Exploring the Intersection of Climate Change and Cultural Heritage: the Case of Croatia’s Eastern Adriatic Coast

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EXPLORING THE INTERSECTION OF CLIMATE CHANGE AND CULTURAL HERITAGE: THE CASE OF CROATIA’S EASTERN ADRIATIC COAST

by

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A Thesis Submitted in Partial Fulfillment of the Requirements for a Degree with Honors
(Anthropology)

The Honors College
University of Maine
May 2020

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Over the latter half of the Holocene – approximately the past 5,000 years – along the Adriatic Coast, the climate regime has been relatively stable with mild temperatures and a low tidal range. Humans have adapted and interacted with their environments within this context, building settlements and expanding civilizations close to sea level. These anthropogenic legacies left behind and modified over the millennia constitute cultural heritage.

Croatia’s Central Dalmatian Coastline, extending between the modern-day cities of Zadar and Split along the Adriatic Sea, is a rich repository of both built and landscape cultural heritage. Croatia’s cultural heritage is and will continue to be threatened by human-induced climate change over the coming century. This thesis explores the effects of climate change on cultural heritage in Central Dalmatia along Eastern Adriatic Coast.
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CHAPTER I

INTRODUCTION

Introduction

I was greeted with pounding rain and howling wind upon my arrival to Dubrovnik at the beginning of February 2019 – typical weather for winter in coastal Croatia. I had been to Croatia once prior in the summer of 2018 for an archaeological field school further north up the coastline in Zadar. I, like many other visitors, instantly fell in love with the Adriatic Coast. I was enthralled exploring Croatia’s stunning, pebbly coastline, crystal-clear aqua waters, and romantic ancient cityscapes. This time around, though, I was in Croatia for a full semester to study abroad at Libertas International University, a small university housed on the second floor of the Dominican monastery in Dubrovnik’s Medieval walled Old Town.

The narrow road that wraps around cliffsides from the airport to the city normally offers a stunning view of the Old Town, but that day the vista was shrouded in a deep fog. Over the coming semester, however, I was able to experience the “Pearl of the Adriatic” in all its glory, frequenting cafe bars and shops, beaches, hiking, exploring the islands, and indulging in traditional Mediterranean cuisine.

At the same time, though, I witnessed Dubrovnik’s vulnerabilities as a compact ancient city nestled against the sea. Dubrovnik may abut the Adriatic, but it is surrounded by hills. In the winter, after any heavy rain event, I witnessed flooding in the Old Town. Hillside stairways turned into roaring waterfalls headed for the Old Town and bans were
posted about drinking tap water. By the summer, temperatures were already soaring, only to get hotter. Large numbers of tourists were a constant presence even from the moment I arrived. By the time I left in late June, the main road of the Old Town, the Stradun, was wall-to-wall with people. These observations and encounters, along with my experience visiting Zadar and participating in fieldwork nearby, laid the foundation for pursuing the impacts of climate change on cultural heritage in coastal Croatia.

Change has been the norm rather the exception during the history of human life on Earth, differing only in the pace and magnitude of change. Over the course of the Holocene – the last 12,000 years of Earth’s history – and especially since the Middle Holocene along Croatia’s Adriatic Coast, climatic changes have been varied but generally relatively stable, allowing for ancient cities and landscapes to evolve close to sea level (Benjamin et al., 2017). Over the Holocene, the dominant drivers of climate change have shifted from natural forcing to anthropogenic factors. In the twenty-first century, humans are increasingly witnessing and experiencing the ramifications of emitting increasing amounts of greenhouse gases into the atmosphere for the last two centuries. Those along the Adriatic Coast of Croatia have already started to and will continue to grapple with these human-induced climatic disturbances. Over the last century, Croatia’s Dalmatian Coast has and will see a notable increase in annual temperatures, decrease in annual precipitation, erratic and intense extreme weather events, and sea-level rise. Such climatic changes can have disastrous implications for cultural heritage.

Humans have always been articulated with their environments. Over the past three to five thousand years, however, Earth’s landscapes are increasingly a product of this coupled relationship; cultural heritage sites, urban and landscape heritage alike, are the
tangible evidence of this interplay between people and the environment. In Croatia, major urban hubs like Zadar and Split along the Adriatic Coast showcase this mélange of living history. In the hinterlands between them and on coastal islands and waters, heritage abounds in the forms of viticulture, island agricultural landscape, and aquaculture. An examination of these heritage sites has vital implications for identity, tourism, and urban development – other factors compounded by climate change. Despite the current and potential degradation of heritage in the face of climate change, cultural heritage sites in Croatia and the efforts to protect them can offer insight into climate change mitigation, adaptation, and resilience.

In short, this thesis explores the impact of anthropogenic climate change on urban and landscape cultural heritage in Croatia. Central Dalmatia, the stretch of Eastern Adriatic Coast between the cities of Zadar and Split, constitutes the primary case study. Undergirded by Croatia’s geographical and historical context, this thesis examines the regional and local climatic history and projections and cultural heritage of the region. Most importantly, this study investigates the intersection between climate change and cultural heritage in Central Dalmatia and discusses the implications for tourism, identity, urban development, and responding to climate change indicators (including temperature and precipitation changes, sea-level rise, and changes in frequency and severity of extreme weather events) and associated risks and impacts.
Geographical Context

The Republic of Croatia is situated on the Balkan Peninsula in Southeastern Europe (see Figure 1). Nestled on the Eastern Adriatic Sea, Croatia neighbors Slovenia, Hungary, Serbia, Bosnia and Herzegovina, and Montenegro. As of 2013, Croatia is the latest addition to the European Union. It covers nearly 56,600 square kilometers and comprises twenty counties (CIA, 2018; DHMZ, n.d.; IUCN, 2017; Republic of Croatia Ministry of Environmental and Nature Protection, 2014).

![Figure 1. Republic of Croatia: A satellite map of Croatia. Google. (n.d.) Croatia. Retrieved from https://goo.gl/maps/LYsyfm3dfoFV3g687](https://example.com/figure1)

The population of Croatia is hovering just above 4 million people, though in recent years Croatia has seen a negative population growth, increasing rural-to-urban migration, and outmigration of young people to other European countries or to North
America. The capital is Zagreb, situated inland, with a population of approximately 1 million residents. The rest of Croatia’s major cities lie along its coastline. These include Split and Rijeka, with populations of nearly 180,000 and 130,000, respectively. The majority of the population of Croatia lives in the northern portion of the country, with just over half residing in urban areas (CIA, 2018; DHMZ, n.d.; IUCN, 2017; Republic of Croatia Ministry of Environmental and Nature Protection, 2014).

Historical Context

Human occupation within the geopolitical borders of present-day Croatia covers a patchwork history spanning the Stone, Bronze and Iron Ages, Antiquity, Middle Ages, and the Early Modern Era, through the twentieth century to the current day. Across these periods, a myriad of cultures and empires introduced various architectural and archaeological imprints, as well as their own economic and social influences that helped contribute to what is now Croatia.

Stone, Bronze, and Iron Ages

Humans shifted away from a nomadic lifestyle and began to settle into a more sedentary lifestyle in Croatia over 7,000 years ago. Archaeologically, this is seen in floral and faunal remains (i.e., edible parts of plants getting larger, herd imbalances) and settlement assemblages of accumulated goods, for instance (Zeder, 2008). Many Neolithic sites can be found along Croatia’s Mediterranean coastline and on its islands. The island of Hvar, off the coast of Split, for example, houses sites such as the Vrboska open-air shore and shell midden (~5000 BC), and highlight Neolithic life, with remnants
of projectile point production, pottery, and remains of mainly domesticated sheep interspersed with some cattle and goats (Barbarić, 2010; Diedrich, 2011; Lightfoot et al., 2014).

Bronze (~3000-1000 BC) and Iron Age (~1000-100 BC) settlements abound along the Adriatic. The creation of hillfort settlements in the rolling hills bordering the sea from Istria through Dalmatia and revolutions in tools and technology were characteristic of this time period. Liburnian and Illyrian tribes inhabited the shores of the Eastern Adriatic here during this epoch, and Greeks were concurrently colonizing the islands off of Split. In addition, the Iron Age saw such things as growth in settlement size as the region was becoming increasingly urbanized. The city of Zadar, for example, was a large Liburnian Iron Age settlement before it became a significant Roman colony. The same could be said of Nadin, a hillfort settlement nearly 25 kilometers into the hinterlands from Zadar, before it became a Roman city, referred to as a municipium (Barbarić, 2010; Diedrich, 2011; Lightfoot et al., 2014; Zaro & Čelhar, 2018).

Antiquity

Following wars over territory and rule of Mediterranean Croatia known at the time as Illyria, the Roman Empire engulfed the region in 9 AD and renamed it Illyricum. Together current-day Croatia and other neighboring geographic areas made up the Roman province of later-renamed-Dalmatia, eponymous to an Illyrian tribe of the region. The capital of Roman rule in Dalmatia was Salona – slightly northeast from Split and up against the hillside. The Roman Empire as a whole was readily interconnected by trade routes over sea and road. Ideas, goods, and people traveled great distances and influenced
the physical, economic, and intellectual landscape. The Roman authorities required tremendous amounts of resources in order to engage in their monumental construction projects, as well as to meet the needs of a rapidly growing population. Roman rule over Dalmatia lasted until the sixth century AD when invading Avars and Croats destroyed Roman settlements (Cornfield, 2016; Dalmatia [Adriatic], 2001; Goldstein, 2011; Jović Gazić, 2010; Roman Architecture, Ancient, 2018).

Evidence of Roman architectural heritage and influence are widespread over Croatia’s Mediterranean landscapes. Archaeologically, Roman influence is evident in ceramics, glassware, and other material goods, building styles, the use of plaster, and the use of spolia – repurposed building materials. The Roman ideals of city planning are also evident in many cityscapes across the Adriatic Coast. Originating from the Roman castrum, these cityscapes are planned in an orthogonal, grid-like fashion, with major roads cutting east-west (the decumanus maximus) and north-south (the cardo maximus).

Diocletian, a Roman Emperor, was a native of Croatia and eventually constructed a retirement palace in Split in the fourth century AD. Diocletian’s Palace, exemplary of an ideal Roman cityscape, still stands, with a riva – a pedestrian promenade – attached more recently, in the Old Town in Split. Today, though, following a reorganization beginning in the Middle Ages, it has been turned into living spaces, shopfronts, restaurants, and historical sites (Cornfield, 2016; Dalmatia [Adriatic], 2001; Goldstein, 2011; Jović Gazić, 2010; Roman Architecture, Ancient, 2018).
Middle Ages

A reorganization of politics heralded the Middle Ages in Croatia. Following invasions and reorganization of the Roman Empire, Roman colonies and municipia reorganized as well. Modern-day Dubrovnik, for example, was initially the Roman Epidaurum (and Greek settlement prior to that). Christianity spread across the region after the installation of Charlemagne in 800 AD and the inclusion in the Holy Roman Empire and the Byzantine Empire. The Kingdom of Croatia began in 925 AD when Tomislav was made the first king. Croatia remained a kingdom in its own right before Hungary stepped in in 1102 (Golstein, 2011; Muzej Hrvatskih Arheoloskih Spomenika u Splitu, n.d.; Tanner, 2019).

Medieval heritage in Croatia includes many examples of religious heritage. Because of the spread of Christianity, churches began cropping up in the cityscapes, sometimes replacing buildings or locations of pagan worship (Goldstein, 2011; Muzej Hrvatskih Arheoloskih Spomenika u Splitu, n.d.; Tanner, 2019).

Over the Middle Ages, Venice had grown in power through sea trade. As part of their expanding empire, Venetians occupied Croatia from the fifteenth through the eighteenth centuries, often engaging in war with the Ottoman Turks for influence and control of the region. In the nineteenth century, the Habsburgs won part of Croatia, and maintained rule until 1867 when it became part of the Austro-Hungarian Empire, with short interruptions from Napoleon in the early nineteenth century. Dubrovnik was an exception, however, and maintained its independence as a city-state that went by the name Ragusa (Goldstein, 2011; Muzej Hrvatskih Arheoloskih Spomenika u Splitu, n.d.; Tanner, 2019).
Early Modern Era through Contemporary

Venetian, Ottoman, and Austro-Hungarian rule also left marks on the landscape of Croatia. Venetian fortification walls, now listed as a UNESCO World Heritage site, are found in cities like Zadar and Šibenik. The construction of mosques spread across Croatia with the Ottomans (Zaro et al., 2020). The Austro-Hungarians brought with them a unique building construction style characterized by large symmetrical stone block buildings (UNESCO, 2020a).

Following the dissolution of the Austro-Hungarian Empire in the aftermath of World War I, the victorious powers brought together an amalgam of ethnic groups under one nation and called it Yugoslavia. Born initially as monarchy, Yugoslavia included such states as Croatia, Bosnia-Herzegovina, Slovenia, Serbia, and Montenegro (CIA, 2018; Malnar, 2019).

During World War II, however, the Axis forces took over Yugoslavia and turned it into a Nazi puppet state. After World War II, Josip Broz, more commonly known as Tito, became the leader of Yugoslavia and instituted a communist system with the active support of the Soviet Union (CIA, 2018; Malnar, 2019; Tanner, 2010).

Over seven decades later, Yugoslavia dissolved following unresolved ethnic conflicts in the wake of the collapse of communist rule throughout much of Eastern Europe. Croatia declared its independence on 25 June 1991. But not everyone was content with independence – some of the Serb minority responded in armed conflict, and a four-year series of wars ensued pitting ethnic Serbs living in Croatia against their Croat neighbors. By 1995, Croats secured victory. Over 20,000 people perished in the Croatian wars of the ‘90s, leaving upwards of 250,000 displaced people in their wake. Many
buildings, neighborhoods, and cities were burned, bombed, and otherwise destroyed by shelling and combat that ravaged the nation. The people and landscape of the country suffered severe physical, emotional, and spiritual wounds that, in many ways, remain (CIA, 2018; Malnar, 2019; Tanner, 2010).

Since the wars of the ‘90s, Croatia has been rebuilding as an independent state. This goes beyond political infrastructure to include restoration projects and revitalization of major urban centers, especially along the Adriatic. Modern cities, including Zadar, Šibenik, and Split, dotting the seacoast exemplify the rich chronological depth and scope of Croatian Mediterranean history. They are a present testament to the rich mélange of culture history and showcases relics of different political regimes through time in their museums, restored buildings, and cultural heritage sites (CIA, 2018; Malnar, 2019; Tanner, 2010).

Conclusion

The exploration of geographical and historical contexts is relevant in understanding the importance of climatic factors and the development and relevance of cultural heritage in Croatia. Exploring these contexts illuminates the anthropogenic time depth of the region and gives weight to the preservation of cultural heritage in light of human-induced climatic change facing the Adriatic Coast.
CHAPTER II

CLIMATE CHANGE IN THE MEDITERRANEAN AND CROATIA

Introduction

Politics are defined by climate change and vice versa, treaties are constrained by climate change, national and state policies are framed by climate change, and students are mobilized by climate change around the globe. In this light, studies on climate change are ever-changing as scholars and international organizations publish new reports, and these studies wiggle their way to the forefront of political, social, and economic agendas. These topics continue to impact large swaths of society and garner further attention and scrutiny.

As noted, the climate of Croatia in particular has been changing for millennia. Over the course of the Holocene epoch, natural forcing and then human agency caused major and subtle shifts. Since the Industrial Revolution, however, anthropogenic behaviors have dramatically increased the pace and magnitude of climatic change. Drawing largely on past data and projections, scholars, non-governmental organizations, and government agencies in and around the Mediterranean have all widely published their climate analyses and projections for the present and future. What follows is an overview of some of these standard works of climate science research on the past, present, and future climate in the Mediterranean region broadly, with a narrowing focus on Croatia. This review will serve to contextualize the problem within past, contemporary, and future climate and environmental projections.
Mediterranean Climate History

First Half of the Holocene

Climatic changes in the Mediterranean region over the Holocene are illuminated through multiproxy analyses. These proxies include palynological records and sediment core and stalagmite analyses. Scholars at the heart of this examination have laid a foundation through their literature that remain consistent.

The termination of the last ice age brought more moisture to the Mediterranean Basin. While the Mediterranean was not covered in glacial ice, the climate was dry during the last ice age. Moisture gradually returned in the Early Holocene, and with that moisture, trees returned to the Mediterranean region. Pollen samples show the spread of moisture-loving deciduous tree species northward, including oaks and even species such a birch commonly found in northern European areas today. The first half of the Holocene maintained a relatively warm and wet climate until around 5,000 years ago (Finné et al., 2011; Rackham, 2008).

Second Half of the Holocene

The second half of the Holocene, on the other hand, is markedly different than the first half. Finné et al. (2011) and McCormack et al. (2012) detail the general climate changes in the region during this half of the epoch based on the same type of multiproxy data analyses. According to Finné et al. (2011), the latter part of the Holocene in the Mediterranean was drier. Until 5-6,000 years ago, the Mediterranean region was generally wetter than average, and that trend continued though slowly declining until around 4,500 years ago. A decline in pollen from deciduous oak tree species around
5,000 years ago and an increase in pollen from pine species correlates to a drying climate. However, Finné et al. (2011) do note that caution should be taken when looking at the influx of pine species because human activity also contributed to the decline in oak trees as the oaks were valued for their timber. The eastern part of the Mediterranean saw a drier climate for the next 3,000 years with pockets and periods of variability. Temperatures increased in the first part of the Middle Holocene, though there have been periods of time with cooler temperatures (Finné et al., 2011).

During the latter part of the Holocene – the Late Holocene – the climate became increasingly like present-day Mediterranean climate. The climate was warmer in the first part of the Late Holocene and fluctuated with intervals of cooler periods, include ages of the Little Ice Age. Rainfall trends over the years also varied like those of the Middle Holocene, but the majority of precipitation occurred during the winter season followed by warm, dry summers. Over the Late Holocene, landscapes underwent pronounced changes due to human activity, including urbanization and agriculture (Finné et al., 2011).

McCormack et al. (2012) focus on climatic changes much later in the Late Holocene, zeroing in climatic changes around the rise and fall of the Roman Empire. McCormack et al. (2012) utilize multiproxy data (comprising tree rings, ice cores, speleothems, lake cores, etc.) around the Mediterranean coupled with archaeological and historical records. The resulting timeline indicates relative stability, warmth, and moisture from 100 BC-200 AD, initial instability turning to cooler temperatures and moisture and ending with drought from 200-400 AD, instability and drought from 400-600 AD, and then warmer summer temperatures, drought, and winter cold spells from
600-800 AD. As a result, this snapshot gives a closeup look at the amount of variability within a short time frame (McCormick et al., 2012).

**Contemporary Climate**

The Mediterranean region’s climate today falls under a Köppen Type C climate, which is characterized by hot, dry summers and mild, rainy winters. The mean annual temperature in the Mediterranean Basin is 15 +/- 5°C. July is the warmest month, with temperatures frequently climbing over 35°C. Annually, locations in the Mediterranean may see an average of 500 mm of rainfall, with at least 70% falling during the winter months. There is a gradient of decreased rainfall and increased temperatures trending north to south across the Mediterranean basin (Finné et al., 2011; Giorgi & Lionello, 2008; Lionello et al., 2012; Roberts et al., 2001).

The Mediterranean region’s climate is affected by local topography and vegetation, but also by various global climate phenomena. Asian and African monsoon patterns affect the southern portion of the Mediterranean. The characteristic Mediterranean hot-and-dry summer across the board is attributed to high pressure, descending air motions, and the northward movement of the Intertropical Convergence Zone (ITCZ). The mild and rainy winters, on the other hand, come from the shifting of the westerly winds to the south and the southern movement of the ITCZ. In the winter as well, the North Atlantic Oscillation – air movement driven by a gradient in sea-level pressures near Iceland and the Azores – affects the western sections of the region, while the northern and eastern sections feel the impacts from the East Atlantic (EA) and the El
Niño Southern Oscillation (ENSO) (Finné et al., 2011; Giorgi & Lionello, 2008; Lionello et al., 2012; Roberts et al., 2001).

Croatian Climate History

First Half of the Holocene

Climatic trends in Croatia specifically follow the regional pattern in the first half of the Holocene. In his foundational piece on the subject of Croatian climate change, Beug (1967) reviews pollen records from lake sediment cores of Malo Jezero on the island of Mljet, along Croatia’s southern Adriatic Coast. The palynological record reveals four distinct periods of vegetational changes. These vegetation changes can be extrapolated to yield insights on climatic data as certain plants thrive in particular climates. The first period (7000-5600 BC) falls during the first half of the Holocene. During this time, Mljet, and Croatia’s coastline, was covered with deciduous forests comprised mainly of oak trees. Because oak trees thrive in moisture-rich soil, such a forest cover generally correlates to a wet climate (Beug, 1967).

Other scholars build from and improve upon the data record from Beug’s seminal 1967 piece. For instance, Jahns & van den Bogaard (1998) explore both palynological and tephra records from sediments in two lakes, Malo and Veliko Jezero, also on the island of Mljet. Their work reinforces conclusions from Beug’s study thirty years prior: from ca. 8000-6000 BC, Croatia’s Adriatic Coast saw oak-dominated forests and very few species of vegetation that are recognizably Mediterranean today, signaling a wetter climate. The carbon dates associated with the tephra reinforce dates from these pollen
samples (Jahns, 2002; Jahns & van den Bogaard, 1998; Šoštarić, 2005; Wunsam et al., 1999).

Wunsam et al.’s (1999) study of Adriatic Sea level and climate further supports the work done by Beug (1967) and Jahns & van den Bogaard (1998). Wunsam et al.’s (1999) pollen and salinity analyses support the trend of wet weather in the Early Holocene – the time periods around 7000 BC saw increased precipitation and the brackish water of lakes became more like freshwater. New data from swamp vegetation pollen analysis, tephra, and diatoms also tell a story of rising sea levels, environmental events moving water, and subsequent salt water intrusion into the lake (Wunsam et al., 1999).


Elsewhere, Balbo et al. (2006) focus on data from farther north along the Adriatic Coast. Polje Čepić, in the Istria region, is a natural depression in the widespread karst topography. While it is not one of the lakes of Mljet that are widely studied, Polje Čepić offers the same opportunity for sediment analysis and climate extrapolation. Balbo et al. conclude that the Early Holocene up until around 6000 BC was characterized by a wet climate in the northeast Adriatic basin (Balbo et al., 2006).
Second Half of the Holocene

Climate changes of the second half of the Holocene in Croatia has been intensively studied and also generally follow the regional trend with specific local variabilities. Looking back at the work of Beug (1967), the latter part of the Holocene encompasses Beug’s Periods B through D. The works of Jahns & van den Bogaard (1998), Jahns (2002), and Wunsam et al. (1999) still build off of Beug’s initial studies of the lakes in Mljet. The second distinct climate period (from 5600-4300 BC) is what Beug calls the “Juniperus-Phillyrea period,” named after the domination of Juniperus and Phillyrea vegetation, signaling a drying climate in Croatia. The analyses of and resulting conclusion of a decrease in phytoplankton production by Wunsam et al. attests to the decrease in nutrient runoff and thus a decrease in precipitation during this time. At the end of this period, the climate starts to approximate more of the contemporary Mediterranean climate.

The third period, the “Quercus ilex period” from 4300-200 BC, is defined by a strong presence of evergreen oak trees most likely brought to the region by humans and is split into three subperiods based on different tree species taking prominence. The prevalence of those trees in the subperiods may not be attributed to climatic factors but rather human activity in the area, a common theme throughout the literature on changing vegetation, which makes sense as the latter act of the Mediterranean Holocene has been increasingly affected by human activity as the region saw the rise (and fall) of many complex civilizations. Lastly, the fourth period is the “Pinus-Quercus ilex period” and it shows an increase in pine trees, a sign of a drying climate once more (Balbo et al., 2006;
One example of specific local variability within the Mediterranean is Rudzka et al.’s 2012 study of stalagmites in Modrič Cave in Croatia. By measuring the ratios of oxygen isotopes, they were able to determine times of wetness and drought. Warm periods of the Medieval Climate Anomaly (MCA) and Roman Warm Period (RWP) show up in the stalagmite record as times of drought, whereas the cold period of the Little Ice Age (LIA) shows more moisture. Such a record goes hand-in-hand with the regional data from the Mediterranean (Rudzka et al., 2012).

Contemporary Climate

Croatia’s coastal climate is characterized as a Mediterranean-type climate. The Köppen climate classification places it at a Type C – “moderately rainy and warm” (Republic of Croatia Ministry of Environmental and Nature Protection, 2014). Croatia’s coast sees winter rain and summer drought. The average minimum temperature during the winter across the country lies above freezing, even though some areas in Croatia may register below freezing. Along the coast in particular, the temperatures in January, the coldest month, hover around 5°C. In July, the warmest month, the coastal temperatures average around 24-25°C. The central coastline receives the least amount of rainfall annually, seeing only around 300 mm. The islands tend to be drier than the mainland along the coast because of cloud accumulation in higher elevations. Wind is a major factor in Croatia’s local climates. From spring to autumn, there is a strong north to northwest wind. In the winter, the Jugo and Sirocco from the southeast herald the typical
Mediterranean mild weather with precipitation. When high pressure develops, the infamous and strong Bura (reaching speeds of between 110 and 250 km/h) rears its head and brings cold gusts down from the mountains (Jahns & van den Bogaard, 1998; Republic of Croatia Ministry of Environmental and Nature Protection, 2014, p. 22).

**Climate Projections**

The Mediterranean is not immune to the effects of anthropogenic climate change. In fact, it is a region that will be more susceptible to risk due to faster, more intense change from anthropogenic climate forcing. The general trends include an increase in average temperatures, a decrease in precipitation, and an increase in sea level. The IPCC Working Group (2013) along with other scholars, including Giorgi and Lionello (2008), report that the Mediterranean region will see a notable increase in average temperatures with especially noteworthy higher summer temperatures; temperatures could warm as much as 5°C (see Figure 2). They also note that there will be a decrease in precipitation annually – by possibly nearly thirty percent – also with a marked decrease in the summer season (see Figure 3). These trends vary based on microclimates, and different regions of the Mediterranean Basin might not follow the trends exactly. For example, the far northern Mediterranean areas are not expected to see any notable decrease in precipitation, especially in alpine areas during the winter (Alessandri et al., 2014; Branković et al., 2012; Giorgi & Lionello, 2008; IPCC, 2013; Peleikis et al., 2014).

Moreover, another effect of climate change on the Mediterranean region is sea-level rise. Sea levels in the Mediterranean have varied since the Middle Holocene, dependent on location, but on a whole generally sees low tidal ranges (Benjamin et al., 2017; Vacchi et al., 2016). Increasing global temperatures threaten the ice sheets in Greenland and Antarctica. If significant portions of these ice sheets melt, global sea level is expected to rise dramatically. Based on current melting rates, seas are rising gradually (Giorgi & Lionello, 2008; Peleikis et al., 2014).

Croatia will also see a rise in temperatures, a decrease in precipitation, and sea-level rise. The increase in temperatures will occur mainly during the summer months, with Croatia’s coast seeing more intense and frequent hot days and heat waves (see Figure 4). The sea temperatures will increase as well. Precipitation in Croatia is also expected to decrease over the coming century because of climate change (see Figure 5). Littoral Croatia and hinterlands are expected to see an increase in the proliferation of dry spells, and wet spells are expected to decrease by up to 12% per decade along northern parts of the coast. Along the Dalmatian Coast, seas are expected to rise up to nearly a meter, dependent on the climate scenario, over the coming century. Climate change is also expected to bring stronger storms and more erratic and intense extreme weather events (Baric et al., 2008; Benjamin et al., 2017; Branković et al., 2012; Gajić-Čapka et al., 2015; Peleikis et al., 2014; Republic of Croatia Ministry of Environmental and Nature Protection, 2014, pp. 108–113; UNDP, 2008; Vacchi et al., 2016).

Croatia is already observing such climatic changes in temperature and precipitation. Data from the Croatian Meteorological and Hydrological Service attest that, since 1931, littoral Croatia is beginning to experience more frequent warm or hot days
(days where temperatures clock in at least 25 or 30°C, respectively), less frequent colder days, and witness a general decrease (up to 20%) in precipitation. Dry spells are also reported to be increasing in frequency and duration over the twentieth and into the twenty-first century. In the past thirty years, long dry spells (those that last for at least thirty days) have occurred five times. The longest dry spell over the past century was recorded in Split; it began in June 1962 and persisted for eighty-four days (Zaninović, 2008).

Figure 4. Dalmatian Coastal Temperature Projections, 2080-2100: This chart depicts the current averages in temperature and contrasts it against projected temperatures for the period 2080-2100. Along the Dalmatian Coast, there is a notable increase in average annual temperatures, especially during the summertime.

Figure 5. Dalmatian Coastal Precipitation Projections, 2080-2100: This chart depicts the current averages in precipitation amounts and contrasts it against projected precipitation amounts for the period 2080-2100. Along the Dalmatian Coast, the summer season is projected to receive even less precipitation.


Conclusion

Across the 12,000-year reach of the Holocene, climate change in the Mediterranean Basin has been the norm rather than the exception, but there has been a great deal of consistency since the Middle Holocene. Given multiproxy data, scholars found that rain dominated the Early Holocene, followed by a relatively dry Middle
Holocene and eventually shifting to a more recognizable climate, which is now characteristically dry and hot in the summer and wet and mild in the winter. Croatia fits nicely within the overall climatic history of the region. Paleoenvironmental records evince parallel periods of wet and dry and climate variability. This climate, however, is extremely fickle and is proving to be vulnerable in the twenty-first century to the effects of faster-paced, stronger climatic changes driven by human behavior. An increase in summer heat, decrease in precipitation, and sea-level rise are just some examples of threats facing the Mediterranean in general and Croatia in particular.
CHAPTER III

CULTURAL HERITAGE IN CROATIA

Introduction

For as long as humans have been on this planet, they have been engaging with their surroundings and leaving their marks. The vestiges of these interactions are found around the world anywhere from the loose arrowhead left behind to the remnants of pastureland to ancient cityscapes. The selectively chosen valued remnants of human interaction with their landscape and creations of human ingenuity are examples of cultural heritage. Cultural heritage unifies people through shared identity and history and values and is a vital component of what draws people to a certain place. This chapter explores definitions of cultural heritage, provides an overview of cultural heritage in Croatia, and introduces specific case studies of cultural heritage in Central Dalmatia.

Defining Cultural Heritage

Defining cultural heritage has its roots, in part, with the Conservation Movement of the nineteenth century in the Western world. At this point, scholars separated nature and history from culture and the resulting definition became something to value and protect. A knee-jerk reaction to the Industrial Revolution, cultural perceptions of nature and the wilderness developed as separate from human influence. Preserving history, historical relics, and the stories behind them went along with this concept (Lowenthal, 2005).
Early definitions of cultural heritage tended to be predicated on this nature-culture dichotomy, Eurocentric, and focused on cultural heritage solely as built environment. Because the built environment is a clear, tangible example of human heritage and activity through time, it was valued and chosen as something to protect and learn from. As such, there was less emphasis on including “natural” landscapes (“natural” because still altered by human activity) and impalpable facets of action through time, such as oral histories, as cultural heritage. Over the past fifty years, however, internationally recognized definitions of cultural heritage have expanded from just material recognition of heritage in the form of architectural and historical monuments to also include the intangible elements and natural environment (Feary et al., 2015; Lowenthal, 2005).

This change over time in what heritage encompasses is found in academic literature by various scholars and international organizations. The seminal 1964 International Charter for the Conservation and Restoration of Monuments and Sites, most popularly known as the Venice Charter, laid the foundation for the preservation of historical and architectural heritage sites (Jokilehto, 2005). International organizations have since built off of this charter to classify what was deemed valuable to conserve.

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) is a paramount global voice in defining and promoting the protection of heritage. At the 1972 Convention Concerning the Protection of the World Cultural and Natural Heritage, the conference delegates denoted cultural heritage only as “monuments, groups of buildings, and sites” that have “outstanding universal value” to present and future societies, whether that value be aesthetic, scientific, historical, or otherwise.
Natural heritage was kept separate (UNESCO, 1972, p. 2). UNESCO World Heritage Sites also fit these definitions.

UNESCO is the primary designator of what is officially and globally recognized to be protected as cultural heritage. Sites are designated as UNESCO World Heritage sites if they fit the ten qualifications laid out in the Operational Guidelines for the Implementation of the World Heritage Convention. This definitional process, however, is not without challenges. What populations might think of as heritage across the world varies broadly. The application process for World Heritage-level recognition lands many sites on tentative lists, left to be reconsidered after one or many years (Jokilehto, 2005).

Over the latter half of the 1970s, UNESCO continued to put out literature defining the parameters of protecting historic areas. It was not until the early 1990s and then early 2000s, however, that UNESCO moved to include other types of heritage as cultural heritage. In 1992, for example, UNESCO included human-altered landscapes as part of cultural heritage. The 2003 Convention for the Safeguarding of the Intangible Cultural Heritage then was the first conference that UNESCO officially recognized intangible elements of culture as an equally important slice of cultural heritage (Feary et al., 2015; Jokilehto, 2005). Today, UNESCO asserts that cultural heritage can be divided into two camps, tangible and intangible cultural heritage. Tangible cultural heritage includes physical examples of buildings and artifacts that fall under subcategories of movable, immovable, and underwater cultural heritage. Intangible cultural heritage, on the other hand, covers customs, traditions, and rituals. Cultural landscapes fall under the natural category and are still considered heritage (UNESCO, 2017).
Another global organization for the preservation of cultural sites is the International Council on Monuments and Sites (ICOMOS). Similarly, ICOMOS denotes cultural heritage as encompassing architectural heritage, sites, and monuments, archaeological sites, cultural landscapes, artifacts, and intangible elements (ICOMOS, 2002; Jokilehto, 2005).

While the definitions of what constitutes cultural heritage might differ through time, the message behind the selection of heritage as something to protect and value remains the same. Whether it is tangible or intangible, cultural heritage is inextricably intertwined with identity and serves to unify people through shared values and shared history. Lowenthal (2005) attests that cultural heritage – the “legacies we inherent” – is “essential to personal and shared identity” (Lowenthal, 2005).

**Cultural Heritage in Croatia**

The Mediterranean Region broadly and Croatia in particular have seen millennia of human occupation. From the interior to the coast, evidence of anthropogenic landscapes abounds. Cultural heritage in Croatia is therefore widespread. The country touts ten designated UNESCO World Heritage Sites. Of these ten, seven constitute architectural heritage while three are “natural” sites. It is important to remember, however, that UNESCO World Heritage designation is essentially an international competition for resources to support the protection of these sites.

The UNESCO World Heritage sites are, however, not the only examples of cultural heritage across the country. Other ancient cityscapes, ancient pasture fields riddled with olive trees and walled enclosures for animal grazing, archaeological sites
dating back to the Neolithic, and island landscapes all exemplify heritage sites, even if the heritage is evidence of daily life and seemingly insignificant. While these other sites may not have “outstanding universal value,” and therefore do not have the recognition and access to resources of others, they hold facets of identity and can also be important draws for tourism.

Identity

For Croatians, ancient cityscape, landscape, and seascape heritage fosters a sense of personal and collective identity. Croatia is a nation with an amalgam of cultural, ethnic, and religious groups; it has a patchwork history and has come through numerous political regimes and divisions. As such, there is no one homogenous or static Croatian identity. Cultural heritage, though, allows Croatians to showcase their history as an independent nation as well as celebrate and remember what is uniquely their own (Goulding & Domic, 2009).

In addition, cultural heritage also facilitates transmission of knowledge and this history to visitors and guests. Interacting with living cities and urban heritage with the time depth as is seen in Croatia and historical landscapes can allow for a reflection on values and a deeper appreciation for those who came before (Mimar Sinan University of Fine Arts, 2014).

Tourism

The cultural heritage of Croatia’s coastline is a major draw for national and international tourist traffic. Croatia has been developing its tourism industry for at least
the past 150 years. Even during the Communist Era, officials made concerted efforts to encourage tourism by turning away from some of the typical central tenets of Eastern Bloc-planned economies. Before the Yugoslav Civil War, the tourist economy was a rising industry and major shaper of the middle class. Tourism was primarily centered around the coast. Croatia was an attractive destination because it offered pristine beaches and engaging cultural heritage at a low cost (Allcock, 1983; Jordan, 2009).

Many of Croatia’s cities endured multiple aerial attacks, horrific fighting, and indelible psychological stains and witnessed pitched battles and intense human suffering during the war for independence that engulfed Yugoslavia after the end of the Communist Era. The wars (1991-1995) severely damaged infrastructure and made the region unappealing for tourism, just as the Nazi occupation of the area did during World War II. The tourism industry fell to 20% of what it was pre-conflict during the 1990s (Jordan, 2009; UNDP, 2008, pp. 53-54). Despite these traumas, city planners and the tourist board throughout the ages of this region repurposed and built on the legacy of the ancient past, believing that tourism would help revitalize the nation as a whole. Cultural heritage was, and continues to be, a draw for visitors from around the globe.

Croatia has emerged from the post-Communist era with a commitment to promoting itself through tourism (Steves & Hewitt, 2018). Today, tourism is central to Croatia’s economy. The tourism industry alone comprises 20% of Croatia’s GDP and nearly 30% of their total employment, which is about 336,000 jobs (Mahečić Bajović, 2009). The people that work in adjacent industries, such as unregistered accommodation work, generate another 1% of the GDP (UNDP, 2008, p. 52). Based on figures from 2019, there were nearly 21 million tourist arrivals in Croatia. Of these tourists, 88% were
foreign (Croatian National Tourist Board, 2020). Historically, most of Croatia’s foreign tourists come from Germany, Austria, Poland, Italy, and Slovenia (Šverko Grdić & Krstinić Nižić, 2016, p. 30). The most popular time of year to visit Croatia is during summer break with numbers peaking in July and August (Peleikis et al., 2014, p. 7).

Croatia has increased in popularity as a tourist destination, especially among foreigners, in part, from advertisements and the rebranding of their tourism slogan as well as recognition in popular media. The latest campaign includes the taglines “Croatia: Full of Life” and “Croatia: Life as it Once Was.” City planners and the Tourist Board have learned that the distant past and the physical beauty of the present topography and landscape of the region are tremendous draws for tourists. Most of Croatia’s tourism is centered on the Eastern Adriatic Coast with its pristine waters, pebble beaches, warm weather, relaxed Mediterranean mood and ancient cityscapes. Because of its geographic location, there exist endless possibilities for recreation and exploration of ancient and modern sites of interest. The cities tourists often flock to in Croatia – ones situated on the Adriatic – are seamless integrations of old, Roman and Medieval structures and the new. As such, these locales can be seen as cityscapes of historic legacies (UNDP, 2008, p. 53). In these cityscapes, tourists are entangled with the past and can interact with tangible and intangible cultural heritage. The focus is largely not, however, on the Civil War and genocide in neighboring Bosnia or the Nazi occupation during World War II, but rather on romantic stereotypes of antiquity and medieval times. In addition, since the turn of the millennium, the tourist board has also pushed for the inclusion of natural cultural heritage engagement and tourism to take the pressure off of already popular and crowded cities.
City planners and the Tourist Board are careful in straddling the reality of a horrific past with a need for economic growth through tourism (Cavrić, 2008, Jordan 2009).

**Case Studies in Cultural Heritage in Croatia**

Examples of cultural heritage are clearly seen and experienced along Croatia’s Adriatic Coast. Because of the draw of rich marine resources, fertile valley soils, and prime settlement topography, humans have understandably been pulled to the coast of modern-day Croatia. Along the Central Dalmatian coastline specifically, extending roughly from Zadar to Split, a distance of some 200 kilometers, many cultures have flourished over the past 2,000-plus years. This region saw the cultural changes of various eras: the Liburnian Iron Age, the Roman Empire, the Middle Ages, Venetian and Ottoman occupations, Habsburg rule, Yugoslavia, and independence following the Balkan Wars of the 1990s. As such, traces of political regimes, occupation, and cultures of the past have built on one another, making up a long-standing cultural heritage tradition in Dalmatia.

Cultural heritage along Croatia’s central Dalmatian Coast is clearly seen in the form of cityscapes and architectural heritage as well as in more “natural” examples. Natural landscapes still fall under cultural heritage because they are cultural. Papayannis & Sorotou (2008) note “The landscape is a result of the interaction between humankind and nature. Therefore, in essence, all landscapes are cultural” (Papayannis & Sorotou, 2008).

Embarking on a tour from north to south down the Adriatic Coast, one can encounter numerous ancient limestone-clad cityscapes dotted along the shores like Zadar,
Šibenik, and Split. The hinterlands, islands, and waters surrounding these cities, such as Ugljan Island, viticulture in Primošten, and aquaculture in Zadar County, also speak to cultural heritage in the region. These cityscapes, architectural monuments, and historical landscapes tell vital stories of the human experience.

**Built Heritage**

**Zadar.** Zadar is the center of Zadar County located in northern Dalmatia. It is the second largest city in Dalmatia and the fifth largest city in the country, hovering around 170,000 in population. The historic heart of Zadar is in its Old Town, situated on a peninsula jutting north-south into the Adriatic and connected to the mainland at the southern end and to the east via a pedestrian bridge. Since its inception in the first millennium BC, Zadar has grown to extend from the peninsula to encompass ten square miles of urban sprawl, easily eating into the hinterlands as there is no mountain or geological barrier unlike some other cities (Zadar Tourist Board, 2020a).

The Old City of Zadar clearly exemplifies built cultural heritage. It is a remarkable example of continuity in urban settlement through time with a rich occupational history dating back to the Liburnian Iron Age. As the administrative hub of Dalmatia for centuries, present-day Old Zadar is the result of a culmination of more than 2,000 years of heritage (Magaš et al., 2010; Zadar Tourist Board, 2020b).

Zadar flourished through Roman occupation, and examples of the “remarkably preserved Roman urban heritage” are within walking distance for anyone surveying the contemporary city. The layout of its streets in the heart of the Old City reflect the traditional Roman orthogonal grid layout with an intersecting cardo and decumanus
maximus. At the center of the Old City are the ruins of the Roman forum, lined with tabernae – shops – and flanked with the capitolium – a temple to Jupiter and other gods – to the northwest (see Figure 6). Further south down the Old City peninsula from the forum is Trg Petra Zoranića, where sections of Classical, Late Antiquity, and Medieval fortification walls are exposed or covered in glass panels at street level. Pedestrians can marvel at the archaeological heritage of Roman Zadar from an aerial view, practically standing on the ruins; this gives a unique perspective into the living history and romantic Roman heritage of the city. A testament to the longevity of the urban architectural heritage of the city is the cross-section of three walls found off Trg Petra Zoranića: one wall from Classic Antiquity, one from Late Antiquity, and one from the Middle Ages (Jović Gazić, 2010, pp. 153-192; Zadar Tourist Board, 2020b).

Figure 6. Roman Forum: The Roman forum is the heart of Zadar's Old Town. Today, cafe-bar-goers can sip a beverage or eat a snack on the ruins. Photo by author, May 2018.

Cultural heritage from Late Antiquity onward is seen in Zadar in the construction of Christian landmarks and buildings. The iconic Church of St. Donatus and Cathedral of
St. Anastasia – an episcopal complex – abut the Roman forum in the nucleus of the Old City (see Figure 7). Notably, the Church of St. Donatus utilized pieces of Roman columns – spolia – in its construction in the ninth century. Other evidence of Christian cultural heritage includes basilicas, such as St. Thomas’s Basilica (Jović Gazić, 2010, pp. 179-192; Zadar Tourist Board, 2020b).

Surrounding the Old City of Zadar is an example of its later Venetian heritage: Venetian defense walls These walls were built to defend against the Ottomans. Today, the walls are designated as part of one of the ten UNESCO World Heritage Sites in Croatia (see Figure 8) (UNESCO, 2020a).
Figure 8. Venetian Land Gate: The sixteenth-century Land Gate, located near Foša harbor, marks the southern entrance into Zadar's Old Town. The Land Gate is the grandest gate into the Old Town as it used to be the main entrance. It is a historic legacy that reminds of Venetian influence and rule of the area. Photo by author, May 2018.

Zadar’s cultural heritage is a major draw for tourism and has put the city on the radar of top travel lists. Zadar landed a spot not only on the Top Ten City list in *Lonely Planet’s* “Best in Travel 2019,” but also in the *New York Times*’ prestigious “52 Places to Go in 2019” (Modak, 2019; Pavlic, 2018). The latest “Tourism in Figures” data put out by the Croatian Ministry of Tourism (2019) report that in 2018 Zadar pulled in just over 550,000 tourist arrivals, an increase of just over 6% from 2017 (Republic of Croatia Ministry of Tourism, 2019, p. 32).

Šibenik. Further down the coast ninety kilometers to the south lies Šibenik. Šibenik is the most populous city in Šibenik-Knin County with 46,000 inhabitants. It holds the title of the “oldest native Croatian town located on the Adriatic” – permanently settled by Croats in 1066. It was an industrial hub during the Early Modern Era, producing steel, and underwent various transformations under Communism and damage
during the Balkan Wars in the ‘90s (URBACT, 2019). Today, the urban sprawl of Šibenik extends along the harbor to the north and south from its historic nucleus. Šibenik, although a slightly smaller city than Zadar or Split, still touts impressive heritage for tourists to visit and explore.

Situated safely in a protected harbor where the Krka River meets the Adriatic and with hillsides sloping into the shore (see Figure 9), Šibenik was a natural choice to build fortresses. The sixteenth-century Fortress of St. Nicholas is one of two UNESCO World Heritage Sites in Šibenik – the other being the fifteenth-century Cathedral of St. James (Barišić Marenić et al., 2019; Šibenik Tourist Board, 2020; URBACT, 2019).

Figure 9. Šibenik: A view of Old Town Šibenik from the harbor reveals the topography; note the fortresses on the hilltops.

Split. Along the coast another ninety kilometers farther south is Split. Split is the second largest city in Croatia and the single largest city in Dalmatia with a population of nearly 180,000 inhabitants in the metropolitan area. Unlike Zadar, the poleogenesis of Split came about at the end of the Roman period when inhabitants came into Roman Emperor Diocletian’s Palace after the fall of nearby Salona, former capital of the Roman
providence of Dalmatia. Today, Split’s urban sprawl encompasses the historic Roman and Medieval nucleus and extends up through Salona to the mountains that divide the coastal region from the Dalmatian hinterlands (Split-Dalmatia County Tourist Board, 2020a).

Urban cultural heritage in the form of cityscapes and architectural monuments is most evident in Diocletian’s Palace in the core of the Old City. The Palace was built in the third century as a residential space for Roman Emperor Diocletian (see Figures 10 and 11). Jović Gazić (2011) calls Diocletian’s Palace, “the best preserved and most researched Classical Antiquity complex in Croatia” (Jović Gazić, 2010, p. 163). The orthogonal grid layout in the Palace remains, whereas the heritage of a Medieval road system is seen across the rest of Old Split.

Figure 10. Diocletian's Peristyle: At the heart of Diocletian's Palace is the peristyle. Today, cafe bars flank the sides and music groups often play on summer nights. Photo by author, June 2018.
Another remnant of built heritage from antiquity is the Split aqueduct (see Figure 12). The aqueduct, a homage to Emperor Diocletian and a relic of social inequality and organized labor, slices through the countryside, from the mountainside springs inland destined to supply water to Diocletian’s Palace.
Like the examples of Zadar and Šibenik, the construction of Christian complexes at the end of the Roman era and into the Middle Ages prevailed in Split. The Jupiter Temple in the Old Town was turned into St. John’s Baptistery, Diocletian’s mausoleum changed to a cathedral, and the Palace peristyle became a church court. Changing demographics and rulership over the ages meant adapting and altering heritage. The transformation of the Palace and surrounding Christian complexes attests the continuity of urban tradition and heritage in Split (Jović Gazić, 2010, pp. 154, 171-173; Split-Dalmatia County Tourist Board, 2020b).

Inland from Split was Salona, the ancient capital of Roman Dalmatia (see Figure 13). While there is no direct continuity from the Romans in Split, the “Roman tradition” carried on when Salonitans moved into the Palace – an “ideal nucleus for a new urban community” – in the seventh century following the fall of Salona. The growth of medieval Split truly began after the reorganization of the Palace space (Jović Gazić, 2010, pp. 152-172).

Figure 13. Ruins at Salona: The present-day archaeological park of Salona is slightly inland from Split but used to be the hub of Roman Dalmatia. Today, visitors can explore ruins of urban life, including buildings and an amphitheater, and walk along Roman roads. Photo by author, June 2018.
Split’s plethora of built heritage is a draw for tourists. The old limestone streets and architectural structures in Diocletian’s Palace have served as a filming location for the award-winning television show *Game of Thrones*. The growing popularity of the show over its eight seasons drew an entire legion of fans to Split and its mythical landscape, where there are now entire tourist packages, cruises, gift shops, and more devoted to touring the sites seen on-screen and buying merchandise. TV show fans aside, many others are also drawn to explore Split’s architectural heritage every year. The Croatian Ministry of Tourism (2018) presents data showing that the number of tourist arrivals to Split in 2018 jumped from just over 720,000 to just shy of 860,000 – a roughly 20% increase (Republic of Croatia Ministry of Tourism, 2019, p. 32).

**Landscape Heritage**

Human interaction with the physical environment did not end with just the cityscapes. A plethora of examples of human interaction with the landscape lay not far beyond the urban sprawl of these walled cities.

*Ugljan Island*. Central Dalmatia is home to over 1,000 islands, but only around 70 of them are inhabited. These islandscapes too have long-standing histories of sporadic human engagement, abandonment, and culture change; the footprint of anthropogenic engagement in the landscape is evident. On the island Ugljan, off of Zadar, one can readily see evidence of human activity and cultural heritage in its small urban settlements but more predominantly in the form of agricultural landscape heritage (Baric et al., 2008; CIA, 2018).
Similar to much of coastal Dalmatia, the soils on Ugljan are poor for wide-scale agriculture. As such, humans relied on investments of landesque capital (Håkansson & Widgren, 2014). Evidence of terraces for maintaining agricultural productivity over many seasons and stone walls for grazing sheep and field clearance are found over Ugljan’s hills, now mostly shrouded in a covering of maquis, or scrubland, vegetation. As demographics shift and people abandon the landscape, the vegetational response is case-in-point for the role humans play in maintaining these sorts of ecosystems. Terraces retain soil moisture (especially important in an often hot, dry environment) and can maintain productivity past the life cycle of one crop (Civello, 2015; Papayannis & Sorotou, 2008).

Other agricultural heritage activities on Ugljan Island include the cultivation of olives, grapes, lemons, oranges, and figs. Groves of olive trees and household grapevines readily seen today across the agricultural landscape and in household lots signify the continuation of these traditional broadly Mediterranean and Croatia-specific heritage activities. These key elements are also exemplary of landscape change over time with human action or inaction (Papayannis & Sorotou, 2008; van der Sluis et al., 2014).

The construction and presence of stone walls for sheep pastoralism is another form of landscape heritage on Ugljan Island. Croatian farming dates back to the Neolithic. Agriculture and animal domestication were in full force by 7,000 years ago. Sheep were one of the first and most popular domesticates to Croatia. Animals like sheep, as well as goats and cattle, are able to eat shrubs and vegetation on the landscape indigestible to humans. Being able to consume the meat, milk, make cheese or butter, and take the animal hide for material goods provides humans a nuanced way of interacting
with the environment. Because of the thinner soils and high prevalence of limestone rocks and karst topography in Croatia’s Mediterranean climate along the coast, there is less directly arable land. As such, sheep and goat grazing are common ways to still get the most out of the landscape (Civello, 2015; Papayannis & Sorotou, 2008). Today, the remnants of old pastoral stone walls interspersed with olive groves and maquis vegetation are common across rural Ugljan Island (see Figure 14).

![Figure 14. Ugljan Island's Agricultural Landscape: Stone walls (intact or otherwise) are remnants of Ugljan’s pastoral heritage. Olive trees, multiyear crop investments, are littered across the landscape. Mediterranean shrub, or maquis, vegetation slowly ebbs into former pastures. Photo by author, May 2018.](image)

Tourists are drawn to the romantic notion of small Mediterranean coastal urban and agricultural settings of Ugljan Island. Due to its proximity to and easy access via ferry from Zadar, it is a popular tourist destination in the region. The Croatian Ministry of Tourism (2018) reports that in 2018, Ugljan Island received just over 34,000 tourist arrivals, up 7% from the 32,000 in 2017 (Republic of Croatia Ministry of Tourism, 2019, p. 32).
**Primošten Viticulture.** Grapes are a critical component of the long-standing Mediterranean agrosystem and Croatia’s agricultural heritage. Wine production has been a significant industry historically, and it continues to be a large economic sector and major draw for tourism (Butzer, 1996).

The present-day Primošten Vineyards at Bukavac Veliki, situated three kilometers south of the town of Primošten along a hillside on the Adriatic, are the culmination of a long-standing wine-making tradition. The soils along the slopes are thin, poor, and rocky. Growers over the years have figured out a system of removing and situating the rocks in symmetrical rows of lots or grids to create the perfect growing conditions for grapevines. This system is sensitive; it is dependent on a significant amount human labor investment to be maintained, and the quality of the grapes would most certainly suffer with land abandonment. The rows of planted vines of the high quality, indigenous Croatian Babić grapes have been traditionally maintained over the years and create the unique symmetrical stone-lace lotting method for which Bukavac Veliki is known. These stone drywalls, characteristic of Dalmatia, create a unique cultural heritage that shows the legacy of centuries of human labor input. The method of creating this particular stone gridwork at Bukavac Veliki is now recognized on the UNESCO List of Intangible Cultural Heritage in Croatia, and the vineyards are on the list of suggested World Heritage sites (Fraga et al., 2012; Omazić et al., 2020; Santillán et al., 2019; Šestan, 2013; UNESCO, 2007).

**Zadar County Aquaculture.** Present-day Croatia’s geographic location on the Adriatic Sea provides ample access to marine resources. Fishing is a traditional subsistence method and heritage activity along the Adriatic Coast. The rich maritime
resources have been a draw for human occupation in Croatia for millennia. Catches such as sea bass, tuna, mussels, and oysters have been on the dinner table and providing sustenance since at least the Roman period – a testament to the historic time depth (Bekker-Nielsen & Bernal Casasola, 2007; Zadar County Development Agency, 2010). Today, fish is still a staple in the Mediterranean diet. The traditional Mediterranean diet is included on UNESCO’s List of Intangible Cultural Heritage in Croatia (Martínez & Tena, 2010).

The traditional activity of fishing still continues, and it also takes on a different form that is growing in popularity: aquaculture. Over the past twenty years, aquaculture has also grown in Dalmatia. Zadar County has the highest percentage of aquaculture shares in the country, with thirty-five companies spreading over the zoned aquaculture areas of the sea. This aquacultural system is made up of floating cages that create rectangular or circular designs on the sea. For these marine systems, the majority of fish are finfish, pelagic fish, and shellfish. Atlantic bluefin tuna are especially prevalent, and most are exported to Japan to their fish markets (FAO, 2005; Republic of Croatia Ministry of Agriculture, 2015). These systems are dependent on human labor for maintenance, and the fish and shellfish themselves are sensitive to changes in water quality and condition.

One such example of an aquaculture pen for tuna is 200 meters off of Ugljan Island. Here, seabass, tuna, oysters, and mussels are among the primary products. Similar to the forests and agricultural sectors, fisheries also require input in labor from people, and maintaining these systems takes work and monitoring (Šegvić Bubić et al., 2011). Spotting these floating cage systems from land, boat, or plane, one can see the example of
maricultural heritage and testament to the long-standing tradition of utilizing sea food resources (see Figure 15).

![Aquaculture Near Ugljan Island](image)

**Figure 15.** Aquaculture Near Ugljan Island: Tuna pens are seen here off the west coast of Ugljan Island. Photo by Greg Zaro.

**Conclusion**

Cultural heritage abounds in Central Dalmatia and serves as testaments to urban tradition and continuity of cityscapes and agricultural and maritime landscapes through various social changes and reorganizations. The internationally agreed upon definitions and examples of cultural heritage broadly and in Croatia in particular build a framework for research and illuminating contemporary issues going forward. They set up the importance of cultural heritage for identity and values and have critical implications for the economy and country as a whole in light of issues facing Croatia due to climate change.
CHAPTER IV

AT THE INTERSECTION OF CLIMATE CHANGE AND CULTURAL HERITAGE

Introduction

Climate change poses various risks to cultural heritage sites globally. Communities have responded to climatic changes in the past, but recent anthropogenic climate change presents a risk that is unprecedented in terms of the pace and magnitude of change. In Croatia, urban, landscape, and seascape heritage sites are threatened by climate change’s negative consequences. Some of these sites or monuments within these areas have been deemed worthy of protection because of their “outstanding universal value,” while the rest may not be recognized by an international organization but are still valuable examples regardless. The heritage examples from Croatia’s Adriatic region from Zadar to Split highlight the intersection of cultural heritage and climate change and provide valuable insights into the vulnerabilities of city-, land-, and seascapes globally. The examination of these heritage sites has vital implications for identity, urban development, and tourism – other industries compounded by climate change and dependent on the protection of heritage. Despite the current and potential degradation of heritage in the face of climate change, cultural heritage sites and the protection thereof in Croatia can offer a connection to climate change mitigation, adaptation, and resilience.
Climate Change and Built Cultural Heritage

Iconic examples of the threat of climate change on urban cultural heritage in the Mediterranean abound; many may think of places like Venice, for example, with sea-level rise flooding its canals and plazas and making international headlines. The cities of Zadar, Šibenik, and Split offer often less publicized but still valuable case studies in the intersection of climate change and cultural heritage.

Zadar

Zadar is not immune from the physical effects of climate change on cultural heritage. The city of Zadar has maintained ebbs and flows of people and an urban tradition for over two thousand years. As described in the previous chapter, the oldest section of Zadar, the Old Town, is situated on a peninsula jutting out into the Adriatic. Because this peninsula is barely situated above sea level, it is particularly at risk to inundation from sea-level rise. Sea-level rise alone, even more so coupled with more intense storms, poses a threat to parts of the Venetian walls and historic buildings along the edges (Climate Change and Cultural Heritage Working Group; International Council on Monuments and Sites, 2019; UNESCO, 2016).

Similarly, although the majority of annual precipitation might be shifted to one season, more intense rainfall events have major implications for cultural heritage in Zadar. Like sea-level rise and intense storms, isolated intense rainfall can cause flooding in the Old Town, damaging foundations of buildings, monuments, and cobblestones – largely made of limestone. With the lack of drainage infrastructure for large volumes of rainfall in a short amount of time and miniscule elevation change over the Old Town,
water would readily pool and flood. Heavy wind and rain also threaten the limestone building and monument facades, like those of Zadar’s episcopal complex and the three walls. Any industrial pollutants that cause acid rain would be especially dangerous, facilitating limestone erosion. Increased humidity and precipitation can also degrade frescoes, like those in Zadar’s churches (Climate Change and Cultural Heritage Working Group; International Council on Monuments and Sites, 2019; UNESCO, 2016).

Severe precipitation events are already revealing what damage can be done in Zadar’s Old Town. In September of 2017, an intense, fast-moving rainstorm swept across Zadar. In a twenty-four-hour period, the city experienced record-breaking rainfall – over 350 liters per square meter. This total is more rain than had fallen in the previous months, and three times more rain than would normally fall over the month of September over the entire region. Following a particularly dry summer, this amount of rainfall proved disastrous. Streets in the Old Town flooded, inundating shops, restaurants, and living spaces. The storm knocked out electricity, made water undrinkable, and transportation impossible (Babić, 2017; Milekic, 2017). Stories of the effects of storms like the one outlined here have not been uncommon in Croatia historically and will be increasingly headline-dominant as extreme weather events ramp up due to climate change in Central Dalmatia (UNDP, 2008).

Moreover, changes in humidity and in conjunction with increasing average temperatures in the summer due to climate change also threatens Zadar’s urban heritage. Wooden framework structures inside of historic buildings, such as the stairs in the bell tower of the Cathedral of St. Anastasia, may risk warping, splitting, and fracturing under
Šibenik faces similar challenges to Zadar with regard to climate change and its impact on cultural heritage physically. Situated at about sea level, rising sea-levels nip at historic buildings on the water. The UNESCO-protected Fortress of St. Nicholas, on an island offshore, is at risk of inundation and erosion as waves from sea-level rise and more frequent intense storms crash into the fortress walls. The lower streets of the Old Town meet the sea and are at risk of coastal erosion and inundation, as well as receiving excess runoff water from upslope. The integrity of buildings may be compromised because of extra humidity and ground saturation (Climate Change and Cultural Heritage Working Group; International Council on Monuments and Sites, 2019; Šibenik Tourist Board, 2020; UNESCO, 2016).

While Šibenik faces similar challenges to Zadar with regard to increased rainfall, pollutant acid rain, and storm intensity causing erosion of the built cityscape, including its UNESCO-protected Fortress of St. Nicholas and Cathedral of St. James, the topography of the landscape differs and thus impacts how climate change variables will cause damage. Heavy localized precipitation events can cause flooding in Šibenik’s Old Town as well as carry soil and runoff from the surrounding hills. Intense precipitation coupled with increased temperatures and summer drought and associated forest fire hazards may destabilize the vegetation on the hillside, potentially leading to erosion on slopes surrounding the Medieval Fortress of St. Michael and fire risk spreading into the

**Split**

Split also is witness to the negative physical effects of climate change on cultural heritage, including sea-level rise, intense precipitation events, summer drought, and increasing temperatures. Out of the list, perhaps the most notable threat to cultural heritage due to climate change is sea-level rise. Diocletian’s Palace, as detailed in the previous chapter, is on the shore of the Adriatic. The riva, or promenade, seen along the water in present-day Split, is only around two centuries old, but it is constructed right at sea level. Rising sea levels mixed with heavier storms when they occur can spell disaster for the front walls of Diocletian’s Palace (Climate Change and Cultural Heritage Working Group; International Council on Monuments and Sites, 2019; UNESCO, 2016).

Maybe more at risk than the walls to flooding from sea-level rise and damage from strong storm surges, however, are the cellars of Diocletian’s Palace. In the age of Diocletian, the cellar, situated under the structure and streets of the Palace-turned-Old-Town-center, was historically used for housing and food and water storage. In the Middle Ages, when the palace reorganization into living complexes began, the cellar was used for sewage and garbage purposes. Excavation in the nineteenth century cleared out the cellars (Hvilshoj, 2013). Today, the cellars of Diocletian’s Palace are a popular place for palace tours, art exhibits, special events, and vendors to sell Split-related and Croatian cultural heritage tchotchkes to passersby. Strong storms and heavy rainfall could and
already easily flood into the basement (Climate Change and Cultural Heritage Working Group; International Council on Monuments and Sites, 2019; UNESCO, 2016).

As is the case with Zadar and Šibenik, the limestone architecture and monuments in Split, such as the Cathedral of St. Domnius, Diocletian’s Peristyle, and the Jupiter-Temple-turned-baptistery, are subject to degradation from heavy wind and rainfall and erosion from potential acid rainfall from pollutants in the atmosphere. The same can be said about architecture and monuments at sites that many come to Split to also visit, such as Salona, the former capital of Roman Dalmatia and now an archaeological site open for visitors, and Klis, a Medieval fortress in the mountains that separate Split and the coast from the Dalmatian hinterlands (Climate Change and Cultural Heritage Working Group; International Council on Monuments and Sites, 2019; UNESCO, 2016).

Prolonged drought and high temperatures in the summer create a recipe for fire and fire damage to urban heritage and infrastructure. Historical data from the past century since 1931 reveals a trend towards hotter, and dryer annual temperatures along the Dalmatian Coastline, setting up an ideal environment for increased fire threat (Zaninović, 2008). In the July of 2017, a forest fire likely sparked by drought outside of Split rapidly spread twenty kilometers through the villages and suburbs, damaging homes and the surrounding landscape (Ilic, 2017). Such a scenario could have serious negative consequences for urban heritage in the Split historic core, as well as for the urban heritage in surrounding Salona and Klis. Increased temperatures and lack of rainfall in the summer months due to climate change could cause an increase in fire events such as this one in Split. These temperature and precipitation conditions followed by extreme weather events can lead to significant soil erosion.
Climate Change and Landscape Cultural Heritage

Land- and seascape heritage along the Adriatic Coast of Croatia are already feeling the effects of climate change. While none of these examples are formally recognized by UNESCO as designated World Heritage sites, they serve an important function to the local communities and to the country as a whole as repositories of local and national heritage.

Ugljan Island

Ugljan Island is covered in evidence of past human activity and changes in land use. Climate change poses a destructive threat when it comes to rising sea levels, increasing temperatures and aridity, and more frequent higher magnitude weather events. The main port centers on Ugljan Island are at lower elevations. Sea-level rise and waves from storm surges degrade the historic buildings, made of limestone just as the ones on the mainland are. Intense winter rainfall events can cause flooding and standing water due to inadequate drainage (Civello, 2015; Climate Change and Cultural Heritage Working Group; International Council on Monuments and Sites, 2019; Papayannis & Sorotou, 2008; UNESCO, 2016).

The agricultural cultural landscape consists of remnants of stone pens and terraces scattered over Ugljan’s rolling hills. Examples of landesque capital as mentioned in the previous chapter, these pens and terraces retain soil and moisture, and they increase productivity. More rain over a shorter timespan can result in erosion of this landscape, breaking the stones down and causing mudslides, especially when the topsoil is dry because of an extended period of drought (Civello, 2015; Climate Change and Cultural
Similarly, the groves of olive trees and household grapevines and gardens are at the mercy of the weather. Erosion of these landscapes will follow heavy rain events after extended periods of drought. Heatwaves and extreme temperatures in the summer may go above the threshold for olive trees and grapevines, for example, leading to a decrease in crop yields. Olive orchards take years of labor investment and maturation to become productive. Because of this, destruction of the crops would mean it would take years to get back to that same productive state (Civello, 2015; Climate Change and Cultural Heritage Working Group; International Council on Monuments and Sites, 2019; Papayannis & Sorotou, 2008; UNESCO, 2016).

**Primošten Viticulture**

The present-day Primošten Vineyards at Bukavac Veliki are the culmination of a long-standing wine-making tradition. The rows of planted vines of the best quality, indigenous Croatian Babić grapes have been traditionally maintained over the years and create the unique symmetrical stone-lace lotting method for which Bukavac Veliki is known. Extreme precipitation events, wind, and the drying out of topsoil from heat waves and prolonged drought conditions from the summer create a recipe for erosion and topsoil runoff, ruining the potential yields. High winds from more intense storms can break branches. Exceedingly hot, dry summers increase the likelihood of fire, which could also destroy the vines. On the converse, excess rain allows for rot and disease to ruin the vines as well. When these crops are damaged, it takes time and labor investment to build up
and cultivate productive capacity again (Fraga et al., 2012; Omazić et al., 2020; Santillán et al., 2019; Šestan, 2013; UNESCO, 2007).

Not only does climate change affect the ability for the vines to grow in the first place, it also affects the growing season. The grapes are sensitive to changes in distribution of temperature and precipitation. Grapes need cool temperatures during the wintertime for the buds to properly develop. As average winter temperatures warm, the proper development of the grape buds becomes threatened. Temperature fluctuations over the growth cycle of the grapes can affect sugar quantity, acidity, and yield, though this varies from year to year, creating an unstable harvest in terms of numbers and quality annually. Temperature extremes can prove detrimental, decreasing yields if vines are damaged by unpredictable frosts in the wintertime or by long-lasting stretches of high temperatures in the summertime. Too little precipitation will stunt development and too high a humidity will create an environment welcome to pests and disease (Fraga et al., 2012; Omazić et al., 2020; Santillán et al., 2019; Šestan, 2013; UNESCO, 2007).

**Zadar County Aquaculture**

The aquaculture pens off of Zadar and Ugljan Island are an example of the continued tradition of fishing and fish harvesting along Croatia’s Adriatic Coast. As noted, in the waters of Zadar County, seabass, tuna, oysters, and mussels are among the primary products. These maricultural systems, however, are particularly vulnerable to climate change (FAO, 2018; Rodrigues et al., 2015).

The fish and shellfish themselves are vulnerable to changes in water temperature, acidity, and salinity. As the sea acts as a sink for heat and carbon dioxide, the sea surface
temperatures increase and the acidity decreases. Seabass, tuna, oysters, and mussels do not tolerate these conditions too well and therefore yields and catches decrease. Rising sea levels and an increase in extreme weather events can damage fishing infrastructure, be it boats, rope used on which to grow oysters, or pen enclosures for fish (FAO, 2018; Rodrigues et al., 2015).

Discussion

The physical ramifications of climatic change along Croatia’s Adriatic Coast are detrimental in their own right. Through its impact on cultural heritage, climate change creates a compounding issue for and secondhandely affects the tourism industry, urban development, and local identity.

Tourism

Tourism to cultural heritage sites, including ancient cityscapes, renowned vineyards, island landscapes, and seascapes along Croatia’s coastline are threatened by climate change. Climate change is causing and will exceedingly continue to cause an overall increase in temperatures, decrease in precipitation, shift in frequency and intensity of extreme weather events, and rise in sea level.

An increase in temperatures and an expansion in the number of warm days a year affect the tourism industry in Croatia. Croatian coastal tourism season falls over the summer, peaking in late July and early August. Coastal tourism relies heavily upon good quality, warm days during this peak season for explorations of old cityscapes and
historical landmarks, vineyards, and classic Mediterranean island-, land-, and seascapes. As such, warmer weather will encourage tourism – to a point.

This is true for cities such as Zadar, Šibenik, and Split. The growing publicization of Zadar as an idyllic Eastern Adriatic ancient cityscape coupled with more favorable conditions for exploration of the Old Town and surrounding landscape make Zadar a popular destination. Tourists may also be more inclined to visit the agricultural heritage of island landscapes, like those on Ugljan Island, or take trips to vineyards like the famous ones of Primošten.

In the coming century, climate change might shift the distribution of Mediterranean tourism, drawing attraction from places in the southern basin northward to Croatia’s Adriatic Coast. Long hot and dry spells could lead summer tourists that would normally favor countries such as Greece to opt to go to more bearable summer conditions in Croatia. Tourists could still experience the “traditional” Mediterranean tourist package in a more comfortable way. This may drive more and more people from the rural countryside to cities such as those in Central Dalmatia to engage full time in the tourist industry through avenues such as apartment rentals, food vendors, other service industries. Likewise, the rural-to-urban migration spurred at least partially by tourism results in land abandonment and a loss of labor investment into landscapes, negatively affecting landscape heritage – a central draw for tourists.

However, it might eventually get too hot. Many tourists may be deterred by the exponentially increasing temperatures that are expected in the coming decades due to anthropogenic climate change. Coastal tourism may transition up the Adriatic Coast to the north, opting instead for exploration of city-, island-, and seascapes of that region.
Although tourists often come to Croatia for “sun and sea,” too much heat could actually drive tourism away from the Adriatic Coast (Šverko Grdić & Krstinić Nižić, 2009, p. 30).

The overall trend of more prolonged dry spells and drought conditions during the summer affects hydrology and leads to a depletion in freshwater resources. Drought conditions in the summer, when coastal tourism is at its peak in places like Zadar, Šibenik, and Split, would mean less water for more people living in and visiting the cities. On islands, saltwater intrusion into aquifers decreases the available freshwater for consumption as well. This depletion in resources would prove detrimental for human health and livelihoods (Republic of Croatia Ministry of Environmental and Nature Protection, 2014).

In addition, although forest fires are a part of the natural processes of the hinterland of the Dalmatian coast, drier and hotter conditions could shift and prolong the fire season, making it start early and end later. An increase in tourists due to warmer weather could also increase the risk of accidental fires from recreational activity on the coast and on islands like Ugljan. Such an increase in the risk of accidental fire coupled with changes in the natural wildfire regime because of drought conditions, water shortages, and changes in occurrence and intensity of precipitation could negatively affect agriculture, destroying crops such as olive groves and grapevines that are staples for the tourist industry, not to mention placing a limit on where and when tourists visit (Republic of Croatia Ministry of Environmental and Nature Protection, 2014).

Temperature increases because of climate change also affect human health. The warmer weather shifts the geographic range of species closer to the poles and/or to higher elevations. As such, a warming climate in Croatia will facilitate the movement of vector-
borne illnesses and disease-carrying mosquitoes and ticks (Republic of Croatia Ministry of Environmental and Nature Protection, 2014). Hotter temperatures also increase the prevalence of heat stroke and cardiovascular complications (UNDP, 2008). Tourists may eventually not want to risk visiting during the summer because of the dangerous heat and potential risk of health complications and vector-borne disease.

Because of all these factors – increased temperatures, drought – and their associated impacts combined, climate change has the potential to alter the seasonality of coastal tourism. Eventually, the persistence of hotter, drier summers will discourage summer tourism during the hottest months. It could even force the tourist season to split into two distinct seasons, one in spring or early summer and one in early fall when temperatures are more bearable (Mahečić Bajović, 2009).

Moreover, sea-level rise poses one of the biggest threats to tourism in Croatia. The geographical positioning of Croatia’s Eastern Adriatic coastal cities such as Zadar, Šibenik, and Split was strategic. Congregating near the water creates accessibility to vital resources and economic opportunities, but also creates vulnerability to the adverse effects of climate change and puts cities and their tourism industries at risk (Mooney, 2018). As mentioned in the Sixth National Communication and First Biennial Report of the Republic of Croatia Under the UNFCCC:

The centers of historical coastal cities represent the most valuable cultural heritage of the Republic of Croatia and they are among the main tourist attractions. The rough analysis indicates that numerous city centers will be in trouble caused by sea-level rise, particularly by stormy weather. (Republic of Croatia Ministry of Environmental and Nature Protection, 2014)
Sea-level rise, coupled with the increase in extreme weather events and winds, creates the risk of flooding and erosion of what tourists come to coastal Croatia to see: historic landmarks and ancient cityscapes in Zadar, Šibenik, and Split alike; agricultural heritage in the form of terracing and old olive groves, for example, on Ugljan Island; the vineyards at Primošten; and seascape heritage and mariculture in Zadar County. These adverse effects of climate change on the Adriatic Coast would decrease tourists’ desires to visit these city-, land-, and seascapes (Peleikis et al., 2014, p. 7; Republic of Croatia Ministry of Environment and Nature Protection, 2014; UNDP, 2008, p. 177).

**Urban Development**

Not only does climate change have implications for those visiting ancient cityscapes like those in Zadar, Šibenik, and Split, it has implications for those who already call these cities home. The tourism industry is a major employer along Croatia’s Adriatic Coast and pulls many from rural jobs into the cities, so any decrease in tourism might land people out of jobs. Croatia is already witnessing youth outmigration and rural-to-urban migration. The changing nature of the landscape due to climate change also drives people away from the landscape or changes the way in which they use or interact with the land. Human input is paramount for maintaining the systems in cases such as Ugljan Island’s landscape, the vineyards of Bukavac Veliki in Primošten, and the mariculture of Zadar County. Additionally, urban development can lead to the destruction of archaeological sites. The absence of human engagement in these land- and seascapes, even coupled with changes in land use because of increased urbanization and pressures of increasing tourism, most certainly affects the heritage of the sites.
Identity

Croatia’s identity is neither homogenous nor immutable. It has evolved over numerous political regimes and thousands of years of occupation of people of varying ethnicities, religions, and cultures within the present-day geopolitical borders. Identity is intertwined with a sense of place and shared culture; the connection to history is shown both in the heritage of the built environment and in landscape and seascape heritage.

This connection to cultural heritage drives inhabitants to protect and to value sites, but it has also driven people to destroy heritage. During the Balkan Wars in the ‘90s, destruction of cultural heritage was used as a tool of deliberate erasure and to rewrite history (Bevan, 2007). As mentioned in the 2016 Tim Slade documentary *Destruction of Memory*, “People are people within their place. Their history, their identity, how they draw meaning about who they are happens in a place. And what happens to that place matters. Those buildings are part of who they are” (Slade, 2016).

Following the wars in the ‘90s, Croatia’s identity again was met with a new challenge of redefinition as an independent nation. (For more on the issues surrounding a creation of a national Croatian identity, see Goulding & Domic, 2009.) Because of various ethnic and religious groups who call Croatia home, the protection of cultural heritage can ideally allow for the transmission of values and culture-sharing that is crucial to understand others and thriving in an increasingly globalized world (Aplin, 2007).

Like war, climate change is another agent of destruction and has the power to wreak havoc in similar ways on cultural and place-based identity. Because there are
different ethnic groups and religions that value their cultural heritage within the borders of Croatia, the questions arise with respect to what and whose heritage merits protection. Preservation should recognize the multiplicity of Croatian identity (Climate Change and Cultural Heritage Working Group; International Council on Monuments and Sites, 2019).

With climate change’s various physical impacts and potential degradation of the material and monumental cultural heritage itself, it also has the potential to damage local identity. The anthropogenic time depth of Zadar’s, Šibenik’s, and Split’s cityscapes is evident in the cities’ mashups of architectural heritage. While these mashups are sometimes contentious and may reflect the narratives of only certain groups of people, they create a sense of interwoven history (Creighton, 2007). Sites in the Old Towns reflect what the people of the cities and the country value and want to protect; the knowledge of the history of these cities is passed on from one generation to the next in this way. If these cities lose those sites, they lose a part of themselves, as their inhabitants lose a slice of their tangible history and identity (Mimar Sinan University of Fine Arts, 2014).

The same is true for landscape heritage. Ugljan Island holds a valuable history of agricultural use and abandonment written into its karst topography and landscape. The olive groves, old pens for sheep grazing, evidence of Mediterranean house lot garden crops such as figs and citrus fruits and grapevines, dotted across the island’s rural and urban landscape are part of its identity. Losing such crops and landscape to drought, erosion from climate change, in combination with outmigration of people who tend to the landscape, means losing part of that Mediterranean island identity. Rural-to-urban migration driven by tourism leads to forest and maquis vegetation regrowth, engulfing
landscape heritage and leading to a homogenization of landscape. Homogenization of floral and faunal communities and the subsequent loss of biodiversity that is often encouraged by human investment makes it harder for these communities and landscapes to respond to and buffer the risk of climate change (Makhzoumi & Pungetti, 2008; van der Sluis et al., 2014).

Viticulture is a staple of Croatia’s national identity. This is especially true in Dalmatia. World-renowned Babić grapes and the unique stone plots at Bukavac Veliki and the Primošten vineyards contribute to the identity of the region and Croatia’s propensity for viticulture on the whole. The potential degradation of the land on which the grapevines grow, the damage to the vines themselves, and variability in climatic conditions making for erratic harvests and quality yields threatens the crops, thereby threatening the identity as well.

A similar scenario plays out in nearby Zadar County maricultural endeavors. Fishing has been a part of Eastern Adriatic heritage for millennia, since before the Classical Era. The destruction of the aquaculture infrastructure as well as the alteration of ideal conditions for fish and shellfish make it hard to maintain the fishing identity.

In combination, climate change indicators have the capacity to erode infrastructure and landscape. The physical effects of climate change on built and landscape heritage have secondary impacts on tourism, urban development, and cultural identity, all of which are vital to the culture, economy, and inhabitants’ connection to place.
**Opportunities**

Despite the current and potential degradation of heritage in the face of climate change, cultural heritage sites and the protection thereof in Croatia from Zadar to Split can offer a connection to climate change mitigation, adaptation, and resilience. UNESCO (2016) and ICOMOS (2019) attest heritage sites are “climate action assets” – they offer models for climate change mitigation and adaptation strategies. Cultural heritage sites are locations on which people have placed a designated value; they cultivate a sense of community and shared identity. Knowing what people value – in a city, a landscape – can help stress the urgency of the climate crisis and guide decision-makers in the implementation of protective measures. Understanding local community feedback – how the community views heritage, what they value, and what their needs are – is critical in creating a common goal for promoting protection. Having an interwoven history, a sense of community, and a common goal through cultural heritage can bond people together in the face of a crisis that will continue to wreak havoc over the coming century, building a resilient foundation and sparking creative solutions (Climate Change and Cultural Heritage Working Group; International Council on Monuments and Sites, 2019; UNESCO, 2016, 2020b).

In addition, recognizing traditional landscape and seascape practices can be guides for more sustainable land use practices and adaptation in the face of climate change. Longstanding examples of cultural heritage are often exemplary of sustainable practices as there has been a maintained balance and coevolution between local ecology and human action. The issues Croatia’s Eastern Adriatic Coast faces due to climate
change is not a new issue – there is only a difference in magnitude, not kind. Examining heritage sites of the past, like those of Dalmatia from Zadar to Split, can prove valuable in reassessing how humans have adapted and interacted with the city, land, and sea over the years. Understanding this interaction with the landscape through cultural heritage sites can supply information for how to mitigate and adapt to the effects of climate change in an equitable way (Aplin, 2007; Climate Change and Cultural Heritage Working Group; International Council on Monuments and Sites, 2019; UNESCO, 2016, 2020b).

Mitigation and Adaptation

As noted above, climate change has the potential to significantly alter the face of cultural heritage along Croatia’s Dalmatian Coastline. The next step forward will be to tackle issues of mitigation and adaptation. Exploring mitigative and adaptive strategies against climate change for cultural heritage is a relatively new line of inquiry. For sites along the Dalmatian Coast, mitigation against and adaptation to the effects of climate change will be widely place-specific and based on local vulnerabilities, risk factors, and adaptive capacities. All efforts to address the short- and long-term protection of cultural heritage should include an integrated approach (Colette, 2007; Sesana et al. 2018).

Mitigative strategies are central in any approach to move forward with the protection of cultural heritage. First and foremost, climate change mitigation strategies should be anchored in community involvement, local values, and local ecology. Such an approach is important because local communities are the immediate gatekeepers of cultural heritage and most affected by potential degradation, and the community-based approach recognizes the interconnectedness of humans and the environment and resulting
knowledge systems. Mitigation strategies might start with an investigation of the role heritage sites and their associated uses, management, and tourism play in both greenhouse gas emissions and sequestration. A combination of local stakeholders – elected/appointed officials, business leaders, scientists, anthropologists, and the K-university educational community can and should develop short- and long-term plans to develop mitigation objectives. While such a task force might appear cumbersome, it is imperative that strategies get discussed and implemented without delay.

Landscape heritage, such as the landscape mosaic of Ugljan Island, can be an example of sustainable land use strategies; they capture runoff, reduce erosion, sequester carbon, and provide local food supplies, for instance. Learning from these past methods in sustainability, promoting the safeguarding of these types of landscape heritage, and educating on why protection is beneficial can ensure a biodiverse, flexible landscape that can play a role in sequestering carbon and mitigating against the adverse effects of climate change. While landscape heritage sites in Croatia might not cover massive swaths of land or sequester egregious amounts of carbon, the protection of such sites partly in the name of mitigation can serve as a model for others globally.

Climate change mitigation in built heritage should both promote energy efficiency at heritage sites as well as promote sustainable, green tourism. In Croatia, local stakeholders might work with organizations under national and international recommendations to retrofit Old Towns, buildings, and monuments to be more energy efficient. Lighting, appliances, and transportation methods, for instance, could transition to lower carbon alternatives.
Another mitigation strategy for Croatian built heritage, as well as for landscape heritage such as viticulture that is heavily interwoven with the tourism industry, would be to push for more energy-efficient, green tourism and agrotourism. This strategy would require collaboration between the Ministry of Tourism, Ministry of Culture, local and regional organizations, climate scientists, and the local communities, including the K-university educational community. Green tourism and agrotourism might include the dissemination of educational information created by local students on the value of heritage sites for tourists to understand and lessen their impact on culturescapes, the availability of low-carbon transportation options, sustainable lodging options, advertising excursions to local agricultural endeavors, and the promotion and utilization of local foods in restaurants. (For more on sustainable tourism and development in Croatia, see Beban & Ok, 2006; Cavrić et al., 2008; Cavrić, 2009; Krbec, 2013; Jordan, 2009; Mesić, 2008; and Sarganić & Favro, 2008.)

In many cases, mitigation might not be enough in the long term. It is the flexibility of culturescapes that have allowed civilizations to flourish over the centuries in the Mediterranean Basin; this ability to be flexible and adapt can be what helps carry on local cultural heritage. Similar to mitigative strategies, adaptive strategies should be grounded in the voices and knowledge systems of the local communities, values, and ecosystems. Cultural heritage adaptation should be integrated, tackled by both identifying the physical effects of climate change on heritage sites and understanding the constraints and needs at a local level. This approach is incredibly multifaceted and, as above, requires interdisciplinary cooperation and communication from all levels, from site up to national and international levels. Adaptation should push for increased monitoring of
climate change and risk-preparedness, appropriate maintenance of sites, technological implementations, education and behavioral changes, and the inclusion of climate change and the effects on cultural heritage into policy in order to increase cultural heritage and local community resilience.

At sites of built and landscape cultural heritage, stakeholders might assess and draw up locally relevant plans for climate change monitoring and dispersal of climate information to the wider public through education at the K-university levels. Adaptive strategies should be based on the data from monitoring as well as from assessments on local vulnerabilities and adaptive capacities. Different sites in Croatia might have differing adaptive capacities based on factors such as leadership, informational, financial, and technological barriers, as well as differing perceptions on the threat of climate change.

Cultural heritage adaptive capacity is also affected by whether or not the site is recognized either at a local, regional, national, or international level as protected heritage. The reality is such that cityscapes and built heritage actively recognized and protected by UNESCO, such as Diocletian’s Palace in Split, will more likely receive greater attention. Emphasis to protect may not be placed on other forms of cultural heritage in Croatia, such as island agricultural landscapes, that are not recognized on a national or international scale as being protected heritage, though these culturescapes are as worthy and relevant to aspects of identity. These issues of recognition raise questions about what and whose heritage is worthy of protection. This would be for local combined task forces to address.
With a foundation of understanding of site vulnerabilities and adaptive capacity, different adaptation methods might be implemented based on site-specific ecology and local heritage values. Built heritage can be adapted to the effects of climate change with additional protection to the facades and structures, additional coastal breakwaters and physical barriers, and the improvement of drainage systems. Planting trees, promoting sustainable land use strategies, and technological additions can help landscape heritage adapt to climate change. Landscape strategies anchored in diversity, flexibility, and holism can pave the way for sustainable development and adaptation moving forward, both in urban and rural areas.

However, not all built and landscape heritage can be saved. This is especially true for the sites that are not necessarily recognized by the national government or by international organizations such as UNESCO as World Heritage. In Croatia, with many forms of cultural heritage so close to sea level and with different risks and vulnerabilities, exploring adaptive strategies raises challenging questions about which heritage can be preserved and at what cost. Documentation through technology, including photography, video, geographic information system (GIS) models, and written work, is key in preserving cultural heritage sites in Croatia for education of future generations. These are strategies that are part of best-practices worldwide and apply to the Dalmatian Coast as well.

Mitigation and adaptation coupled together are important facets of the protection of cultural heritage sites in Croatia. It is often hard to take action on a threat that is looming in the future as the effects are not necessarily fully tangible, and there are certainly issues with funding as well as other technological and institutional barriers.
With methods to reduce greenhouse gas emissions and promote sustainability, as well as proactive adaptive strategies, local stakeholders, in collaboration with individuals and organizations at varying levels and disciplines, can work in positive and creative ways to strengthen adaptive capacity and preserve cultural heritage (and thus cultural memory and identity) along Croatia’s Dalmatian Coast.

Current Efforts

There are currently efforts underway to preserve cultural heritage in Croatia. Organizations, educational institutions, and government bodies are at the forefront of preservation. Most came about following the wars in the ‘90s when Croatia was attempting to rebuild and create its own identity as an independent nation. The Croatian Conservation Institute was created in 1996 with the goal to document and preserve cultural heritage (Croatian Conservation Institute, n.d.). Croatia’s Ministry of Culture includes a Directorate for the Protection of Cultural Heritage. Within the Directorate, there are different departments for variable classifications of cultural heritage, including immovable, movable, intangible, architectural and landscape, and archaeological heritage. In February 2020, the Ministry of Culture held a conference in Dubrovnik titled “Fostering European Cooperation for Cultural Heritage at Risk” in order to facilitate collaborative decision-making on risk reduction (Croatian Ministry of Culture, 2020).

The intersection of cultural heritage and climate change is appearing more often in reports and scholarly publications as well. It became a point of focus after UNESCO and ICOMOS publications in the late 2000s and mid-2010s (Colette, 2007). In 2018, the so-called EU “year of cultural heritage,” the European Commission published
“Safeguarding Cultural Heritage from Natural and Man-made Disasters: A Comparative Analysis of Risk Management in the EU” (Bonazza et al., 2018).

Such organizations, government bodies, and publications are attempting to create a framework at the national or EU level to be applied to local levels, understand place-specific risks and vulnerabilities, and promote the documentation and protection of heritage.

**Conclusion**

Alterations in temperature, precipitation, extreme weather event frequency, and sea-level rise due to climate change are paramount problems for cultural heritage in Croatia. Since the Middle Holocene, the pace and scale of climatic changes in the Mediterranean in general and Croatia in particular have allowed for an expansion of human settlement abutting sea level. More recently, anthropogenic forcing has accelerated the pace and scale of climate change. These effects of climate change impact built and landscape heritage along the Adriatic Coast in various ways, such as flooding cityscapes and eroding agricultural zones. This, in turn, affects the tourism industry, urban development, and a sense of local identity as they are interconnected with heritage. The examples of the ancient cityscapes in Zadar, Šibenik, and Split, the landscapes of Ugljan Island and Primošten, and the seascape of Zadar County, taken together, can give a deeper understanding of how climate change will affect cultural heritage.

Cultural heritage sites are already areas deemed valuable to a sense of identity and shared history. These sites provide a foundation for how ideas of resilience and sustainability in the wake of palpable climatic changes can be approached. In addressing
the multifaceted impacts to cultural heritage and how to move forward with opportunities for adaptation, mitigation, and resilience in the face of climate change, it is important to have an equally multifaceted response replete with local community input and interdisciplinary action. The effects of climate change on cultural heritage are not just Croatian issues either – the same holds true for the Mediterranean region and globally as a whole.
CHAPTER V

CONCLUSION

It is a given that the climate has changed globally over the course of the Holocene – be it from natural forcing or, more recently, from anthropogenic climate change. Today, humans are increasingly witnessing the consequences of two-plus centuries’ worth of pumping greenhouse gases into the atmosphere for the sake of industry, progress, technology, and globalization. While initially there was no realization of the impact of industry, the planet is now bearing the burden. Increases in concentrations of carbon dioxide, methane, and water vapor are effectively warming the troposphere, causing upticks in temperatures on a global scale. Exceedingly hot days and extended periods of drought are becoming a more regular occurrence. The carbon dioxide also dissolves into the oceans, slowly but surely increasing acidity and warming the waters. The planetary warming causes a domino effect of impacts, including sea-level rise from melting glaciers and ice sheets, an increase in humidity, and shifting suitable habitats for flora and fauna. The change in the energy balance in the lower atmosphere with warmer near-surface temperatures affects weather patterns. Extreme weather events, including cyclones and storms, are becoming more erratic, sometimes increasing in intensity. Precipitation events may also become more erratic in magnitude and predictability, shifting all to one season in some cases.

The Mediterranean region in general and Croatia in particular has already started to and will continue to grapple with these human-induced climatic disturbances. Over the coming century, the Adriatic Coast of Croatia has and will see a notable increase in
temperatures over the whole year, with especially hot summers and an increase in the number of above-average hot days. The majority of precipitation events will shift to one season – the winter – and summers will be exceedingly dry with prolonged periods of drought. These precipitation events may be stronger in intensity and more erratic to predict. While the seas of the Adriatic have stayed relatively consistent in level, though varying by individual sites, for thousands of years, the effects from melting glaciers and ice sheets at the poles may still add height gradually.

For as long as humans have been on the planet, they have interacted with their environments and adapted to a great variety of climates. The Mediterranean region and Croatia in particular, as evidenced in archaeological and historical records, has been a hotspot for human activity for thousands of years. Croatia’s Mediterranean climate offers excellent growing conditions for a variety of crops, and the Adriatic Coast presents strategic locations for ports and access to ocean resources. Such favorable climatic and geographic factors historically paved the way for the expansion of civilization growth in the latter half of the Holocene.

Cultural heritage sites, urban and landscape heritage alike, are the tangible evidence of the interplay between people, the land on which they live, and the environment. Many of these cultural heritage sites are situated along coastlines, longtime population hubs and regional draws. In Croatia, this is no exception. Major urban hubs – Zadar, Šibenik, Split – lie along the Adriatic Coast and showcase a mix of rich, living history created and altered over thousands of years of occupation. In the Dalmatian hinterlands between them and on islands and waters off the coast, heritage abounds in the
forms of island agricultural landscape on Ugljan Island, viticulture at Primošten, and aquaculture in Zadar County, for example.

Climate change has and will continue to exponentially affect cultural heritage. Over time, this has held true, except today, it is now a difference in pace and magnitude of climatic change and impact rather than type of issue. The examination of the intersection of unprecedented anthropogenically precipitated climatic changes and such examples of cultural heritage along Croatia’s Adriatic Coast emphasizes how vulnerable these cultural environments are, their importance to Croatian culture, economy, and identity, and how the protection of sites can prove beneficial to climate change mitigation, adaptation, and community resilience.

Exploring cultural heritage sites in Croatia and how they will be impacted by climate change is not just important for the country. Climate change will affect cultural heritage sites across the Mediterranean region and across the globe as well. Climate change is a multifaceted issue calling for multidisciplinary, complex, flexible, creative, and collaborative mitigative and adaptive solutions with input from diverse stakeholders, from local populations through global organizations.

Taking note of the importance of cultural heritage to individual communities, countries, regions, and the world is the first step in a glaring call for action for preparation. Cultural heritage sites, industries, various economic sectors all need to prepare for mitigation and adaptation over the coming century.

Global protectors of cultural heritage are only more recently coming around to recognizing and discussing the potential of detrimental impacts of climate change on cultural heritage. This is especially true for not just the Dalmatian Coast and Croatia but
for the entire Mediterranean region. As the corpus of literature addressing Croatia and various regions across the globe grows, it is important to continue the discourse.

The limited research on mitigative and adaptive strategies for cultural heritage in light of climate change highlights the need for deeper and wider future research. Climate change, cultural heritage, identity, and tourism are all extraordinarily connected and complex; there are still many uncertainties. Future studies might include interviews on climate change perceptions in Dalmatia and more in-depth explorations of the sticky issue of identity.
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