effets du changement climatique et les réponses à ceux-ci participant à la résilience des systèmes agricoles peuvent ou pourraient déstabiliser le système patrimonial des Causses et Cévennes, que ce soit au niveau de l'intégrité des grands paysages ouverts (remis en question par la peut-être future construction de bassins de rétention avec les systèmes d'irrigation associés, le développement de la forêt pour développer le sylvopastoralisme...) ou des systèmes locaux de connaissance et de pratiques.

¹⁹ CLIMFOUREL, op.cit.

²⁰ En tant qu'attribut du site Causses et Cévennes, ainsi qu'au regard de la démarche d'inventaire au patrimoine culturel immatériel « Les savoir-faire de l'irrigation gravitaire par béals (canaux) en Lozère» (<https://www.culture.gouv.fr/Fiches-inventaire-du-PCI>)



Figure 4. Un béal, canal d'irrigation traditionnel (Crédit : Entente Interdépartementale des Causses et des Cévennes)

A contrario, nous constatons que la multiplication des aléas climatiques peut également participer à réactiver des usages anciens et renforcer la pertinence de certaines pratiques ou éléments à caractère patrimonial. En effet, celle-ci peut par exemple encourager les éleveurs et éleveuses à se tourner d'autant plus vers des races rustiques moins fragiles et bien adaptées aux milieux méditerranéens, celles-ci représentant souvent des races à très petits effectifs leur conférant une valeur patrimoniale.

Un autre exemple de réactivation des attributs patrimoniaux inscrits se trouve dans les usages liés aux lavognes (figure 5). Ces bassins pavés, récupérant les eaux de ruissellement sur les causses karstiques, n'étaient plus qu'utilisés ponctuellement car ils ne correspondent plus aux normes sanitaires nécessaires dans la production alimentaire, notamment dans les systèmes laitiers. Cependant, les derniers grands épisodes de sécheresse ont été marqués par le retour de leur utilisation, réactivant toute la pertinence des anciennes techniques de maîtrise de l'eau dans ces milieux où cette dernière a toujours été un enjeu majeur.



Figure 5. Lavogne, Causse Méjean (Crédit : Entente Interdépartementale des Causses et des Cévennes)

Un dernier exemple de patrimoine qui à l'avenir pourrait bien être réactivé en raison des effets du changement climatique : la transhumance et les savoir-faire des bergers. En effet, la pratique de la transhumance illustre bien la capacité des systèmes pastoraux à s'adapter et se déplacer en fonction de la ressource disponible. Ainsi,

serait-il possible que le changement climatique encourage d'autant plus de troupeaux à se mouvoir pour accéder à la ressource quand celle-ci viendrait à manquer sur les terres de leur exploitation ? Il serait difficile de le prédire car, tout d'abord, la transhumance est une pratique toujours bien vivante (avec aujourd'hui environ 20 000 brebis transhumantes réparties sur le Mont Lozère et le Mont Aigoual), qui a cependant largement périclité au XXème siècle pour diverses raisons (elles étaient plus de 100 000 sur le Mont Lozère en au tournant du XXème siècle). Par ailleurs, tout comme dans les plaines, les ressources des estives souffrent également des aléas climatiques, poussant déjà parfois les troupeaux à redescendre plus tôt que prévu. Cependant, les évolutions actuelles du climat peuvent nous interroger dans le sens de la réhabilitation de la pratique à plus grande échelle qu'aujourd'hui. Enfin, si l'on s'appuie sur les travaux menés dans les Alpes tel que [le programme Alpages sentinelles](#), nous pouvons penser que le changement climatique rappelle l'importance accrue du rôle des bergers et peut participer à revaloriser leurs savoir-faire liés à la conduite du troupeau. En effet, leur connaissance des animaux et des milieux permette de gérer de manière très fine le prélèvement de la ressource (contrairement aux systèmes en clôtures) et ainsi de gagner quelques jours, voire semaines en altitude tout en contribuant à l'entretien et à la biodiversité des estives, ces milieux agricoles pas comme les autres et à l'équilibre fragile. Dans un même mouvement, ce « retour aux estives » pourrait également laisser présager un « retour aux parcours » favorisant le redéploiement des troupeaux sur ces espaces souvent parfois délaissés ou mal valorisés, non sans réappropriation des techniques de garde nécessaires à la pratique.

Les impacts du changement : quels effets sur le tourisme ?

Nous pourrions maintenant nous questionner... Quels liens avec le tourisme et la mise en découverte du site dans tout ça ? La question du tourisme se pose en fait ici de différentes manières.

Alors que sur les Causses et Cévennes, agriculture et tourisme sont les piliers de l'économie locale, nous pourrions imaginer une hausse de la fréquentation de visiteurs en provenance des garrigues, ceux-ci venant déjà rechercher la fraîcheur des zones de moyenne montagne au grès des épisodes de canicule, comme j'ai pu l'observer sur le terrain durant l'été 2019. Par ailleurs, le phénomène touristique peut participer à amplifier les risques de pénurie d'eau, ceci en raison de la forte augmentation de la population que le tourisme entraîne. C'est d'ailleurs pourquoi certaines communes s'investissent dans l'élaboration de « plan de gestion de crise en cas de sécheresse » pour gérer au mieux les usages agricoles, privés, liés aux loisirs etc, avec pour idée centrale la nécessité de construire une solidarité autour de l'accès à l'eau. Pour le moment, la priorisation des usages peine cependant à faire consensus.

Et si, au-delà de la question de la fréquentation touristique, on s'intéresse à la valorisation des patrimoines du site Causses et Cévennes, là aussi le changement climatique peut poser question. En effet, quel avenir pour le tourisme sur site, celui-ci passant essentiellement par la randonnée afin de découvrir les milieux semi-naturels, si le grand paysage subit d'importants changements ? Si les parcelles agricoles s'intensifient – banalisant le paysage – afin de produire davantage de fourrage pour subvenir à leur besoin croissant ? De même, la question de la randonnée pose question lorsque l'on voit que dans le Gard, juste aux portes du territoire, un [arrêté](#) a été émis durant l'été 2019, interdisant tout accès aux routes et pistes non-revêtues en raison d'un risque d'incendie EXTREME, et ce même à pieds.

Parmi les autres questions qui peuvent se poser, il y a également l'avenir des paysages ouverts. Aujourd'hui, la recherche, les gestionnaires et la médiation soulignent particulièrement la richesse et la singularité de ces milieux. Cependant, nous pouvons peut-être nous interroger sur leur pertinence à l'avenir. En effet, ces espaces non ou peu arborés peinent à se remettre des épisodes de sécheresses. Ainsi, un des scénarii possibles de l'adaptation des systèmes agricoles passerait par le développement du sylvo-pastoralisme sur les causses, permettant de disposer de ressources herbagères en sous-bois. Celui-ci permettrait de maintenir l'activité agropastorale au détriment des grands paysages steppiques qui caractérisent une partie du territoire inscrit.

Enfin, la dernière perspective interroge cette fois-ci la transhumance et ses fêtes, celles-ci attirant environ 10 000 visiteurs par an chacune. Pourrait-on imaginer que le changement climatique entraînerait des

modifications dans la saisonnalité de la pratique, non sans impact sur les savoirs et la culture associée, ainsi que sur les paysages d'estive ? Par ailleurs, en ce qui concerne les milieux, nous pourrions imaginer que ces changements pourraient aussi bien impliquer des réouvertures d'espaces (pour accéder à de nouvelles ressources) que des fermetures en raison de l'abandon de certaines estives. Autre scénario, les zones de transhumance pourraient éventuellement changer comme elle l'ont déjà fait dans le passé, pour s'installer dans des zones céréalières et bénéficier de cultures dérobées, en dehors du territoire inscrit ?

Loin de vouloir dresser un portrait catastrophique de la situation, sans base scientifique solide qui plus est, il s'agit ici de nous interroger sur l'avenir touristique de la région et la mise en découverte de la thématique agropastorale dans un contexte d'évolution probable des paysages et des pratiques, ceci même si nous n'en sommes pas encore là aujourd'hui.

Le changement climatique, une nouvelle ressource touristique ?

Mais alors que le changement climatique apparaît comme un potentiel élément perturbateur du système patrimonial des Causses et Cévennes et de son économie touristique, il émerge en même temps comme une nouvelle ressource potentielle pour l'interprétation du site.

D'une part, il s'agit d'un sujet émergent à l'échelle des visites d'exploitation et de la médiation directe. Ainsi, dans mes recherches de terrain, j'ai eu l'occasion de le voir abordé à la fois par des visiteurs et par des médiateurs.

Car si le changement climatique apparaît comme un enjeu agricole et patrimonial important, il possède également un fort potentiel d'interprétation. C'est ce qu'illustre le projet de Centre d'Interprétation et de Sensibilisation aux Changements Climatiques, initiative portée par Météo France et la Communauté de Communes Causses Aigoual Cévennes, avec l'aide de l'État, de la Région Occitanie et du Département du Gard, accompagnés localement par le Parc national des Cévennes et l'ONF, et auquel l'Entente Interdépartementale des Causses et des Cévennes a également participé. Ce centre, dont l'ouverture est prévue pour l'été 2020, se situe en plein cœur du site inscrit Causses et Cévennes, sur le sommet de l'Aigoual à 1567 mètres d'altitude, un des Haut-Lieux de la transhumance cévenole en provenance des garrigues. Cette exposition prendra place dans les lieux du dernier observatoire habité de France, l'Observatoire du Mont Aigoual, effectuant des relevés depuis 1894. Ce projet de 3,5 millions d'euro vise d'une part à restaurer ce bâtiment chargé d'histoire, et ce de manière exemplaire, de l'autre à maintenir une équipe sur place, ainsi qu'à renforcer l'attractivité touristique du territoire du fait du caractère innovant de l'exposition. Évidemment, il s'agit également de participer à la prise de conscience des visiteurs et des habitants sur le changement climatique, et d'encourager à entreprendre des actions pour limiter notre impact. Composé de multiples salles thématiques agrémentées de dispositifs interactifs, la future exposition vise à plonger les visiteurs au cœur des problématiques climatiques, et ce traitant des enjeux internationaux, nationaux et locaux. Il s'agira de présenter les constats actuels émis par les experts, d'interroger l'évolution des milieux et les modifications des modes de vie, ainsi que d'encourager les actions qui peuvent être engagées à nos échelles pour limiter notre impact et donc de replacer le visiteur dans son rôle d'acteur et de citoyen.

L'implantation de ce centre d'interprétation sur le sommet de l'Aigoual a beaucoup de sens, car certains effets du changement climatique sont visibles sur place : rareté de la neige en hiver, entraînant la fermeture régulière de la station de ski, évolution de la flore environnante...

Avec 70 000 visiteurs en 2018, l'Observatoire de l'Aigoual, doté de son nouveau centre d'interprétation, espère alors renforcer le tourisme de proximité et attirer de nouveaux visiteurs dans la région dans le but de sensibiliser le grand public au changement climatique. L'ouverture est prévue en 2020.

Pour conclure, on pourrait dire que si on pose la question du changement climatique au prisme d'un site protégé à vocation agricole tel que les Causses et Cévennes, on peut voir que celui-ci pourrait agir à la fois comme un perturbateur potentiel du système patrimonial et touristique, mais également un facteur de réactivation de certains patrimoines dont l'usage avait été abandonné, voir une nouvelle ressource en matière

de tourisme et d'interprétation du site.

Bien entendu, si celui-ci apparaît comme un facteur de changement, d'évolution, de déstabilisation des pratiques et de paysages agropastoraux, il n'agit pas seul. La PAC, la prédation, sont autant de facteurs agissant sur les paysages de manière conjointe, et peuvent représenter des menaces sur le système patrimonial d'un paysage culturel vivant comme celui des Causses et Cévennes. Il ne s'agit donc pas ici de tout mettre sur le dos du changement climatique.

Il ne s'agit pas non plus ici d'avoir une vision fixiste de ce patrimoine vivant et évolutif, mais d'interroger les évolutions potentiellement induites par les phénomènes climatiques, accompagnées pourquoi pas par le développement d'un tourisme plus durable, et de nouvelles thématiques à interpréter. Pour le moment, il s'agira également de s'investir dans des programmes de recherche pour mieux cerner et anticiper les évolutions, dans le but également de partager cette connaissance à travers d'autres dispositifs d'interprétation.

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Changements climatiques, changements de valeurs, et changements de discours : les cas du Vieux-Lunenburg et du Vieux-Québec

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Introduction

La conservation et l'interprétation du patrimoine dépendent des besoins et des intérêts des acteurs sociaux du présent. L'actualité étant marquée par les discours sur « l'urgence climatique », les préoccupations envers les effets négatifs des changements climatiques sur l'environnement, et le patrimoine en particulier, se font donc aussi plus présentes. Devant la crainte de sa dégradation, l'environnement, qui a longtemps été considéré comme une ressource à exploiter, se voit aujourd'hui accorder de nouvelles valeurs, notamment celle de rareté et de protection de la santé. De nouveaux discours apparaissent pour assurer une cohérence entre ces valeurs, les comportements attendus pour assurer la conservation du patrimoine, et plus largement l'identité de ceux qui doivent « prendre soin » du patrimoine.

Afin de mieux comprendre comment les changements climatiques peuvent affecter le patrimoine mondial, deux sites du patrimoine mondial de l'UNESCO canadiens, soit le Vieux-Lunenburg et le Vieux-Québec, sont analysés. Ces deux quartiers historiques habités subissent les effets des changements climatiques de façon très différente : l'un voyant son patrimoine matériel local mis en danger, l'autre profitant – à court terme – des avantages économiques du déplacement des activités touristiques au plan mondial. L'analyse met aussi en lumière les changements de discours et de valorisation du patrimoine dans ce « régime climatique ».

Le Patrimoine Mondial du Canada

En 2019, le Canada compte 20 sites du patrimoine mondial de l'UNESCO sur son territoire, dont 9 sites culturels, 10 sites naturels et un site mixte. Parmi les sites culturels, 6 ont été reconnus selon des critères relevant de l'histoire de la colonisation ou à l'établissement des Européens sur le continent américain, et 4 présentent des critères liés à l'histoire des peuples autochtones.

Du point de vue du nombre, ces 20 sites canadiens sont à peine un peu moins que le nombre de sites du patrimoine mondial dénombrés chez les voisins du Sud, les États-Unis. Ce dernier pays en compte 23 en 2019, soit 10 sites culturels, 12 sites naturels et un site mixte. Un site, le Parc international de la paix Waterton-Glacier, est transfrontalier entre le Canada et les États-Unis²¹. Rappelons que le Canada compte l'équivalent d'un peu plus de 10 % de la population états-unienne (soit 36 millions de Canadiens pour environ 320 millions d'États-Uniens).

²¹ Établi en 1931, ce parc binational avait pour but de « promouvoir la paix ..., mais aussi de souligner le caractère international de la nature et la coopération nécessaire à sa protection » ([Parcs Canada, 2019](#)).



Figure 1. Les sites Patrimoine Mondial de l'UNESCO au Canada et aux États-Unis
(Crédit : Université Laval, Département de Géographie)

Les comparaisons géographiques sont certes des plus boiteuses quand il est question de comparer le nombre de sites du patrimoine mondial d'un État à l'autre. Ni le nombre de kilomètres carrés de la superficie nationale ni le nombre d'habitants ne justifient le nombre de sites inscrits. Cet écart quantitatif permet tout de même de percevoir une différence quant aux modes de reconnaissance patrimoniale entre l'Amérique du Nord et les autres pays occidentaux, dont les pays européens. Le nombre de sites du patrimoine y est moindre en Amérique du Nord, mais le poids du patrimoine naturel y est proportionnellement beaucoup plus élevé. En effet, le patrimoine naturel correspond à plus de la moitié des sites américains, alors qu'il représente à peine 20 % de l'ensemble des sites de la Liste.

Cette comparaison introductive ne vise pas à démontrer le déséquilibre quantitatif de la liste, mais à souligner les différences culturelles et les rapports institutionnels différents qui se manifestent à l'égard de la reconnaissance liée au patrimoine mondial de l'UNESCO. Considérant ces rapports différents de patrimonialisation, il est possible de s'attendre à ce que les discours relatifs aux effets des changements climatiques prennent également des formes et des contenus différents.

Le Vieux-Lunenburg et le Vieux-Québec, sites du Patrimoine Mondial canadiens, et quartiers habités

Le Vieux-Lunenburg

Le Vieux-Lunenburg a été inscrit comme site du patrimoine mondial en 1995 selon les critères (iv) et (v) de la Convention. Le critère (iv) se réfère au Vieux-Lunenburg à titre d'exemple architectural « bien conservé de la colonisation britannique et du développement urbain au XVIIIe siècle, qui n'a subi aucune modification importante depuis sa fondation et qui continue largement à remplir les objectifs économiques et sociaux pour lesquels [il] a été conçu[e]. Sa tradition architecturale vernaculaire diversifiée et bien conservée, qui s'est développée pendant 250 ans, revêt une importance particulière ». Le critère (v) indique qu'il s'agit d'un « un

excellent exemple de communauté urbaine et de culture conçue pour et fondée sur la pêche en haute mer dans l'Atlantique, qui connaît une évolution irréversible et qui évolue sous une forme que l'on ne sait pas encore parfaitement définir » (Parcs Canada, 2019). Les deux critères soulignent donc, de façon paradoxale, la pérennité du modèle urbanistique et architectural, mais aussi la désuétude de ce modèle.

La superficie reconnue est d'environ ½ km² (33,85 hectares). Son front de mer, dont l'iconographie s'appuie sur une ancienne usine de pêcherie en bois, peint en rouge, est un paysage distinctif, et sa principale image touristique.



Figure 2. Le front de mer du Vieux-Lunenburg (Source: www.novascotia.com)

En 2016, le rapport intitulé « Patrimoine mondial et tourisme dans le contexte des changements climatiques » (UNESCO, PNUE, UCS, 2016), identifiait le Vieux-Lunenburg parmi les sites du patrimoine mondial les plus à risques de subir les effets des changements climatiques, avec les prévisions d'augmentation du niveau de la mer, des épisodes de sécheresse et de feu. Dans le cas particulier de Lunenburg, les plages et les fronts de mer sont identifiés comme étant des sites particulièrement en danger. Il s'agit aussi de lieux identitaires forts pour les citoyens, et qui constituent le paysage touristique iconique (Municipality of the District of Lunenburg, 2012).

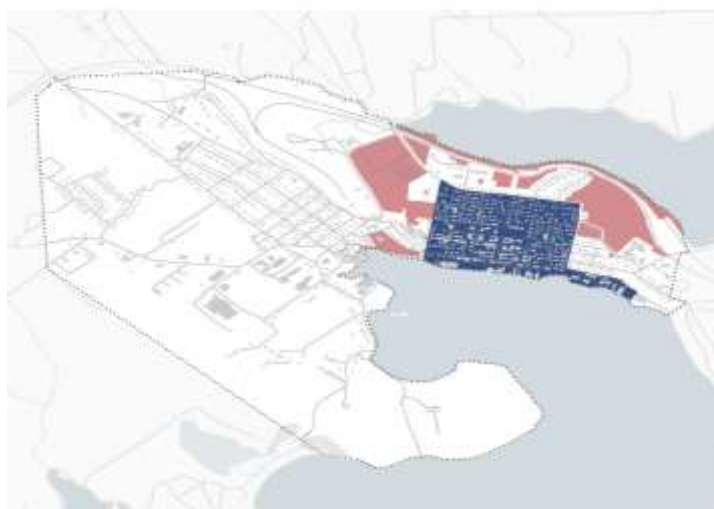


Figure 3. En bleu le Vieux-Lunenburg, en rose la zone tampon (Source: Project Lunenburg - Town of Lunenburg Comprehensive Plan, 2019, p.9)

L'eau, principale ressource ayant permis à la ville de se développer, au départ avec les pêcheries puis avec le tourisme, constitue « l'identité du lieu », c'est-à-dire son histoire et son image. Aujourd'hui, l'eau représente la principale menace qui pourrait faire disparaître le site patrimonial. En effet, le quartier historique est entouré d'eau. Les rues, qui sont disposées perpendiculairement à la rive, et le positionnement de la collectivité, ont été prévus le long du bassin. La colline escarpée s'étend jusqu'au bord de l'eau, et sa topographie concentre ainsi les activités le long de la rive. La vue sur l'océan, les quais et le port où accostent souvent de grands voiliers, et le paysage des rues linéaires sont des éléments essentiels du patrimoine de Lunenburg.

Risques climatiques, politiques, économiques et sociaux

Les autorités de la Ville de Lunenburg et de la province de la Nouvelle-Écosse ont réalisé de nombreuses études pour évaluer les risques encourus ainsi que les conséquences prévisibles (ex. Forbes et Wightman, 2013; Fudge, 2017; Town of Lunenburg, 2014). Les résultats sont annonciateurs d'une transformation du littoral.

Comme nombre de villes en bordure d'océan ou de mer, le quartier historique sera soumis à une érosion accélérée. L'augmentation du niveau de la mer et des tempêtes plus fréquentes augmenteront les inondations, causeront l'infiltration d'eau salée dans les infrastructures et donc l'érosion. Cette dernière rendra plus vulnérables les bandes de terres basses, qui seront plus facilement inondables et donc toujours plus érodées. L'enjeu des effets des changements climatiques ne se limite toutefois pas à l'érosion du patrimoine matériel, mais accroît aussi la vulnérabilité d'autres facteurs.

Les changements climatiques accroissent le changement économique – des pêcheries au tourisme – ce qui génère encore davantage de pression sur le paysage urbain. L'industrie de la pêche, avec ses entrepôts et ses usines sur le port de mer, a été rudement mise à l'épreuve durant les années 1980 et 1990. La transformation économique des pêcheries au tourisme était donc souhaitée et attendue. En effet, l'inscription du site au patrimoine mondial était liée à la volonté d'en faire un site touristique. La ville connaissant un déclin touristique continu depuis de nombreuses années, l'obtention de cette reconnaissance internationale était considérée comme un moyen de la remettre en valeur et d'en faire la promotion. Il semble à cet égard que l'inscription a eu un effet positif. Le site ayant connu une croissance du nombre de visiteurs pendant une quinzaine d'années à la suite de l'inscription, une croissance supérieure aux autres régions de la province (VanBlarcom et Kayahan, 2011).

Avec le tournant économique vers le tourisme, les fonctions de ces bâtiments sont devenues « encombrantes » pour l'accueil des touristes et ont donc été relocalisées ailleurs dans la ville. Les usines génèrent en effet du bruit, des odeurs, du trafic de véhicules lourds, qui sont incongrus dans un paysage touristique. Les édifices emblématiques liés aux pêcheries ont dès lors été convertis en lieux de services touristiques et de patrimoine. Ces lieux ont été vidés de leurs activités traditionnelles qui leur a valu la reconnaissance. De même pour la fabrication de poteries, qui était une activité traditionnelle locale, et qui ne fabrique plus maintenant que de petits pots qui s'emballent et se rangent bien dans les valises. La pression urbaine, touristique, mais aussi la vulnérabilité de ce port de mer sont d'autant plus importantes que la topographie de la ville concentre les touristes sur les quais et les bords de mer.

Les autres secteurs de la ville se transforment aussi pour répondre à la « nouvelle économie », en transformant les lieux de résidence en espaces de location touristique. La modification du tissu social, les habitudes de vie et de consommation différentes des touristes, a pour effet d'accroître les effets négatifs de la saisonnalité (Projet Lunenburg, 2019).

La protection du lieu est assurée par un ensemble de lois et par différents paliers de gouvernements. Le Vieux-Lunenburg a été désigné lieu historique national par le gouvernement canadien (1991), et deux lois provinciales assurent sa protection sur le plan de l'aménagement et de la protection du patrimoine (Municipal Government Act [1998] et Heritage Property Act [1989]). Plusieurs autres plans de conservation ont été élaborés depuis afin d'assurer la protection du site du patrimoine mondial et d'intégrer le développement économique induit par le tourisme et les activités culturelles et patrimoniales (Parcs Canada, 2019).

On doit également ajouter que la pression et la spéculation foncière ainsi que les coûts de restauration des bâtiments de bois sont identifiés comme des risques potentiels à la conservation du patrimoine. En Nouvelle-Écosse, 70 % des terres sont privées. Le quartier historique de Lunenburg ne fait pas exception, alors que la majorité du territoire est de propriété privée. En 2005, le gouvernement a acquis 17 propriétés (22 bâtiments et 8 quais). Néanmoins, avec 2 300 résidents, l'assiette fiscale pour l'entretien du territoire est très restreinte. D'autant plus que cette population est également vulnérable, sur plusieurs points (Town of Lunenburg, 2015). D'une part, son nombre a diminué de 10 % depuis 2001. L'âge médian est de 53 ans, contre 43 ans pour l'ensemble de la province, et 40 % de la population a de plus de 60 ans (contre 25 % pour l'ensemble de la province). Elle est moins scolarisée, moins active, et son revenu moyen est plus bas de 12 %. La population est donc moins en mesure d'assurer les investissements pour l'entretien du patrimoine immobilier privé.

Changement... de valeurs

Les changements climatiques induisent non seulement des transformations matérielles, mais également une révision des discours, des connaissances et des valeurs. Un « régime climatique » produit et est produit par ces nouvelles valeurs. Les effets globaux, les prédictions abstraites, résonnent aussi concrètement pour les communautés locales, et transforment, peu ou prou, leur vision du monde (Aykut et Dahan, 2011).

Ainsi, la municipalité a entrepris plusieurs démarches pour que l'ensemble de la communauté puisse continuer à vivre, et y vivre. Elle a notamment entrepris une démarche de planification communautaire qui revoit non seulement le mode de vie, mais aussi l'identité même de la ville (Project Lunenburg, 2019).

La filiation britannique a présidé à la définition identitaire de la communauté pendant des décennies. Cette identification s'appuyait tant sur les modèles économiques qu'urbains, et elle a servi de référence aux critères d'obtention du titre de patrimoine mondial. L'Europe, qui était le modèle valorisé, et donc à imiter, se voit substituer pour un modèle différent, et les valeurs environnementales sont au cœur de cette redéfinition. L'histoire est revisitée pour intégrer ces nouvelles valeurs au récit identitaire. On s'attache ainsi à d'autres « vérités ».

Cette « révision » identitaire est également concomitante à la tenue de la Commission de vérité et réconciliation du Canada, qui amène à reconnaître la présence des premières nations, dont les Mi'kmaq et dans une moindre mesure, les Acadiens, dans l'histoire de la ville.

Alors que le mode de vie des autochtones a été perçu comme une aberration économique, il est maintenant perçu comme étant plus près des valeurs environnementales. En effet, les récits autochtones sur l'origine du monde sont directement en lien avec la nature, maintenant reconnue comme valeur suprême. L'UNESCO a aussi développé des programmes mettant en valeur les « Savoirs autochtones et changements climatiques » (voir notamment United Nations University [Japan]. Traditional Knowledge Initiative, 2012). On constate donc un changement de valeurs et l'avènement de nouveaux discours les intégrant.

Le Vieux-Québec

S'il baigne également dans ce « régime climatique », le cas du Vieux-Québec diffère du cas du Vieux-Lunenburg à plusieurs égards.

Le Vieux-Québec a été nommé site du patrimoine mondial de l'UNESCO en 1985 pour ses fortifications et son passé de capitale de Nouvelle-France ayant joué un rôle essentiel dans la fondation des colonies en Amérique.



Figure 4. Le front de mer du Vieux-Québec avec le château Frontenac (Source : authentikcanada.ca)

Alors que la candidature du Vieux-Lunenburg était principalement motivée par les retombées économiques potentielles du tourisme, celle du Vieux-Québec a surtout été motivée par son besoin de reconnaissance identitaire. La dimension touristique n'était pas un argument majeur, la ville étant reconnue comme destination touristique depuis le XIXe siècle.

Ainsi, le Vieux-Québec est depuis presque deux siècles une destination touristique. Si le quartier compte aujourd'hui moins de 5 000 personnes, population en légère, mais continue décroissance, la Ville de Québec est en position avantageuse pour soutenir le développement et la protection du Vieux-Québec. La région accueille annuellement 4,5 millions de touristes, dans une ville ayant un taux de chômage parmi les plus faibles du Canada. La région présente une économie diversifiée, une population très scolarisée et un revenu disponible moyen parmi les plus élevés de la province (Institut de la statistique du Québec, 2019).

Les changements climatiques ne l'affectent pas de la même façon que Lunenburg, du moins, pas à court terme. Bien que le quartier historique soit situé à proximité du fleuve Saint-Laurent, il est moins vulnérable aux inondations, quoique ces dernières soient aussi présentes.

Cette proximité maritime a joué un rôle de premier ordre dans l'histoire de la ville. Au début du XIXe siècle, son port était le troisième plus important port d'Amérique, après New York et La Nouvelle-Orléans (Port de Québec, 2019). D'un petit port colonial de bois en 1713, le Vieux-Québec s'est transformé pour accueillir, durant les 50 premières années du XIXe siècle, jusqu'à 30 000 immigrants par année, dans une ville qui comptait environ 30 000 habitants. Plusieurs aménagements ont donc été nécessaires afin d'accueillir ces immigrants, et le port a été graduellement remblayé, bétonné. Le port a été le symbole de l'accueil des immigrants européens, qui arrivaient à Québec dans l'intention de se refaire une nouvelle vie, ainsi que le symbole de la transformation de la ville.



Figure 5. Les transformations du port du Vieux-Québec de 1713 à aujourd'hui (Source : www.quebecurbain.qc.ca)

Aujourd'hui, la Ville de Québec rappelle matériellement jusqu'où se rendait la rive à différentes époques. Elle a inscrit par un marquage au sol les différentes lignes de rivage, et donc l'avancée de la terre, et des travaux humains, sur l'eau. Ce marquage est un rappel de cette époque faste en activités et en bouleversements (figure 6).

Cent cinquante ans plus tard, le port ne figure plus parmi les ports les plus importants d'Amérique, mais il est toujours en activité. Depuis une trentaine d'années, s'est ajoutée au transport de marchandises une autre activité : l'accueil de touristes de croisière. Ce sont là des effets de la mondialisation, et des changements climatiques, qui permettent à Québec de générer une nouvelle économie touristique. Ces activités lui sont dévolues de façon saisonnière à cause des tempêtes tropicales accrues qui se produisent dans les Caraïbes en début d'automne.



Figure 6. Marquage de la ligne de rivage de 1800 dans une rue du Vieux-Québec (Photo : P. Marcotte)

En effet, à partir des années 1990, le Port de Québec a profité du repositionnement de certains navires de croisière qui ont choisi les eaux calmes du Saint-Laurent au moment où des troubles politiques sévissaient dans le golfe persique (Port de Québec, 2019). Depuis lors, le port a continué à accueillir des navires prestigieux. Tandis que l'économie et le transport des produits céréaliers décroissaient, le marché des croisières prenait de l'expansion et n'a, depuis, cessé de croître. Les activités de démarchages de l'industrie touristique auprès des croisiéristes ont certes eu une efficacité, mais les tempêtes tropicales, toujours plus nombreuses avec l'accélération des changements climatiques, ont également poussé les bateaux de croisières à choisir les eaux froides du Saint-Laurent. Les bateaux de croisières qui cherchent à fuir les eaux caribéennes durant la saison des ouragans viennent maintenant au Québec durant l'automne. Ils sont de plus en plus nombreux, mais surtout, ils viennent sur une courte période (6 semaines).



Figure 7. Navires de croisière dans le port du Vieux-Québec (Source : www.portquebec.ca)

Si Québec est depuis longtemps un lieu d'accueil, aujourd'hui la question des flux se pose autrement, notamment à propos des effets sociaux et environnementaux des croisières sur la population locale et sur la transformation de la ville pour accueillir ces populations temporaires.

Conclusions

Les cas des quartiers historiques des villes de Lunenburg et de Québec démontrent que les changements climatiques peuvent avoir un impact réel sur la transformation d'un site patrimonial, mais également sur la perception et la compréhension du patrimoine. Dans le cas de Lunenburg, la mer qui a influencé sa désignation comme site patrimonial, pourrait aujourd'hui affecter négativement l'existence même de son patrimoine. Dans le cas de Québec, le remblayage du littoral, afin d'accueillir les immigrants et de réceptionner les marchandises dans le port, est devenu une composante patrimoniale du site. Toutefois, l'eau semble reprendre maintenant ses droits et apparaît redonner au patrimoine naturel la place qui lui revient.

Le patrimoine est conservé en fonction des besoins du présent, et il est justifié par les valeurs contemporaines. Les changements de valeurs modifient donc ce que l'on choisit de conserver, mais surtout ce que l'on choisit d'argumenter dans le discours qui justifie la conservation de ce patrimoine.

Les changements climatiques influencent le patrimoine, atteignent son intégrité en le dégradant, mais le « régime » qu'ils instaurent amènent aussi à reconsidérer les différentes échelles d'intervention qui

produisent - ou fragilisent - ce patrimoine. Les nouvelles vérités sont notamment associées aux valeurs environnementales contemporaines. Comme le patrimoine, quelles seront-elles demain ?

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Ecological Reconversion to Fight Climate Change: the Case of the Monastery of Poblet (Catalonia)

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Introduction: the Monastery of Poblet as World Heritage Site



Figure 1. View of the Monastery of Poblet (Source: www.poblet.cat)

Poblet is a Cistercian monastery whose monks, since its foundation in 1150, have followed the Rule of Saint Benedict. The monastery was closed in 1835 due to the Spanish law and re-founded in 1940 by Italian monks of the same Order. In 1991 it was declared World Heritage.

The criteria for the inclusion of the Monastery of Poblet in the World Heritage list are (i) and (iv):

Criterion (i): “Poblet is a unique artistic achievement and one of the most perfect expressions of Cistercian style in the 12th, 13th and 14th centuries. The abbey contains masterpieces from every period such as the great alabaster altarpiece by Damià Forment (1529)”.

Criterion (iv): “The Santa Maria of Poblet complex presents a unique blend of architectural forms generally reserved for distinct applications. Poblet has served as one of the largest and most complete of the Cistercian abbeys, as a massive military complex, and as a royal palace, residence and pantheon.” (UNESCO, 1991)

The two main ideas that are under this declaration are **integrity** and **authenticity**.



Figure 2. The Monastery's cloister
(Photo: Maria Rosa Ferrer from Vilafranca del penedes, Catalunya / CC BY-SA)

Integrity because, as mentioned, is one of the best preserved examples of Cistercian architecture. Built in the 12th to 15th centuries around a church that dates to the 13th century, Poblet is one of the largest and most complete Cistercian abbeys in the world. It is impressive for the majesty, but at the same time austerity, of its architecture and includes a fortified royal residence as well as the pantheon of the kings and queens of Catalonia and Aragon (fig.3).



Figure 3. The tombs of the Royals of Catalonia and Aragon
(Credit: Xevi Vilardell; xelu.net under Creative Commons licence)

From the authenticity point of view, it still preserves the spiritual values that inspired its construction. The fact that a monk community still lives there and takes care of the space is extremely important in terms of preserving the spirit of the place. The spiritual quality of the life of Poblet Monastery has also made it a very important center in the life of the country, from the time of its foundation until the present day.

Poblet is extraordinarily important in terms of art, culture, history and spirituality and for its key role in the repopulation and agricultural exploitation of New Catalonia under the Crown of Aragon. The library and scriptorium (fig. 4) were well known from the 13th century onwards for their works on law and history, and the monastery served as a custodian of the history of the dynasty as well as the Royal remains.



Figure 4. The Monastery's library, located in the ancient scriptorium (Source: www.poblet.cat)

The Ecological Reconversion: Main Axes

All the great religions and spiritual traditions teach that a wise relationship with nature is based on respect, love, compassion, austerity and, impregnating all, the sense of the sacred. The three Abrahamic religions teach that the earth belongs not to men but to their Creator. That we are the depositors, or custodians, of a legacy we have received and that we have a duty to transmit (Mallarach, 2007).

In his encyclical letter *Laudato Si*, published in 2015, Pope Francis also refers to the care of our common home, the Earth. Monastic orders have embodied these principles since their foundation. Especially in the case of the Cister, monasteries have been eminent exponents for centuries, tending to self-sufficiency, to produce what they consume as near as possible, to close short cycles. The ecological conversion that the Monastery of Poblet has undertaken is somehow a return to the faithfulness of the Cistercian principles.

All the information for this conference is provided from P. Lluç Torcal, former Prior of the Monastery at the time when the process began, and Josep Maria Mallarach, environmental consultant of Poblet.

In 2007, the community began a process of reflection on its relationship with the environment, which led to a number of important changes, in a line of ecological conversion. In 2009, a Declaration was approved in this sense. This is why the community is oriented towards self-sufficiency in the field of energy, water and food, and consciously pursues a sustainable and effective economy, based on short and closed cycles, to the extent of its possibilities. This process was based on three axes:

1. Improve the management of all the facilities, buildings and properties of the monastery, through the application measures based on social and environmental justice criteria.

2. Inform and educate the visitors to the Monastery interested in environmental values linked to spiritual principles.
3. To protect the quality of the rural and forest landscape of the environment, improving the ecological integrity, its silence and its beauty.



Figure 5. The Abbey's nave (source: www.poblet.cat)

Most experts and scientists state that one of the main causes of climate change and the warming of the planet is the high concentration of gases that produce the greenhouse effect. Most of these gases come from combustion of fossil fuels, mainly produced in processes of energy production and transport. Therefore, within the three axes of action proposed by the Monastery, the main actions to fight climate change have to do with actions to reduce energy consumption. With this purpose, fossil fuels and other pollutants energy sources have been replaced for other clean and renewable sources. An approximate reduction of half of the fossil fuels consumed before 2007 has been achieved. Other actions have to do with more efficient water management with the aim of reducing domestic consumption, collecting rainwater, recycling grey water, avoiding the pollution of the surface and underground water of the environment caused by the use of detergents and non-organic cleaning products, or aggressive agricultural practices. In recent years, 80% of water has been saved.

The actions done under these three axes have been grouped under six labels: water management, energy, food, waste management, landscape and visitors' services. The actions done are going to be presented below mentioning the aim or purpose and the actions done.

Water management

The main purpose of water management is to reduce domestic consumption, collect rainwater, recycle grey water, avoid the contamination of surface and groundwater in the environment caused by the use of detergents and non-organic cleaning products, or by aggressive agricultural practices.

Some of the actions done were, for example:

- In-depth study (with Radar) of the historical systems of water use and of the water networks that the monastery had, to evaluate which ones can be recovered.
- Gradual replacement of conventional detergents with environmentally friendly detergents to reduce the contaminated load of wastewater.
- Audit of water consumption to identify leaks in the facilities and solve them.
- Creation of a loop that guarantees the water supply throughout the monastic enclosure and allows the circulation in both directions of the loop. This allows the removal of about a dozen intermediate pumps that had been used up until then, with the consequent energy savings.

- Implementation in the monastery and in the lodgings of several devices that reduce water consumption, such as diffusers of faucets and ecological showers (that use the Lenard effect and with a pressurizer) and that allow saving of 65 % of soap, water and energy.

The result is that since 2007, an 80% of water has been saved; the rainwater of the cloister sector has been collected, the main contamination caused by sewage to the water has been solved, and the contaminated load of the wastewater from the monastic complex has been reduced.

Energy Management

The main aim is to replace, progressively, the use of fossil fuels and pollutants for cleaner and renewable energies and reduce emissions of CO₂ and other polluting gases derived from oil and aerosols, and also to fight against acoustic and light pollution.

Some of the actions done were, for example:

- Install photovoltaic panels.
- Since 2007, gradual improvement of the energy efficiency of the facilities reducing the use of fossil energy and using more sustainable sources of energy, for example a geothermal system for heating in some of the parts of the monastery.
- Installation of solar thermal collectors for hot water
- Installation of lanterns with LEDs and collectors that are individually powered by solar energy in different places of the monastery (entrances, squares...)
- Improvement of the efficiency of internal heating systems: valve removal, simplification of circuits, thermal insulation of pipelines, cleaning, etc.
- Feasibility studies for implanting small vertical axis windmills in the Monastery facilities, in a camouflaged manner (farm, tower head...) and well-integrated with the monumental building.
- Lighting project for the new Monastery Reception, which includes the monastery shop, the reception space for visitors and the information and tourism office of the region. The project has been based on achieving proper lighting that, through LEDs, allow maximum efficiency and reduced consumption.

The result is an approximate reduction of half of the fossil fuels consumed before 2007 and a sensitive reduction of light pollution.

Food

The purpose is to return to cultivate, at least partially, the land that from the monastery, according to ecological criteria.

Some of the actions done were, for example:

- Since 2008, olives, nuts and honey are collected in the lands of the monastery.
- An orchard of about 850 m² is put into operation with ecological criteria, for the supply of the community.
- Gradual increase in food products consumed at the monastery from nearby businesses and farms, which work with organic farming or livestock criteria. This criterion has been extended to the external lodging and its restaurant.
- The community has recovered the management of some of the fields that had been transferred to a wine company in order to increase the monastery's orchards, always following ecological criteria. The monks in charge of the orchards receive lessons on organic farming

- A professor at the Santa Teresa del Vendrell Foundation, who manages the Tasta Poblet school-restaurant in Poblet's hostel, teaches practical classes to the two responsible monks.
- 2013- Extension of the ecological cultivation areas within the gardens of the Monastery.
- The result is the maintenance of the existing crops and the revitalization of the monastery orchard with the implementation of ecological criteria.

Waste Management

The goal is to organize the selective selection of waste, minimize non-organic waste and compost the organic fraction, and dispense with unnecessary packaging and wraps.

Some of the actions done were, for example:

- The selective waste selection is organized, and the organic fraction is composted and used to fertilize the orchard.
- Use of corn meal plates and cups (that are very decomposable) for festivals that gather many diners at the Monastery.
- Production of yogurt for own consumption, from commercial packaged milk, started; this allows reducing most of the wrappers that were generated every day before. At the same time, individual packaging of food and cleaning products is reduced when buying wholesale packages, in order to reduce the inorganic fraction of waste.
- The pruning and logging remains are converted into 'biochar', a product of combustion of organic matter by the pyrolysis system, which incorporates CO₂ instead of releasing it into the atmosphere (which slows down global warming) and it also serves as a fertilizer for the soil.
- Development of dishwashing detergents with citrus scraps. Use of medicinal herbs for toothpastes and perfumes.
- The non-organic fraction, which is recycled selectively, has been reduced in a large part, and the entire organic fraction generated in the monastery, which is used for fertilization, is composted.

The Restaurant-school "Poblet" in the External Lodging

With the aim to improve the quality of life of people with difficulties in socio-occupational integration, in the Conca de Barberà region, an ambitious project was launched. The project began with the new hostel of the Monastery of Poblet, managed by Santa Teresa Foundation. This foundation has the training experience of the Baix Penedès Tourism School and manages several bars-restaurants.

In the case of the restaurant of Poblet, they are managing the place taking into account their own identity. The cuisine of the Restaurant offers dishes based on products of the land and the sea, elaborated with austerity, love and harmony, which manage to reflect the love for things well done and the wisdom that comes from the experience of the monasteries, authentic cradles of the universal knowledge. Organic foods have also been incorporated, and in conjunction with the Monastery, an organic vegetable garden has been put in place to supply organic vegetables to the restaurant.

With the consolidation of the restaurant, the Tasta Poblet Restaurant School became operational. The vision of this project is to make the Restaurant School of Poblet a referent, both for the quality and the level of the cuisine, as well as for the educational task and the job placement of people with difficulties in inserting socio-labor of the territory.

The training is highly practical and with individualized support. Within a few months, the initially envisaged goals have already been achieved: the creation of jobs for people in the territory, the hiring of people with

disabilities, the establishment of a local purchasing policy and the provision of good cuisine and good service.

Improving Visitor Service

The objective is to make the visit to Poblet a deeper, more attractive and enriching experience and to break with some of the clichés and erroneous thoughts around the monastic world with rigorous, simple explanations and understandings.

Some of the actions done were, for example:

- Development of a strategic plan to improve the reception of visitors to the Monastery (about 150,000 a year). It covers on-site visit, virtual tour, internal and external lodging, shop, some complementary services and related cultural activities.
- Development of a preliminary project to improve the external car park, with a total area of 8,900 m², which will solve various barriers, functional and safety problems for visitors.
- Installation of pivots on the access doors to the monastic precinct to reduce traffic on the inside of the monastic precincts and improve the quality of the visit.
- Construction of new toilets.
- Rearrangement of the Biblical Species Botanical Garden project, a biblical garden open to the public outside the limits of the closure of the monastery, physically and functionally linked to the visitor reception centre.
- Opening of a visitor centre in a pre-existing building located near the entrance. In this building it has been grouped the information center, the sale of tickets to the monumental complex, the shop and the regional tourist information office.

It is planned to put into operation the audio guide system during visits to the monumental complex. This way, the visitor will be more free to see, feel and experience the monument, and will automatically receive information on each space and individually. In order not to favour isolation of people or to cause noise pollution problems, a headphone service will be adopted that provides information directly to the ear and does not isolate the public.

The monastery receives around 100.000 visitors per year with good levels of satisfaction. If we check, for example, Tripadvisor reviews it obtains a 4,5 out of 5 and only 1% of negative comments. Some of the comments stand out the quality of the tour and the spiritual values of the place.

Landscape Improvement of the Monastery Lands

There are two main goals related to the monastery lands and the surrounding area.

Related to the monastery land the aim is to protect the quality of the rural and forest landscape of the monastery environment, improving its ecological integrity, silence and beauty.

Regarding the surrounding area, it is worth remembering that it was the former abbot of Poblet, who promoted the establishment of the Natural Site of National Interest to protect the Monastery environment against the threat of degradation and urbanization. The objective is to foster dialogue with the Public Administration and forest owners so that the forests around the monastery are managed in a correct, conservative and protective way. Introduce in the protection guidelines of nature the spiritual, cultural, symbolic and religious values. So, the action of the Monastery is direct in its properties, and indirect, through the Governing Board and the management team of the Natural Park, in the rest of the protected natural area.

Some of the actions done were, for example:

- Recovery of the riverside forest of the Sant Bernat stream, restoring its integrity with native species

and, in particular, increasing the presence of poplars in the wetlands, with the support of the Natural Area of National Interest.

- Drafting of a preliminary project to improve the landscape integration of the large external car park (8,900 m²) in relation to the surrounding landscape.
- Silvicultural action aimed at improving the forest structure and recovering old forest.
- Promotion of forest management guidelines for Poblet's area and active participation in the process of discussing the guidelines for the Protected Area.
- Collaboration and participation in various activities organized by the Protected Area Managers, such as hiking in the mountains and visits to ice wells, which will continue in the future.
- Collaboration in the study on the species of bats promoted by the Protected Area managers.
- Installation of an ecological apiary in collaboration with the Protected Area Managers
- Collaboration with the educational services of the Protected Area and the Learning Camp of the Cistercian Monasteries, in guided visits to the monastery, trips to the Protected Area, etc.

Because of these actions, the quality of the environment has increased, especially through the recovering of a mature forest via silvicultural actions that allowed the creation of a therapeutic itinerary.

Reflections for the Future

For the Cistercian community, this process of ecological conversion, far from the desire to follow ecological fashion has deep roots, moral coherence and a return to the principles of the monastic tradition itself.

The Cistercian community is aware of the challenges that Humanity is facing today, so the aim is not to work on sustainability in the monastery itself but also in the surroundings and try to spread the message. In this sense, it is significant the role they have with the Natural Protected Area.

In addition, it is important the message they are transmitting to visitors in order to try to make them more aware. They are aware, for example, of the importance of the impact that the travelling of the visitors has, so they are trying to make people reach the monastery on foot, promoting initiatives linked to the preservation of walking paths. Today there is a route called "Ruta del Císter" that links the three Cistercian Monasteries in Catalonia (Poblet, Santes Creus and Vallbona de les Monges) in a three days walking itinerary (fig.6).

The example of Poblet should be an inspiration for other site managers in terms of preserving the intangible values of the site (mainly spiritual) while facing the sustainability challenge.



Figure 6. The Poblet Monastery seen from the Cister Route (Source: www.larutadelcister.info)

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Parcs archéologiques, espaces naturels sensibles et tourisme : la cité antique de Glanum et l'oppidum d'Ensérune (France)

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Introduction

Le Centre des monuments nationaux gère, en dotation du ministère de la Culture, plus de cent monuments historiques ouverts au public sur le territoire français dont une quinzaine de sites archéologiques majeurs.

La cité antique de Glanum (fig.1) et l'oppidum d'Ensérune (fig.2) constituent des cas exemplaires où la gestion patrimoniale se double de l'ambition d'intégrer une dimension de haute qualité paysagère.



Figure 1 : Vue du parc archéologique de la cité de Glanum adossé au massif des Alpilles (Photo : L. Izac)

La maîtrise des effets indirects induits par la fréquentation touristique invite désormais à se doter d'outils prédictifs permettant de concilier à long terme la volonté d'ouvrir les espaces à la visite tout en contrôlant mieux l'érosion des vestiges et des sols. L'aménagement de parcours adapté mêlant découverte du patrimoine archéologique et naturel permet d'enrichir les contenus vers des publics plus diversifiés et de les sensibiliser à la fragilité des sites archéologiques et des écosystèmes qui y sont liés.

La création de parcs archéologiques ouverts à la visite depuis les années 30, aménagés progressivement au sortir de la seconde guerre mondiale puis équipés d'infrastructures à partir des années 80, permet de s'interroger désormais sur l'adaptation de ces équipements aux nouveaux enjeux écologiques.



Figure 2 : Vue de l'oppidum d'Ensérune depuis le Sud avec son paysage viticole (Photo : L. Izac)

Glanum : antiquité et biodiversité

La cité antique de Glanum a été découverte après la première guerre mondiale, la première fouille officielle démarrant en 1921.

Les terrains progressivement acquis par l'État et classés monuments historiques feront l'objet d'investigations intensives durant les années 30. Il faudra attendre les années 50 pour que l'ouverture au public permette à celui-ci de découvrir les vestiges d'une cité hellénistique organisée autour d'un sanctuaire des eaux lié à une source naturelle pérenne.

A la fin des années 80, la construction d'un bâtiment d'accueil semi-enterré, inscrit désormais la cité dans la liste des grands sites archéologiques nationaux valorisés par le Ministère de la Culture. Le transfert de gestion au Centre des monuments nationaux va progressivement amener la mise en œuvre d'un parcours de visite adapté, au sein des vestiges, qui accueille en moyenne chaque année près de 60 000 visiteurs.

La création du parc naturel régional des Alpilles, en 2007, autour de 16 communes couvrant près de 50 000 hectares du massif, constitue une étape décisive dans la prise en compte des enjeux écologiques.

La cité antique est comprise dans ce périmètre et a intégré la marque Valeurs Parc, depuis 2019, en adhérant à la charte des bonnes pratiques en matière de gestion environnementale du parc archéologique.

Depuis deux ans Glanum est également labellisé refuge LPO suite à un diagnostic floristique et paysager menée par une équipe de la Ligue de Protection des Oiseaux Provence Alpes Côte d'Azur. Les inventaires réalisés au cœur du parc archéologique ont permis de mettre en évidence les zones préférentielles où se développent et nichent les espèces endémiques du pied du massif des Alpilles.

De la même manière, une série de bonnes pratiques a été mise en place afin d'adapter les périodes de fauche et de taille des espèces arbustives aux contraintes des périodes de reproductions et de présence d'une partie de la faune désormais recensée dans le périmètre de la cité antique. Le maintien d'un couvert végétal faisant majoritairement appel à des espèces xérophiles est systématiquement privilégié ainsi que l'entretien raisonné de pelouses naturelles aux abords du parcours.

L'ensemble de ce partenariat a débouché sur des actions de médiation auprès des publics sous forme :

- d'une exposition « Antiquité et biodiversité » présentée dans le bâtiment d'accueil de Glanum de mars

à septembre 2019 ;

- de la création d'une carte de la biodiversité qui est proposée aux visiteurs de la cité antique et renvoie également sur les sites archéologiques accessibles au public dans l'ensemble du massif ;
- des ateliers spécifiques ont été développés, en partenariat avec la LPO, à destination des enfants et de leur famille.

Ensérune : un oppidum celtique dans un environnement protégé

Ensérune constitue un cas unique dans le paysage archéologique du Midi de la France de mise en valeur d'un oppidum celtique adossé à l'un des tous premiers musées de site, créé au sortir de la première guerre mondiale.

L'histoire de l'oppidum se décline depuis la découverte, en 1916, d'un ensemble exceptionnel de tombes de guerriers celtes, richement dotées, qui contribua à sa célébrité en passant par la mise en place d'un des premiers grands chantiers école d'archéologie sous l'égide de l'Université de Montpellier, à partir des années 50, jusqu'à sa mise en valeur progressive depuis quelques décennies.

Un siècle de fouille de la nécropole et de l'agglomération protohistorique a permis la constitution d'une collection unique pour le Midi de la France : armement celtique, vases grecs, italiens et ibériques, corpus d'inscriptions ibériques unique en Gaule, riche médaille, bijouterie celte et méditerranéenne de référence.

Vigie implantée au sommet d'une paléo-terrace de l'ère Secondaire, la colline d'Ensérune fait face à la cité antique de Béziers au-delà de l'Orb. Elle constitue un point de jonction historique entre la baie d'Agde, colonie portuaire grecque et les districts miniers de la Montagne noire riches en métaux cuivreux et argentifères.

L'agglomération protohistorique est positionnée sur une voie stratégique reliant le monde ibérique à l'Italie étrusco-romaine via la voie Héracléenne puis Domitienne tracées au pied même de l'oppidum.

Cette dimension propre à Ensérune explique, pour partie, le succès de l'oppidum du VI^{ème} s. avant notre ère au I^{er} siècle de notre ère. Il assure un véritable leadership en tant que plateforme d'échanges économiques (vins, céréales, minerais, etc.) et culturelles (monnaies, écritures, architecture, religion, etc.) entre les quatre grandes civilisations méditerranéennes : Celtes, Grecs, Romains et Ibères.

L'oppidum est installée au sein d'un paysage viticole typique de type languedocien au moment des premières découvertes au tout début du XX^{ème} siècle.

Au milieu des années 20, l'État décide de créer un musée afin de présenter les collections issues des fouilles de Félix Mouret et pour ce faire acquiert la villa de la famille Maux alors propriétaire de la partie sommitale de la colline. Il s'agit d'une maison de maître édifiée en 1914 au point le plus haut du plateau et dotée d'un petit parc équipé d'une promenade avec belvédère sur l'étang asséché de Montady (fig.3). Ce parc privé est conservé avec ses plantations d'arbres méditerranéens (cyprés, pins et sophora majoritairement) qui donne son caractère au parc historique qui correspond aux canons paysagers d'une maison de villégiature.

Des années 50 aux années 90, un parc boisé se développe marqué par une pinède dense, notamment aux abords du musée. Le caractère méditerranéen du site est ainsi amplifié à l'instar de la majorité des parcs archéologiques aménagés dans le Sud de la France (site de Lattes près de Montpellier par exemple) ou en Catalogne à même époque (sites d'Ampurias et d'Ullastret près de Gérone par exemple).



Figure 3 : Vue de l'étang asséché de Montady depuis le parcours de visite d'Ensérune (Photo : L. Izac)

En 1996, la tempête qui touche la région met à bas la quasi-totalité de la pinède sommitale notamment à l'arrière du musée (fig.4). Suite à cet épisode climatique violent, le caractère boisé qui caractérisait la partie sommitale de la colline va être profondément altéré même si le parc occupant la pointe orientale de l'oppidum a pu être préservé.



Figure 4 : Vue du parcours de visite (Photo : L. Izac)

Le Centre des monuments nationaux s'est engagé, à partir de 2017, dans un programme de rénovation du musée d'Ensérune dans l'objectif d'une réouverture au public à l'horizon 2021. Ce calendrier a correspondu à la publication du décret du 25 septembre 2017 portant classement des paysages du Canal du Midi.

L'oppidum est compris dans une zone de co-visibilité directe avec le Canal du Midi dont le tracé tangente la colline sur son versant méridional avant son franchissement par le tunnel du Malpas (fig.5).



Figure 5 : Vue du tunnel du Malpas, ouvrage de franchissement du Canal du Midi creusé sous la colline d'Ensérune
(Photo : L. Izac)

Désormais à la dimension patrimoniale d'un site classé monument historique au titre des grands sites archéologiques français s'est ajouté le classement aux titres des sites pour leur caractère lié aux abords du Canal du Midi lui-même faisant partie des sites sous label Unesco. Afin d'intégrer cette double dimension, les équipes de maîtrises d'œuvres travaillant sur les bâtiments à réaménager et la refonte du parcours de visite extérieur se sont appuyés sur une équipe de paysagistes.

De la même manière la construction du dossier de rénovation et de réaménagement du site se fait conjointement en collaboration avec les services des bâtiments de France (Udap) et de la Direction régionale de l'Environnement, de l'Aménagement et du Logement (Dreal). Ce double sceau vise à intégrer les dimensions d'insertions paysagères de manière plus fine et de proposer également aux visiteurs de l'oppidum une visite orientée sur les composantes du grand paysage à partir de la vision à 360° qu'offre le parcours extérieur.

Glanum et Ensérune : vers une gestion de parcs archéologique intégrée ?

Ces deux grands sites archéologiques français, découverts au début du XX^{ème} siècle et classés au titre des monuments historiques, ont fait l'objet, en près de 100 ans d'existence, de nombreuses campagnes de restaurations et ont été progressivement équipés pour la visite.

De fait, leur statut a progressivement évolué pour en faire des parcs archéologiques qui permettent de présenter un état historique (souvent très restauré) au grand public afin de donner à comprendre la morphologie générale d'une cité ancienne.

De fait, ces sites entrent aujourd'hui dans une typologie assez hybride, sorte de « lieux de mémoire », vastes maquettes de pierre destinées à replonger les publics dans l'Antiquité. Ces parcs archéologiques contemporains conservent pourtant une forme d'« esprit des lieux » qui en font de lointains héritiers des jardins antiques romantiques propres au XIX^{ème} s.

La dimension environnementale et végétale leur a ainsi fourni un écrin qui valorise et magnifie les « ruines antiques ». Au-delà de cette dimension qui s'insère dans la longue tradition française des parcs d'agrément, se pose la question du maintien de la qualité paysagère au sein même de ces parcs et aux abords immédiats.

Ce type de préoccupation doit être envisagé dans la longue durée afin de pouvoir assurer la pérennité des formes paysagères et assumer les enjeux environnementaux au même titre que les missions de préservations patrimoniales stricto sensu.

De manière à pouvoir planifier les actions à mener à moyen et long terme, nous avons adopté la méthode du plan de gestion, pour les deux sites, qui permet ainsi d'articuler une série d'actions concrètes visant à tenir compte de la fragilité des biotopes qui se sont développés au sein même des vestiges antiques.

A Glanum, le plan de gestion en cours d'élaboration intègre des zones hors public afin de garantir un minimum de quiétude aux espèces recensées dans le domaine (prairies naturelles, bosquets protégés, etc.).

Le nouvel appel d'offre pour le marché d'entretien des espaces verts intègre non seulement l'objectif norme zéro phyto mais également la valorisation des déchets végétaux in situ.

A Ensérune, plusieurs pistes sont à l'étude, comme par exemple la gestion en éco-pâturage de la pinède du versant Nord de l'oppidum ou l'installation de ruches par convention avec un apiculteur sur des zones en périphérie du parcours ouvert au public.

Après près d'un siècle de fonctionnement de ces parcs archéologiques, s'impose désormais la prise de conscience de leur valeur environnementale qui fait désormais partie intégrante des ressources à préserver et à valoriser auprès d'un large public à l'heure d'une prise en compte des facteurs de dérèglements climatiques planétaires (fig.6).



Figure 6 : Vue de l'étang asséché de Montady lors des intempéries de 2019 (Photo : L. Izac)

Il est d'ailleurs intéressant de constater la convergence des intérêts de protection environnementale et patrimoniale qui initie de nouveaux partenariats entre professionnels de la conservation des monuments historiques et organismes chargés de la sauvegarde des écosystèmes.

Il va sans dire désormais qu'une partie des sites archéologiques ouverts au public peut également être porteuse d'une démarche de maintien d'une haute qualité environnementale qui fait partie désormais de leur identité propre au même titre que leur classement au titre des monuments historiques pour leur valeur d'exemplarité patrimoniale.

Tourisme, environnement, agriculture : bâtir un écosystème vertueux dans un site patrimoine mondial

Philippe MORGE

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Le site de la Chaîne des Puys – faille de Limagne face au changement climatique

Le Haut lieu tectonique Chaîne des Puys – faille de Limagne constitue un théâtre géologique unique qui permet de voir et de comprendre un phénomène colossal qui façonne la surface de notre planète : la rupture d'un continent (ou « rift continental»). La lecture et la compréhension de ces phénomènes géologiques sont rendues possibles grâce au maintien d'activités agricoles ancestrales qui préserve la lisibilité des formes tectoniques et volcaniques.

Toutefois, ici aussi et quand bien même le site relève de grands ensembles paysagers qui pourraient sembler immuables, les modifications climatiques impactent les espèces et les espaces.

Face à cette situation, le Conseil départemental du Puy-de-Dôme, gestionnaire du Bien, en partenariat étroit avec le Parc Naturel Régional des Volcans d'Auvergne et les services de l'État français met en œuvre un plan de gestion pluriannuel prenant en compte les conséquences du dérèglement climatique.



Figure 1. Vue du site de la Chaîne des Puys – faille de Limagne

Un site de compréhension de l'Histoire géologique de la Terre

Le paysage de ce haut lieu tectonique permet d'observer comment la croûte terrestre s'est fracturée, effondrée, laissant remonter les magmas et surélevant massivement la surface.

Les différentes formes géologiques présentes dans le périmètre du Haut lieu tectonique Chaîne des puys – faille de Limagne, donnent à voir les étapes successives du processus de rift (figure 2): un plateau continental ancien (le plateau des Dômes), qui s'est étiré, fracturé et effondré (le long de la faille de Limagne). La surface s'est ensuite massivement soulevée, entraînant une forte érosion qui a créé des formes spécifiques appelées inversions de relief (la montagne de la Serre). Le magma est également remonté par les fissures créées par la fracturation, faisant apparaître du volcanisme en surface (la Chaîne des Puys) (figure 3).



Figure 2. Les grands ensembles géologiques du site qui montrent les différentes phases du rift continental

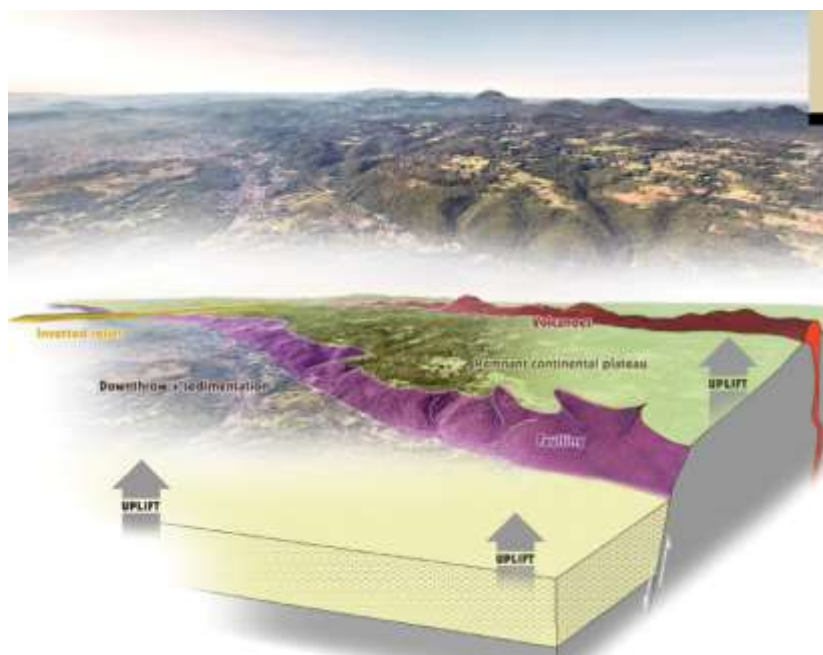


Figure 3 Le processus d'inversion du relief et la remontée du magma

Ces grands évènements tectoniques sont visibles dans le territoire autour des 4 grands ensembles suivants :

1) Le plateau des Dômes

Relique d'une ancienne chaîne de montagne totalement aplanie par l'érosion il y a 350Ma, il constitue le socle continental ancien qui a été fracturé par le processus de rift.

2) La faille de Limagne

Haute de près de 700m, elle marque la limite entre le plateau des Dômes (socle continental ancien) et le bassin effondré (la plaine de la Limagne) qui s'est formé lors de la rupture du continent il y a 35Ma.

3) La montagne de la Serre

Ancienne coulée volcanique située à l'origine en fond de vallée et devenue plateau surélevé sous l'effet de trois millions d'années d'érosion.

4) La Chaîne des Puys

Cet alignement volcanique qui rassemble quelques 80 édifices aux formes variées (dômes, cônes, maars et leurs coulées) est le résultat de la remontée des magmas par les fissures créées par le rift entre 95.000 et 8.000ans.

Ce lieu unique de lecture des grands phénomènes de l'Histoire géologique de la Terre est inscrit sur la liste du patrimoine mondial depuis le 04 juillet 2018. Ce Bien s'étend sur 242km² avec une zone tampon supplémentaire de 163km² (figure 4). L'ensemble de 405km² est réparti sur 30 communes et 5 Établissements publics de coopération intercommunale.

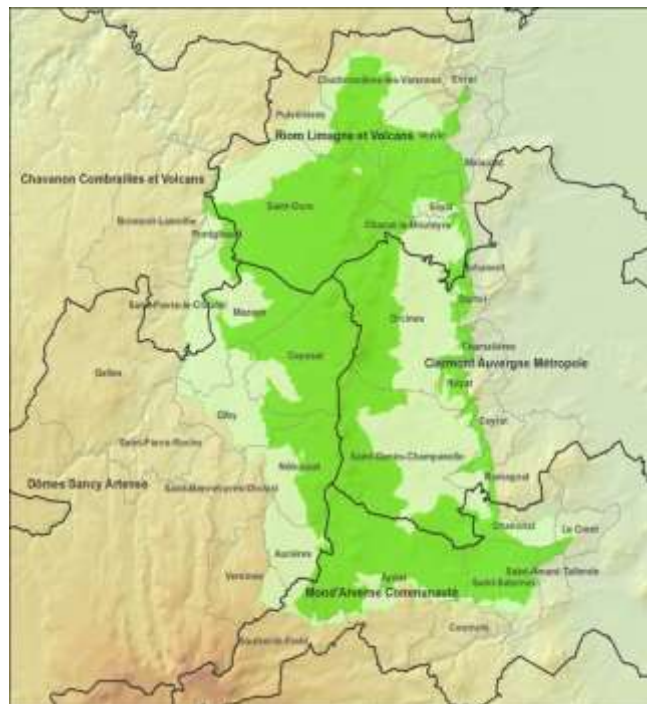


Figure 4. Le site « Chaîne des Puys -faille de Limagne » (en vert foncé) et la zone tampon (en vert clair)

Un site impacté par les changements climatiques

Si ce site est né de grands phénomènes tectoniques et volcaniques, l'homme a façonné la Chaîne des Puys depuis 6 000 ans. Aujourd'hui encore, en maintenant l'équilibre entre les prairies et la forêt, il préserve la lisibilité des formes géologiques. Toutefois les changements climatiques de ces dernières années perturbent ici aussi les équilibres. En effet, il est clairement observé une accélération des processus de fermeture des

espaces ouverts liés à l'origine à une déprise agricole mais amplifiés par un réchauffement climatique global qui favorise la pousse des ligneux (figure 5).

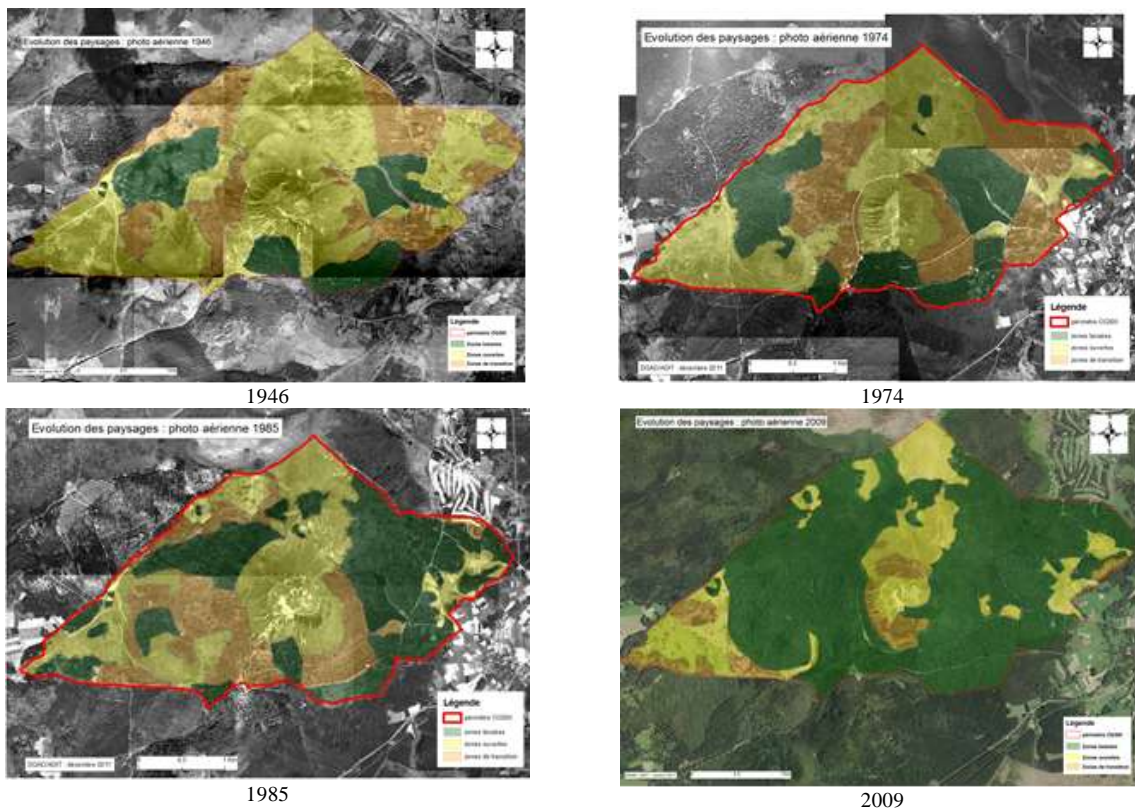


Figure 5. Évolution de la fermeture paysagère depuis 1946 : en jaune les espaces ouverts, en orange les espaces en cours d'enfrichement et en vert les espaces boisés

Cette fermeture des espaces ouverts de type pelouses subalpines et la perte de diversité de milieux qu'elle provoque favorise la disparition progressive d'espèces inscrites sur les listes rouge de l'IUCN. Ces modifications de l'état végétal constitue alors un facteur cumulatif et aggravant se rajoutant aux conséquences directes des modifications climatiques sur les espèces et des modifications des pratiques agricoles dont la baisse de la pression de pâturage qui bloquait jusqu'à présent la limite altitudinale supérieure de la strate arbustive et forestière. En Chaîne des puys-faille de Limagne, le cas du papillon Apollon et de la vipère péliade sont deux exemples flagrants des conséquences du réchauffement climatique sur des espèces relevant de liste rouge de l'IUCN (figure 6). En effet, ces deux espèces dont les populations régressent année après année, sont réduites à se réfugier sur les plus hauts sommets de la chaîne des puys et, de ce fait, sont condamnées à disparaître sur ce site dont la limite altitudinale se situe à 1465 mètres.



Figure 6. Deux espèces menacées de disparition : la vipère péliade et le papillon Apollon

Un site de renseignement sur les changements climatiques

Le puy de Dôme, volcan culminant au centre de la Chaîne des puy, à 1.465 m d'altitude, est un lieu d'observations et de recherches scientifiques sur l'atmosphère et le climat depuis 1869. Cette continuité de la recherche scientifique depuis plus de 150 ans nous permet de mesurer objectivement les modifications climatiques tant dans les relevés d'hydrométrie et de température que dans la composition physico-chimique et bactériologique de l'atmosphère. La qualité de ces recherches scientifiques poursuivies par l'actuel Observatoire Physique du Globe de Clermont-Fd (OPGC) a été saluée par l'attribution du label international Global Atmosphere Watch à la station du sommet du puy de Dôme en 2015 (figure 7).



Figure 7. L'Observatoire Physique du Globe de Clermont-Fd (OPGC)

En parallèle, le Conseil départemental du Puy-de-Dôme, gestionnaire du Bien, a mis en œuvre un Observatoire des paysages qui, grâce au concours d'un protocole de prises de vues photographiques strict, permettra de suivre l'évolution des paysages et d'anticiper sur la mise en œuvre d'actions de gestion qui devront permettre le maintien d'espaces et de paysages préservés de trop fortes évolutions.

Dans le même souci de mieux connaître et anticiper les conséquences du changement climatique sur les espèces et les milieux, le Conseil départemental du Puy-de-Dôme en lien avec le Parc naturel régional des volcans d'Auvergne, a créé un Observatoire de la biodiversité. Cet Observatoire s'appuie sur des études naturalistes spécifiques (dont un « état zéro » de la biodiversité) mais aussi sur un Comité scientifique biodiversité. Celui-ci est composé de naturalistes couvrant l'ensemble du monde du vivant (avifaune et chiroptères, lépidoptères et entomofaune, mammifères, reptiles et amphibiens) et émet des avis critiques sur les actions de gestion que le Conseil départemental souhaite initier tout en pouvant préconiser des études spécifiques complémentaires préalables aux actions de gestion envisagées.

Un site de sensibilisation du public aux changements climatiques

Une mobilisation citoyenne forte autour d'une candidature au patrimoine mondial de l'UNESCO présente l'intérêt de pouvoir mobiliser plus facilement tous les acteurs du territoire à la préservation du Bien. Ainsi, dans la dynamique de la candidature de la Chaîne des puy – faille de Limagne au patrimoine mondial, la population reste mobilisée sur la préservation du Bien et les messages de respect de celui-ci passent par la formation et la mobilisation de plus de 400 ambassadeurs. De plus, en 2019, ce sont près de 465 animations qui ont été offertes aux habitants du site comme aux visiteurs soit plus de 10.000 personnes qui ont pu être sensibilisées aux messages de préservation du Bien. Enfin, une Fondation créée par les 7 plus grandes entreprises du territoire (Michelin, Aubert et Duval, Limagrain, Volvic, Rockwool, EDF et Echalié) s'engage à soutenir financièrement les actions de connaissance et de préservation du Bien.

Un site géré pour freiner les causes et les conséquences des changements climatiques

La Chaîne des puys – faille de Limagne est un site exceptionnel et donc prisé des habitants et des visiteurs. Afin de réduire l’empreinte carbone de l’activité touristique et particulièrement l’empreinte carbone liée aux déplacements, le Conseil départemental du Puy-de-Dôme, depuis 2012, a supprimé la possibilité aux véhicules (véhicules légers et autocars) d’atteindre le sommet du puy de Dôme, site recevant alors 450.000 visiteurs annuels, pour le remplacer par un train électrique à crémaillère : le Panoramique des Dômes (figure 8). Ainsi, avec 30% de l’énergie nécessaire au train montant produit par le train descendant et avec la suppression des 50.000 véhicules annuels et des 7.000 autocars annuels, ce sont alors 5.250 tonnes de CO2 qui sont économisées sur 35 ans.



Figure 8. Le Panoramique des Dômes, train électrique qui permet d’atteindre le sommet du puy de Dôme

Ce dispositif est complété par la mise en place de bus interurbains entre le centre de l’agglomération clermontoise (300.000hab) et la chaîne des puys, bus servant aussi bien aux visiteurs qu’aux habitants du Bien. Enfin, les connaissances obtenues grâce à la mise en œuvre de l’Observatoire des paysages comme de l’Observatoire de la biodiversité seront de nature à mieux appréhender les conséquences du réchauffement climatique et donc de mieux anticiper les impacts que celui-ci pourrait avoir sur les milieux et les espèces et plus globalement sur les paysages. Cette connaissance approfondie devra nous permettre de multiplier à l’avenir les actions correctrices favorables à la diversité biologique et tenter de réduire les conséquences du réchauffement climatique.

Concluding remarks

Peter Debrine

There is a common thread through the presentations we listened to today: stakeholder engagement, retrofitting historical buildings and the complexity of that, having to deal with some of the more immediate impacts of climate change, as we saw in Venice.

Today climate change is in such a state of flux that what we know today might be different tomorrow, depending on what measures will be taken in the future. Unfortunately, what came out from COP 25 held in Madrid in December 2019 is not encouraging to make the top-down policies have an impact on the sites themselves, on how they are managed and, more important, how they will be managed in the future.

Everybody should have a voice as we work in the reconciliation of irreconcilable forces that are pulling us in different directions. Many presentations pointed out the importance of involving the different stakeholders, especially the local communities, in the management and planning process

We need to have very clear management plans in place and plans that are not static but that get implemented dynamically, because changes are occurring very rapidly.

No World Heritage site is static, and their managers are used to deal with change: their knowledge and experience is essential. From this point of view, the example of the City of Regensburg is a model for many WH sites, especially urban ones.

Finally, most presentations underlined the importance to communicate on the impacts of climate change on World Heritage sites: to tourists, but also to children, because they will inherit the world. That's why educational projects and workshops for schools and children are very important. I think that the Heart of Neolithic Orkney site is doing an excellent work in both directions.

To conclude, I would say that we need to improve communication more effectively to illustrate the potential for Cultural Heritage to help address challenges of climate change and its impacts on tourism. The Climate Change Network, mentioned by Adam Markham and Ewan Hyslop, is going in this direction and it is an important vector of promoting sustainable change.

Adam Markham

What I love about working on heritage is that you can be surprised, inspired and moved by new stories, looking to what we can take from traditional knowledge and past to bring to the future and strengthen communities but also to be more resilient to climate change, like we heard in Adine Gavazzi's presentation.

In some WH sites, like Yellowstone Park for example, there is a lot of scientific research on the impacts of climate change; but in other World Heritage sites there is no or very little research, and the local communities are not consulted, so their traditional knowledge is not taken into account.

All these systems are extremely complex, and things change through time for a variety of reasons, as in the example of Hoi An, where one of the causes of flooding is the deforestation caused by Americans during the Vietnam war in 1969. But we know that climate change, which is caused primarily by human action in the past 100/150 years, is making the systems even more complicated. We already had to deal with the complexity of changing in natural systems and heritage, some of which humans caused in the past, some of which caused by multiple human activities like urban development, tourism, resource extraction. Climate change comes on top all that making things even more difficult.

Pour les chercheurs en Tourism et Heritage Studies, la question du changement climatique dans les sites du patrimoine, a fortiori du patrimoine mondial, est extrêmement intéressante mais aussi particulièrement complexe. Elle engage en effet tout une chaîne d'acteurs et de prises de décision qui se réfèrent à la prévention et l'atténuation des effets du changement climatique : les décideurs locaux et nationaux, les gestionnaires des sites, les communautés locales et, bien entendu, les touristes eux-mêmes.

Si le contexte général dans lequel se pose le problème du changement climatique et ses raisons fondamentales échappent aux décideurs locaux, il est apparu à travers les présentations faites dans le cadre du séminaire que les réponses locales, prises au sein de chaque site, jouent un rôle déterminant.

Nous espérons que les bonnes pratiques présentées dans le cadre de ce séminaire mais aussi les difficultés auxquelles sont confrontés les sites aujourd'hui, contribueront à la prise de conscience et inspireront d'autres sites.

De la part de la Chaire UNESCO « Culture, Tourisme, Développement », nous adressons nos plus sincères remerciements à l'ensemble des participants, au public, au Centre du Patrimoine mondial de l'UNESCO pour son accueil dans ces lieux, et à Adam Markham, Helena Rey et Peter Debrine pour la co-organisation. On pourrait difficilement espérer une thématique plus intéressante et des présentations plus stimulantes pour ce 10e séminaire de la Chaire UNESCO.