



ISSN: 1812-0512 (Print) 2790-346X (online)

Wasit Journal For Human Sciences

Available online at: <https://wjfh.uowasit.edu.iq>

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Keywords:

Citizen Science, Virtual
tourism, Marshes and Swamps,
Southern Iraq

Article history:

Received: 17 Jan. , 2024
Accepted: 10 July, 2024
Available online: 30 Aug. 2024



Citizen Science Tourism of the Iraq Marshlands

A B S T R A C T

This study emphasizes the critical importance of restoring and protecting the Marshlands, not only for their ecological benefits but also for preserving and reconnecting the cultural identity of a region recovering from conflict. The Marshlands, severely damaged at the turn of the century due to mismanagement and militarization, remain vulnerable. Local awareness of their cultural and economic value is limited, largely due to inadequate education, hindering recognition of their indirect benefits. Despite the rich history of the Marshlands, including significant archaeological sites like Ur, Eridu, and Uruk, and the unique lifestyle of the Marsh Arabs, tourism is minimal. The study advocates for the promotion of this cultural heritage to empower local communities, helping them reconnect with their history and appreciate the value of the Marshlands. The research proposes new citizen science initiatives to engage the public, particularly in areas affected by conflict. This participatory approach can support sustainable tourism, offering immersive experiences like virtual reality tours, which are particularly beneficial given the ongoing security issues that deter foreign tourists. The project aims to reconnect southern Iraq's citizens with their cultural roots, promoting healing and unity, and paving the way for a sustainable and prosperous future. The study employs descriptive, quantitative, and analytical methods, utilizing satellite data and maps.

DOI: <https://doi.org/10.31185/wjfh.Vol20.Iss3.538>

سياحة المواطنة العلمية في أهوار العراق

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الخلاصة

يهدف هذا البحث إلى إعادة ربط المواطنين في جنوب العراق بجذورهم الثقافية والتاريخية، مما قد يساعد على التوحد وإنعاش منطقة الأهوار بصورة أكبر مما هي عليه، وقد يمهد الطريق لمجتمع أكثر ازدهارًا واستدامة. إنه مشروع لتعزيز تحقيق السياحة المستدامة في المنطقة من خلال نهج علم المواطن. إن ضمان استعادة الأهوار وحمايتها أمر حيوي ليس فقط لخدمات النظام البيئي التي توفرها، ولكن للحفاظ على الهوية الثقافية الأثرية وإعادة ربطها في منطقة خرجت بشكل من صراع بيئي حتمي. لا تزال الأهوار في حالة محفوفة بالمخاطر وهي تتعافى من الدمار شبه الكامل منذ مطلع القرن الحالي، بسبب سوء الإدارة والعمليات العسكرية التي خلفت آثارًا كبيرة. ومع ذلك، فإن قيمة الأهوار وتراثها الثقافي لا يحظيان بالاعتراف الكامل من قبل الجهات المحلية الفاعلة، إذ يؤدي عدم كفاية الدراية إلى محدودية الاعتراف بفوائدها الاقتصادية غير المباشرة.

على الرغم من تاريخها الأسر، إلا أن السياحة غائبة إلى حد كبير عن الأهوار. تشمل المعالم التاريخية والثقافية آثارًا من مهد الحضارات في المواقع الأثرية في أور، إريدو وأوروك، ونمط الحياة الفريد لعرب الأهوار، والذي تم إحيائه مؤخرًا من الدمار شبه الكامل. نعتقد أنه من هذه المقدمة، سيتمكن المجتمعات المحلية من التوفيق بين الصراع، وإعادة الاتصال بتراثها الثقافي وتقدير قيمة الأهوار. على هذا النحو، نقترح بحثًا جديدًا في مناهج علم المواطن في الأهوار والمستنقعات.

يمكن أن يفتح علم المواطن على الجمهور في المناطق المتأثرة بالانزاعات أو انعدام الأمن؛ مما يعزز مشاركتهم وتعليمهم، ونقترح أن يلعب دورًا في السياحة المستدامة. إن مثل هذا النهج التشاركي سيعطي السياح حصة أكبر، ويوفر بيانات قيمة للمساعدة في ضمان الصحة والحماية المستقبلية للأهوار. على الرغم من أنه من غير المرجح أن يزورها السياح الأجانب في المستقبل القريب بسبب الوضع الأمني غير المستقر، إلا أن التكنولوجيا يمكن أن تقدم فوائد محلية عبر سياحة الواقع الافتراضي. يمكن أن تتبنى الحكومة المحلية موضوع السياحة الافتراضية وذلك بالتنسيق مع الجامعات، المراكز البحثية، شركات القطاع الخاص، مراكز أبحاث الأهوار أو الأفراد بدرجة أقل.

على سبيل المثال، قد يتضمن ذلك تجربة غامرة تجعل الزائر يشعر كما لو أنهم كانوا هناك. كالقيام برحلة بالقرب عبر الأهوار مع مرشد سياحي محلي حقيقي، أو زيارة متحف، موقع أثري، أو شراء المنتجات المحلية. اعتمد البحث على المنهج الوصفي والكمي والتحليلي لعدد من الصور الفضائية وكذلك الجداول والخرائط والبيانات المتعلقة بموضوع البحث.
كلمات مفتاحية: سياحة المواطنة، السياحة الافتراضية، الأهوار والمستنقعات، جنوب العراق.

1. Introduction:

Historical wetlands regions such as marshes of southern Iraq present particular challenges for governance and for the implementation of the local society, not least because these areas are focal regions of human activity and presence. At a time, the marshlands of Iraq were the largest wetland in the whole Middle East region and home to an ancient civilization of Marsh Dwellers known as the Madan, (The New Arab & agencies, 2019, pp 1). The historical and biodiversity value of the Marshlands is well recognised academically, (Al-Aayib and Azeez, 2020, pp 8579) and although it is a UNESCO World Heritage Site, (Al-Lami et al, 2014, pp 15). There is limited appreciation from local people. Meanwhile, the international public remains oblivious.

As such, this project will develop novel, traditional content and techniques to educate different audiences. This includes citizen science approaches and a scoping of virtual tourism to overcome current security constraints. Our approaches and new research findings will be communicated to key decision makers with the ability to realise sustainable tourism. Such a development would not only provide local jobs and stimulate the local economy, but reconnect the local population with past generations through their shared cultural heritage. All together this will help protect the Marshlands and its archaeological sites.

Citizen science approaches can address these deficiencies by helping to educate and providing direct economic gains, all together enhancing towards sustainable tourism in the region, (Sylvain Mercadier, 2019, pp1). This work proposes to develop sustainable tourism experiences that can initiate further

research leading to high-level investment and in particular threats that remain and those which are emerging.

2. Key Concepts:

There are 2 key concepts derived from this project from our international consortium provides multidisciplinary expertise of academia (University of Thi-Qar, UTQ and the Conflict and Environment Observatory, CEOBS) to develop sustainable tourism experiences under two variables:

- A. The first is by closing research gaps in the environmental history of the marshlands to properly understand the risks to the Iraqi Marshlands. Thereby the suitability and sustainability of any tourism and to be able to tell an accurate story to tourists and decision makers, original research is required.
- B. The second is developing sustainable tourism approaches to best sell the idea of sustainable tourism to those decision makers who can make it a reality, this project will develop different approaches to the tourist experience.

3. Environmental History of Iraqi Marshlands

Surrounded by arid desert, the marshes are situated in a triangular region of southern Iraq on the flat floodplains of the Euphrates and Tigris rivers. The two great rivers originate in Turkey and flow through Syria before entering Iraq and flat alluvial plain south of Baghdad. The shallow slope and narrowing of the plain near the Persian Gulf have caused the rivers to meander, bifurcate into many branches, deposit silt, and generate the complexes of shallow and deep lakes, marshes, and seasonally inundated mudflats, (Bhagwat et al, 2005, pp2). This is particularly true of the Euphrates, and near Nasiriyah the main river channel even dissolves completely into marshes, before reemerging more clearly downstream.

Springtime pulses of snowmelt are key to replenishing and regulating the dynamics of the marshes, (Brower et al, 2012, pp2). At the town of Al-Qurnah the rivers merge and become the Shatt al-Arab, a more tidal and saline waterway which flows onward into the head of the Persian Gulf, (Al-Mudaffar et al, 2016, pp4) figure 1.

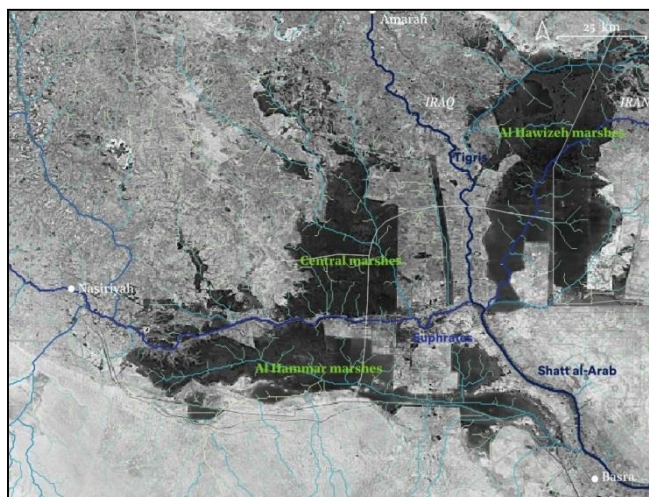


Figure 1: Marshlands (dark shades) surrounding areas and its rivers network in the year 2019. This map was generated by using WWF Hydro RIVERS database.
Source: the base imagery 2019 is sentinel-2 cloudless mosaic at <https://s2maps.eu/>.

The marshes - known locally as Al-Ahwar - are bounded by three large cities, Basra to the South, Nasiriyah to the west, and Amarah to north-east. Although a mosaic of nearly interconnected marsh and lake complexes, the marshes are typically subdivided into three distinct areas: the Hammar marsh in the south, the Central marsh between the Tigris and Euphrates, and the Hawizeh marsh to the east of the Tigris and bordering Iran (Bonney et al, 2014, pp.1436-1437).

The central marshes are primarily fed by the Tigris, interspersed with many open water bodies, lakes approximately three meters deep, (Albarakat et al, 2018, pp.5) characterised by tall reed beds and recognised as the ecological core of the marshes. The Hawizah marshes, fed mainly by the Tigris and Iran's Karkeh river, has the densest vegetation and the deepest lakes (up to 6km), (García-Barrios et al, 2009, pp.871). Approximately 30% of the marshes are in Iran, where they are known as the Hawr Al Azim, and is the area of marshland to survive most unscathed, (Al-Ansari et al, 2012, pp.75). Given its proximity to the sea, the Hammar marsh is more tidal, brackish and eutrophic, creating an ecological niche for marine fish to breed. It is fed primarily by the Euphrates, (Chen et al, 2011, pp.1).

Historically, the three marshes were interconnected by chains of seasonal and permanent marsh and lake complexes, especially during periods of high floods, when large tracts of desert would also be under water, (Hausmann et al, 2018, pp.9). However, resulting from developmental and political landscaping decisions, a number of drainage channels run between the marshes resulting in a variety in the land cover as illustrated in figure 2. In the drained areas, there are now vast tracts of irrigated agriculture.

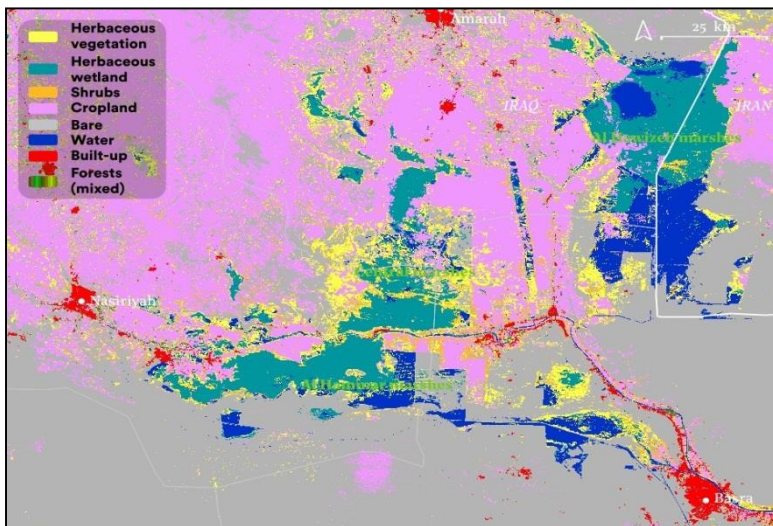


Figure 2: The 2019 land cover of the marshlands of Iraq. Source: this map was generated by using the data of the Copernicus Global Land Service V3.0.1 at <https://land.copernicus.eu/en/products/global-dynamic-land-cover>.

4. Biodiversity

In stark contrast to the surrounding desert, the marshes have provided habitat for important endemic and endangered wildlife. According to Birdlife International, (Bird International, 2024, pp1), the area is of globally significant importance for the wintering and staging of waterbirds, wintering raptors and as a refuge for waterfowl, the reedbeds and papyrus offer cover and protection (figure 3). Particularly vulnerable bird species include the dalmatian pelican, the pygmy cormorant and the imperial Eagle. Hunting and

trapping remain threats, especially for raptors. Endemic species include the Iraq babbler, Basra reed warbler, African darter and Mesopotamian Crow.



Figure 3: An example of the biodiversity life in the marshlands. A) birdlife, B) Flamingo bird, C) Buffalo and D) reedbeds and papyrus. Credit UNDP, Flickr and Authors photography on the fieldwork on 18-20/12/2020.

The vegetation of the marshes is dominated by aquatic species such as reeds *Phragmites*, reedmace *Typha* and papyrus *Cyperus*. These species are also important culturally, as they are used as raw materials for house building and paper production. These environmental conditions are ideal for the Asian water buffalo which inhabit the marshes, whilst before drainage, wild boar and wolves roamed the marshes, (Al-Abbad et al, 2015, pp.68). Common and smooth-coated otters live in the marshes alongside a diversity of freshwater fish at least 40 species, (Biodiversity Survey Report, 2017, pp17). The marshes are also home to unique small mammals, such as the Short-tailed Bandicoot Rat and Mesopotamian gerbil, (Dinets et al, 2022, pp.180). The long-tailed nesokia rat is endemic and was presumed extinct, although recent findings suggest it may be hanging on, (Bonney et al, 2014, pp.1436-1437).

Two to three years after the reflooding of the marshes in 2003, the vegetation had begun to recover with native plants returning. However, this was not necessarily a sign of a functioning and stable ecosystem recovery, for example it has taken a long time for foundational phytoplankton diversity to recover, figure 4.

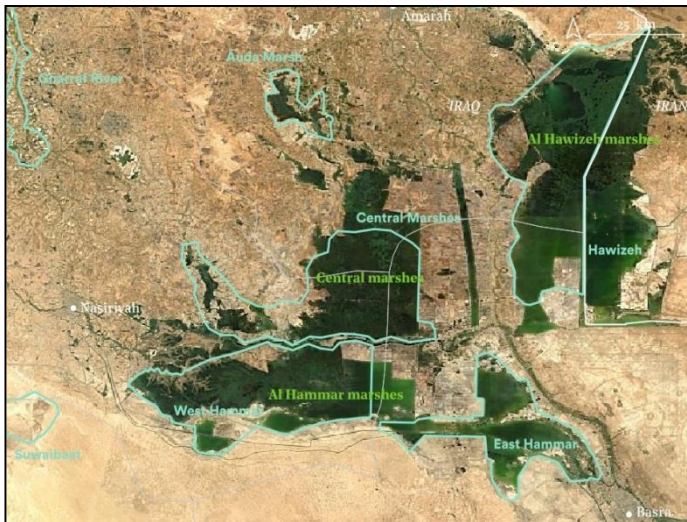


Figure 4: Key Biodiversity Areas (KBA'S), 2019. This map was generated by using the Birdlife International database. Source: the base imagery 2019 is sentinel-2 cloudless mosaic at <https://s2maps.eu/>.

5. Ecotourism

In spite of the reflooding in recent years, challenges lie ahead in preserving the unique landscape and livelihoods, amid climatic, security and economic challenges. Here, we consider how eco-tourism might offer an option, whilst discussing some of the main current threats. As a high value environmental resource in a post-conflict area, what happens in the marshes may be a benchmark for other landscapes in insecure settings. Despite the captivating history and landscape, tourism is and has been largely absent from the marshes. Yet, eco-tourism has enormous potential as a new industry to:

- a. Protect and rehabilitate the marshland ecosystem, which is a cultural heritage landscape, creating a sense of stewardship between locals, civil society, government and the tourists themselves.

- b. Help protect and conserve traditional cultural heritage and archaeological sites in the cradle of civilisation.
- c. Create sustainable livelihoods for the disenfranchised Iraqi youth.
- d. Ensure the ecosystem services of the marshes are maintained and enhanced, against the backdrop of climate change and upstream management.
- e. Empower local civilians to reconcile the conflicts, reconnect with their cultural heritage and appreciate the value of the marshes.

But first, it may be worth a step back to understand what actually is eco-tourism? According to the International Ecotourism Society it is defined as: “Responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education”, (TIES, 2015, pp1). In other words, it offers a different model to traditional tourism as it minimises impact to the destination, builds cultural awareness and mutual respect. It also creates more authentic tourist experiences, where the money spent filters more back to the local communities, aiding economic growth and creating jobs.

We believe a key part of the eco-tourism experience would involve the inclusion of the environmental history of the marshes as the landscape is a fundamental part of the area’s cultural heritage. This means the impacts of war, the drainages or the current problems would be whitewashed. Instead, this chequered past and the fact the marshlands are not a pristine environment ought to be embraced, it is a recovering ecosystem that tourists can play a part in and this will be empowering for them. Although there still remain some gaps in this recent environmental history.

In other parts of the world, the eco-tourist model has been hugely successful - at least before the Covid19 pandemic - and can be more profitable than any other land use. For example, in Mexico ecotourism has played a central role in forest conservation whilst reducing rural poverty and deforestation, (Klooster & Masera, 2000, pp.259). However, there are still major limitations to eco-tourism in the marshes which will need to be overcome and some of these are structural from the Iraqi state, for example the government tourism website has been offline since December 2016.

Furthermore, to our knowledge there has been no progress in the repeated UNESCO request, in the second and third State of Conservation reports, for the Iraqi government “to develop and implement an overall tourism plan for the whole property, to regulate visitation, and to ensure visitor safety, and sustainable and adequate tourism practices, infrastructure and facilities”, (Boers & Cottrell, 2007, pp.3). Here, we now provide some alternative eco-tourism approaches which may be useful in such an overall tourism plan, to help protect the marshes and engage new audiences.

1. Traditional Eco-Tourism Approach

Perhaps the most important starting point is local, domestic eco-tourism. The value of the marshlands and its cultural heritage is not fully recognised by local actors, thanks in part to the education which has not recognised the indirect economic benefits. Domestic tourism has and for some time will continue to be the dominant source and the numbers of international tourists has been very few, (Al-Lami et al, 2014, pp 15). They are mainly employees of oil companies or Christian pilgrims to the City of Ur, (Abdan, 2015, pp7).

Prior to UNESCO inscription, the 2014 Nomination Dossier stated that the marshes received fewer than a thousand tourists a year, this number was higher pre the 2003 war, (Jotheri & Hamzah, 2016, pp.94). Although the marshes are now visited by between ten to twenty thousand tourists per year, this remains a very small number for such a large area and a UNESCO site, where inscription can often lead to over tourism, especially were used as a marketing tool rather than a route to preservation. Indeed, there is some local scepticism of the impacts of UNESCO inscription, with one buffalo herder telling The New Arab website "Those decision makers have no idea of our needs. We haven't met anyone from any international organisation to ask for our requirements. This UNESCO site project is leading nowhere because the area is doomed if the water quality doesn't improve rapidly", (Sylvain Mercadier, 2019, pp.1). These points to the need for any future tourism efforts to ensure the livelihoods, conditions and opinions of locals are foremost and fit within the eco-tourism mantra.

In fact, there is a burgeoning eco-tourism industry in the marshes, with numbers increasing in recent years. The typical marshes day involves hiring a local to paddle a reed raft down the river, followed by lunch in a mudhif

guesthouse. However, the industry is stymied by the lack of tourist centres or hotels, owing to limited state budgets. Hence, to attract more domestic tourism investment is needed across the sector. To this end, the Sumereen project, (Ladkin, 2000, pp.1) was set up by UNDP and Un Ponte Per in mid-2020. It has US \$2 million funding from the EU to promote the marshlands near Thi Qar as a tourist destination. This includes creation of tourist infrastructure, including shops, parks and displays, alongside capacity building (through training), enhancing democratic governance and job creation. But there are 4 challenges in this traditional category of the eco-tourism:

1. Because of the COVID-19 pandemic, the numbers of marshland tourists have declined. This has also been the case for eco-tourism across the globe, as billions of pounds of revenue crucial to livelihoods has been lost. This has threatened the environments these locals steward and may unravel years of conservation progress. The rebound from COVID-19 remains uncertain, for instance how will international travel change and how will travellers need and desires be transformed? Against this back-drop it is hard to develop a future-looking tourism plan based on old models.

2. The interannual environmental variability of the marshes may postpone intending tourists. If tourists expect marshes, but it is a year of low water levels - for whatever reasons - trips may be cancelled, or visiting tourists be disappointed. Given the uncertainty of climate changes and water management plans, there is little prospect of resolving this challenge soon. Furthermore, there is a limited and possibly shortening tourist season, given the intolerable summer temperatures in recent years hitting records and reaching over 50 degrees.

3. The ongoing insecurity in Iraq puts off foreign tourism, although much of this will be based on ignorance. One Iraqi diaspora based in the USA summed it when speaking to Arab News “Most people don’t know what Iraq is really like - they think it’s the world’s most dangerous place, with nothing but killings and terrorism. There are some mesmerising places”, (Sylvain Mercadier, 2019, pp.1). However, there is no disputing that recent years have seen incidents of conflict, violence and protest. If or when this is resolved, there will remain a fear amongst would-be travellers. But this is not

insurmountable, as the case of Rwanda shows and instead, it requires time and investment.

4. The eco-tourism model itself is coming under some scrutiny. A meta-analysis of over 100 studies showed how eco-tourism affects wild animals found that their behaviour was altered, potentially leaving them more vulnerable, although the presence of humans discourages natural predators. For example, one study in the Kodagu district in India found ecotourism has led to a decrease in biodiversity, as well as water and air quality, (KM, 2015, pp.46). Furthermore, eco-tourism may harm local indigenous communities, especially if the eco-tourism is in the form of top-down, tourist-centric impositions. Other concerns include the 'eco-tourism fallacy' means carbon emissions associated with flying are incompatible with a sustainable industry.

2. Citizen Science

Citizen science can open up science and imbibe a sense of environmental stewardship, thus we propose it can play a role in sustainable tourism. It can take many forms, from low-tech surveys when wildlife spotting to high-tech phone apps of games, for example Wilde verse, an augmented reality experience where the citizen scientist can virtually experience forest wildlife, (Richardson & Hussain, 2006, pp.479).

Such a participatory approach will give tourists a greater stake in, provide valuable data to help ensure the health and future protection of the marshlands. It is envisaged tourists will choose the participatory activities which they are most interested, be that biodiversity surveys, water quality sampling or something associated with archeology, (Salim et al, 2009, pp.217). Future work will be required to build these low-cost and low-resource citizen science approaches, and ought to involve co-creation with Marsh Arabs and other stakeholders. Undertaking citizen science in insecure locations is challenging but possible, as CEOBS found when hosting a workshop at the 2020 European Citizen Science Association conference, where we were joined by experts who have worked in such fragile locations.

A key finding was the need to work with an active civil society and co-create projects with the citizens. In the case of eco-tourism this is not possible with

the travellers, but instead it seems more appropriate to do so with the Marsh Arabs, who themselves can get involved in data collection. Thankfully there is a burgeoning civil society in Iraq, especially around protection of the marshes, this includes Save the Tigris group, (Save Tigris, 2024, pp1) who formed the Mesopotamian Water Forum, Waterkeepers Iraq and Nature Iraq amongst others. NB Citizen Science is an activity which ought to be COVID-19 secure, given it will take place outside and on small scales, (Smith, & Petteorelli, 2020, pp.195). It is this kind of small-scale tourism which is likely to flourish in the post-pandemic period. In this work, we demonstrate how to make citizen science project possible in post-conflict zones. This is will be via employing a virtual eco-tourism system.

3. The Virtual Eco-Tourism

Against the challenges to the traditional tourism model, it is worth considering if there are alternative ways to meet the eco-tourism objectives. Here, we propose a model of virtual eco-tourism which overcomes the challenges outlined above, it has the potential to reach much wider audiences and generate significant revenue. Thereby helping to protect the marshes and providing local employment with minimal intervention.

Although it is impossible to recreate the real experience of being in a place, virtual eco-tourism aims to mimic by reaching as many senses as possible. This can be through the creation of a navigable virtual environment, capturing an environment and digitising it, which can be accessed on a computer, or for a more immersive experience through a virtual reality headset. Both approaches can feature interaction, both visually and audially. The interactivity is much greater in the case of a virtual reality headset in a digitised environment, for instance objects can be picked up, whilst on the horizon are technologies which will allow natural walking, wind, smell, or the feel of touch through haptic technology. In the case of the marshes this could be to travel in a boat along the marshes, feeling the reeds or water.

Virtual eco-tourism is a nascent market, but one which has seen some growth owing to the Covid-19 pandemic. Experiences range from simple videos through to virtual reality and are listed below, although none yet encapsulate the all-senses immersive experience we propose here:

- A- 360° videos, e.g., Virtual Helsinki.
- B- 360° videos with movement in street-view style and narration, e.g., Google Arts and Culture.
- C- Virtual world re-enacting the Battle of Culloden through to modern day archaeology, in association with the National Trust for Scotland, (McLean et al, 2007, pp.226).
- D- Interactive online eco-tourism tours of locations, similar for example to Kenya, Uganda, Sumatra and Virunga.
- E- Narrated virtual reality videos, e.g., of Iceland’s glaciers.
- F- Integration of Google street-view and Wikipedia for VR headsets-Wander.
- G- Virtual renderings of iconic locations, e.g., Manco Picchu, for VR headsets with National Geographic Explore.

A significant step may be the entry of Amazon into the tourism sector with Amazon explore a new platform offering short one-to-one online travel experiences and tours, (Chen et al, 2011, pp.1). These are not the fully immersive virtual experience as envisaged here and none of the current offerings are anything near eco-tourism, but it does incorporate the idea of buying local goods which these can be automatically added to your Amazon basket. Given the companies record, one wonders how much goes to the sellers and into the local economy, there is a danger this model could be the antithesis of eco-tourism. Nonetheless, reviewers have been impressed with the high production value and unique platform, with integrated graphics, maps, labels and conversation with your guide.

Although virtual technologies are, at present, largely found in the initial phases of the tourism cycle, i.e., deciding a destination, their potential is much greater than this limited horizon, as we outline below. However, at the very least, these activities may have the benefit of advertising the marshes and lead to in-person holiday makers in the future, figure 5.

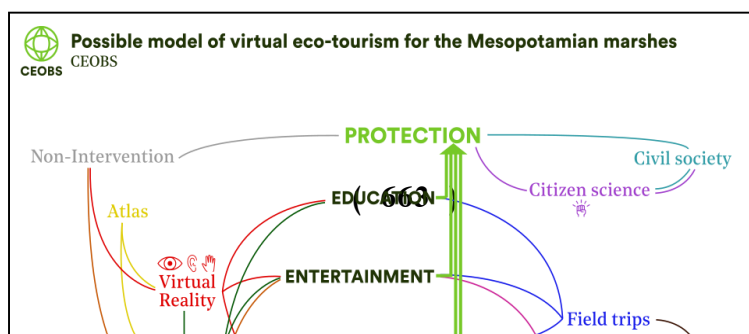


Figure 5: A potential model for virtual ecotourism in the marshlands of Iraq.

As outlined in figure 5, the aim is to give an engaging and interactive touristic experience that is provoking and emotional, featuring as many senses as possible and as opposed to just a visual product. At the same time, the model helps educate, employ and grow the local economy, all key to ensuring the ongoing protection of the marshes.

In the virtual reality component, we envisage that digitised environments will help capture the environmental history of the marshlands, figure 6. This will help give tourists a feel of not just what the location is like today but at various points throughout time. Local tour guides would be trained in order to deliver one-to-one guides and interact with the virtual visitors. Although this would require stable internet, which can be problematic, for example there was a blackout in 2019 associated with the violent protests.

The online platform would also provide the opportunity to sell locally produced non-perishable goods and items which would travel well, for instance reed woven items. Although the postal lead time may be long, having a souvenir from the virtual visit and knowing it is produced in a traditional way with the proceeds going to locals. Nonetheless, it will be a key part of the tourist experience.

As we suggest for local tourism, there is also a place in virtual tourism for citizen science in association with civil society, in order to help monitor the marshes. For example, this could be by looking at satellite imagery for pollution, identifying wildlife from camera traps or webcams. This could

even be combined with longer term remote approaches such as adaptation of wildlife as has happened in Mexico with monarch butterflies.



Figure 6: Virtual reality tourism in the classroom, Credit: PNNL, Flickr. Pupils wearing a 3D virtual reality headset to take a virtual tour and explore places virtually.

In regards to how to incorporate taste and smell elements into the touristic experience, it struck us that the number of Iraqi diasporas could be utilised not only to provide an authentic food, drink and dining experience, where nearby to tourists, but also in education. The same security reasons that put off individual international tourists will apply doubly to field trips. However, there is an opportunity for virtual field trips for classes of different ages, such as a diaspora group could tour the otherwise expensive virtual reality equipment between schools and have an authentic dialogue with the students. At a more advanced level, there could be a link-up between college or university field trip students and their counterparts in Iraq.

The increased accessibility of virtual tourism offers not just the opportunity of more revenue, but also the possibility to connect with a more diverse group of people and to spread the story of the marshes more globally. People who would otherwise be excluded from visiting far flung locations could visit the marshes. For instance, those without the financial means, those with physical

or mental disabilities and because of the flexible nature of the virtual visit, it allows tourists to travel at their own pace. Although the cost of high-quality headsets restricts access, these are typically cheaper than most return flights and can even be rented.

This proposed model could be met with cynicism, or some ambition and an appetite to make the marshes the world leading example of virtual eco-tourism (in this sense it can be a trailblazer for other insecure or areas of active fighting). To that extent, there are many risks to such a virtual tourism approach, for example the competition from destinations across the world leading to a price war and making the industry unsustainable. Perhaps the foremost risk though is that this model was concocted in the heads of a few individuals, rolling it out in its current state would represent a top-down imposition on locals and be rightly criticised. What is required is the consultation of locals as the next step, to help co-design a virtual eco-tourism model.

6. Conclusion

Despite the captivating history and landscape of the marshes of southern Iraq, tourism is and has been largely absent, yet eco-tourism has enormous potential as a new industry. This work proposes a right direction to enhancing tourism experience in post-conflict regions such as the marshlands of southern Iraq. The aim is to identify the most suitable tool and the best forms for transforming ecotourism promotion into the marshes. The work has reached the following conclusions:

- 1- The analysis presented in this paper showed that in some critical parts of the world where security is crucial and mostly absent.
- 2- Citizen science can open up to the public and reconnect citizens in post conflict region of southern Iraq to their cultural and historical roots.
- 3- A similar conclusion of citizen science cannot be drawn to offset actual tourism activity, but it is apparent from the current Covid-19

global pandemic situation that it can be an alternative way in scoping of virtual tourism to overcome current constraints.

- 4- Another target of the work is to connect our approaches with decision makers in Iraq.
- 5- Developing sustainable tourism approaches to best sell the idea of sustainable tourism to those decision makers who can make it a reality.

Acknowledgment

Authors are grateful to Nahrein Network and University College London for sponsoring this project. Thanks to University of Thi Qar and local people in marshes for facilitation some aspects of the work.

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