

# AJSs

Appalachian Journal of  
Student Scholarship

Volume 1 / Spring 2021



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## **CONTENTS:**

### **EDITOR'S INTRODUCTION**

*The Value of Undergraduate Student Scholarship*  
Dr. Molly Clever

### **SUBMISSION GUIDELINES**

### **ORIGINAL RESEARCH**

*Recognizing Current Threats to the Biology and Habitat of the California Tiger Salamander, Ambystoma Californiense, and Summarizing Conservation Efforts*  
Courtney-Dee Kovar and Jessica LaBella

### **CURRENT EVENTS COMMENTARY**

*How Police Militarization has Affected Protesting in 2021*  
Tera Adkins

*Political Campaigning in the Age of COVID-19*  
Caitlin Cottrell

## **EDITOR'S INTRODUCTION**

### *The Value of Undergraduate Student Scholarship*

Dr. Molly Clever

The landscape of higher education has been undergoing rapid transformation in recent years, and changes that have been further exacerbated by the recent COVID-19 pandemic. Shifts to virtual learning technologies and an increasing focus on labor force preparedness are inevitable consequences of cultural and economic shifts in the broader society. Still, there is a need to retain a focus on the core traditional values of higher education: intellectual curiosity, deep critical thinking, and deliberative research. The aim of AJSS is to promote these core values and to provide an avenue for professional development for students with connections to the Appalachian region.

Our focus on research conducted by or about Appalachians is driven by the recognition that Appalachian scholarship has been historically marginalized in the academy. Appalachian students in particular are underrepresented in graduate-level programs and research careers. Too often, our cultural understanding of Appalachians are driven by negative media stereotypes, rather than by Appalachian voices.

We are proud to launch this inaugural volume of the Appalachian Journal of Student Scholarship and hope to establishing a long-lasting and far-reaching forum to promote intellectual curiosity, professional develop, and societal impact among the next generation of scholars.

## **SUBMISSION GUIDELINES**

Submissions are accepted on a rolling basis. In addition to original research, we accept editorial commentaries on current events as well as film and book reviews.

Submissions must represent original scholarship conducted by an undergraduate student (submissions after the author's graduation are acceptable, as long as the work described in the manuscript was conducted while the author was enrolled as an undergraduate).

Submissions are welcome from undergraduate students at any college or university, although preference is given to scholarship with connections to the Appalachian region.

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# Recognizing Current Threats to the Biology and Habitat of the California Tiger Salamander, *Ambystoma Californiense*, and Summarizing Conservation Efforts

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## ABSTRACT

*Ambystoma californiense* (California tiger salamander) is an endangered species of mole salamander native to central California that is facing threats of extinction at the cost of habitat loss and depletion of vernal pool mating grounds. *A. californiense* has unique breeding patterns initiated by a heavy winter rainfall and concluding in late spring. Due to their seasonal dependence, the mortality rate of offspring is very high. It also has specific habitat requirements and their survival is largely dependent on the presence of rodent burrows (particularly ground squirrels). Not only does the species face intense selection pressures and the threat of hybridization, but it also faces pressure from a boom in industrialization and the agriculture industry. For future conservation, the main focus should be reintroducing the species to historically occupied habitats and maintaining population numbers. This can be done by implementing man made pools that fill and drain in tandem with natural vernal pools. Also, sections of grassland and woodland habitats around the pools should be preserved. The goal of this article is to summarize existing knowledge of the biology and habitat requirements of *A. californiense*, recognize threats to the habitat that threaten the species' survival, explore the current state of species conservation, and identify future conservation efforts.

## KEY TERMS

Ambystoma; Californiense; Salamander; Conservation; Endangered

## INTRODUCTION

As first described by John Gray in 1853, *A. californiense* is a large broad salamander native to California, particularly in areas with fertile river valleys and abundant vernal pool complexes (Figure 1). It is characterized by its dark body and dorsal lines of round yellow spots as well as its relatively large total body length of 17.5-20 centimeters<sup>1</sup>. Closely related to the eastern tiger salamander, *A. californiense* is one of seven ambystomatid subdivisions of *Ambystoma tigrinum tigrinum* (Figure 2). The name *Ambystoma californiense* originates from the Latin *anabystoma* meaning “to cram in mouth” and from the Greek *amblystoma* meaning “blunt mouth”. There have been no revisions to taxonomy and phylogeny since the original naming in 1853.

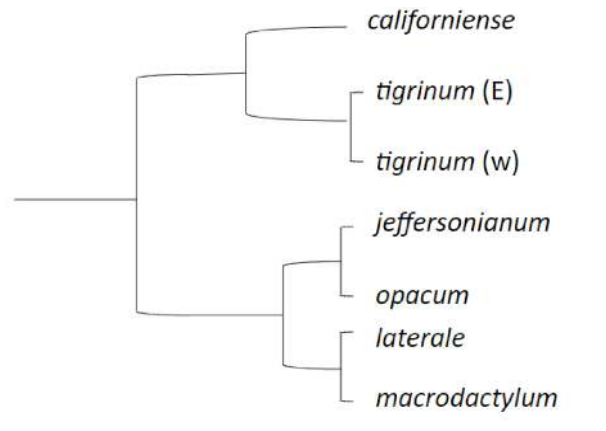
Figure 1. The California tiger salamander, *Ambystoma californiense*



Photo credit: Robert Fletcher/Ohlone Preserve Conservation Bank

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**Figure 2.** Ambystomatidae phylogenetic relationships of mole salamanders.



*A. californiense* has a unique, highly specific mode of reproduction that causes intense breeding pressure due to the extreme dependence of the species on vernal pools, grasslands, and winter rainy seasons<sup>2</sup>. As a result of agricultural and industrial changes to the terrestrial habitat, they are facing extinction throughout their range as part of the global decline of amphibians<sup>3,4</sup>.

In parts of their range, they are listed as threatened and endangered under the U.S. Endangered Species Act and the California Endangered Species Act<sup>5</sup>. All *A. californiense* are federally listed; however, they are listed as three unique entities, or Distinct Population Segments (DPSs). This includes the Sonoma County DPS, the Santa Barbara County DPS, and Central DPS. Under the Endangered Species Act of 1973, listing a population as a DPS takes into account three elements<sup>6</sup>.

The three elements considered are: (1) the discreteness of the population segment in relation to the remainder of the species to which it belongs, (2) the significance of the population segment to the species to which it belongs, and (3) the population segment's conservation status in relation to the Act's standards for listing<sup>7</sup>. The purpose of this paper is to provide a current understanding of the biology, habitat, and conservation of *A. californiense*.

## DESCRIPTION

*A. californiense*, is a large, broad, mole salamander characterized by its dark black or brown body and stark yellow subround spots on the dorsal surface with a yellow ventral surface. They have small internal nares and triangular palatine teeth. Adults may reach 17.5-20 cm in length (body 11.25 cm, tail 8.75 cm). Larvae are yellow/gray and have feathery external gills with a long caudal fin<sup>8</sup>.

### Diet

*A. californiense* has a preference for consuming small crustaceans, snails, and tadpoles as part of a regular diet<sup>9</sup>. Invertebrate prey can be consumed by larvae, along with the tadpoles of California red-legged frogs, bullfrogs, and western spadefoot toads. Adult *A. californiense* can act as lie-in-wait predators at the mouths of burrows and may eat ground-dwelling invertebrates/small vertebrates that are attracted to burrows, like spiders, earthworms, and sometimes aquatic insects. Juvenile mice may also be consumed, and in some cases, cannibalization may occur with smaller salamanders<sup>10</sup>.

### *Reproduction*

*A. californiense* reproduction is universally low, with only about six percent of offspring surviving to maturity. In order to maintain a stable population viability, females must produce at least one male and one female offspring that survive to breed and prevent local extinction<sup>11</sup>. Adult breeding is initiated following rainfall and begins at the onset of the winter rainy season<sup>12,13</sup>. This allows for breeding to occur in ephemeral ponds that fill during winter and dry during summer<sup>14,15</sup>. However, some adults may arrive in October/November, but most arrive December-February and depart February-March<sup>16</sup>. With the arrival and departure of adults, distances traveled to these local ponds can range from 550–3000 m. During drought years, they may not breed at all<sup>17</sup>.

*A. californiense* breeds in ephemeral, seasonal, and permanent ponds that are free of fish and other introduced predators<sup>18</sup>. Their eggs are laid in abundance attached to vegetation in the pools<sup>19</sup>, generally deposited singly or in small groups of less than four. They then hatch two to four weeks after deposition<sup>20</sup>. The developing aquatic larvae grow and mature in these pools for three to six months, at which time they metamorphose and disperse onto the surrounding terrestrial landscape<sup>21</sup>. This metamorphosis begins in the spring and is followed by the departure of the juveniles in mid-late summer<sup>22</sup>.

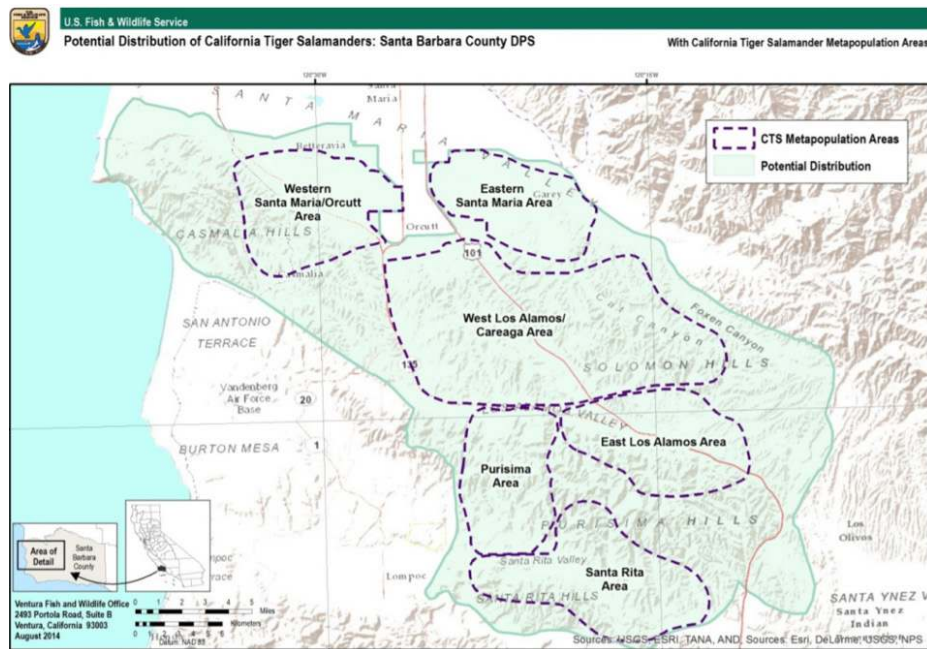
Movement among breeding sites is common in this species<sup>23</sup>. Evidence suggests breeding pond size can affect population size, and there is evidence of genetic variation between ponds<sup>24</sup>. Males have a tendency to stay at the ponds longer than females for more potential breeding partners, and they are also more sensitive than females to environmental cues that initiate breeding<sup>25</sup>. Their migration patterns are influenced by environmental conditions such as rainfall and temperature, with most migration beginning on the last day of storm systems<sup>26</sup>. Females maximize reproductive success by waiting for prolonged periods of ideal environmental conditions before migrating, where they enter ponds in waves that correspond to periods of rainfall<sup>27</sup>. Adults aestivate for the summer in burrows and emerge after autumn rains for mating season<sup>28</sup>. Juveniles were found to move to the most moist microenvironments<sup>29</sup>.

Sexual morphology and social interactions also contribute an important aspect of breeding. Metamorphosis timing can affect individual fitness, specifically in reference to their tails<sup>30</sup>. Tails have an importance associated with courtship as males have longer tails than females. The males typically use their tails to perform a nudge-walk to initiate breeding<sup>31</sup>. The species has been reported to exhibit distinct ontogenetic patterns of aggression, with the highest and lowest rates of aggression exhibited during rear leg development and metamorphosis, respectively. Species-specific aggression rates were observed, with the related *A. tigrinum* consistently displaying the highest levels of aggression. Winner or loser effects were not evident because of this increased aggression<sup>32</sup>.

### *Habitat and Range*

*A. californiense* are native to California terrestrial habitats extending through the Rocky Mountains and central California<sup>33</sup>. The landscape provides geographic isolation from any other ambystomatid salamander and is composed of steep, open grasslands with deciduous and oak trees<sup>34</sup>. In particular, they are endemic to the Mediterranean-like climate in the lowlands of Sonoma and Santa Barbara Counties and are allopatrically distributed with the other native species of tiger salamander in the grassland community<sup>35,36</sup>. For the recovery plan implemented by the U.S Wildlife and Fisheries for the Santa Barbara county population segment, potential distribution includes the general area of suitable habitat within the range of the species that is currently occupied or has the potential to become occupied (Figure 3)<sup>37</sup>.

**Figure 3.** Distribution of Santa Barbara County California Tiger Salamanders through the Rocky Mountains and central California, United States.



In terms of terrestrial and aquatic habitats, the *A. californiense* has a preference for locations suitable during hot dry summers and cool rainy winters<sup>38</sup>. They prefer to reside and aggregate in cracked soil or under algal mats<sup>39</sup>. Mammal burrows are a critical part of the habitat for adult salamanders, with California ground squirrel burrows being an important habitat feature<sup>40,41</sup>. *A. californiense* also requires areas with active populations of burrowing animals, as burrows can collapse rapidly if not maintained. Most salamanders are found in burrows and tunnels 20 cm to one meter below the surface. The depth of these burrows can be critical for salamander survival through the hot dry summers of central California, where temperatures commonly exceed 37 °C and monthly rainfall averages less than one millimeter<sup>42</sup>.

## CONSERVATION

### Current State

Currently, there are a myriad of causes of *A. californiense*'s endangerment and "vulnerable" listing. One of the main causes, anthropologically, would be the conversion of grasslands to urban or agricultural uses in central California<sup>43,44,45</sup>. Grading and leveling operations associated with agricultural conversion have destroyed ponds and pools. This not only reduces breeding habitat and causes direct injury and mortality to larvae and juveniles occupying the pools, but creates permanent barriers that can isolate *A. californiense* and prevent them from moving to new breeding habitats or returning to their breeding ponds<sup>46</sup>. Beginning with post-WWII urban development, extensive human alteration of habitats in the past 150 years has resulted in the loss of 75 percent of vernal pool breeding habitats<sup>47,48</sup>. Vernal/ephemeral pools and aestivation sites are eliminated during urbanization which presents consistent evidence for several bottlenecks events<sup>49,50</sup>. Humans also have historically harvested and used tiger salamander larvae from wild populations to serve as fish bait and to supply the bait industry, likely altering the natural distributions of tiger salamanders<sup>51</sup>.

Another important potential cause would be hybridization with nonnative tiger salamanders, such as with the invasive barred tiger salamander (*Ambystoma mavortium*). *A. mavortium* larvae were introduced to areas of California in the 1950s for use as fish bait, allowing their genes to gradually spread away from the introduction sites due to hybrid advantage. By 2004, about 24 percent of the tiger salamanders' genome was compromised by nonnative genes, and full hybrids were filling the ecological role currently occupied by tiger salamanders. At least one-fourth of their range is occupied by "full hybrids" that have approximately 70 percent nonnative genes<sup>52</sup>. Natural selection favors hybrids, so the spread of nonnative genes may be unstoppable as these alleles spread conferring a selective advantage relative to native alleles, and pure tiger salamanders may go extinct<sup>53</sup>. It was found that differences in breeding phenology exist, whereas full hybrids delay metamorphosis as long as conditions exist that allow for continued growth, resulting in the largest, most fit individuals emerging at the end of the breeding season. This contributes to full hybrids taking advantage of any factor that would allow them to metamorphose at a larger size in comparison to pure *A. californiense*<sup>54,55</sup>. Not only this, but about 36 percent of tiger salamanders survive into adulthood whereas 51 percent of hybrids survive<sup>56</sup>. Competition and predation by nonnative species also factor in; predators may include ground squirrels, garter snakes, and bigger fish.

Other impacts on *A. californiense* population numbers include vehicle-strike mortality and a lack of compliance with existing regulatory mechanisms like the Clean Water Act, the California Endangered Species Act, and the California Environmental Quality Act<sup>58,59</sup>. This could include a lack of protection resulting in over-collecting and breeding pool water manipulation<sup>60</sup>. The occasional introduction of fish, discing the bottom of lakes, and draining lakes rapidly all contribute to destroying/manipulating breeding pools. As a result of the salamanders having a highly permeable skin, exposure to pollutants within their habitats, such as pesticides and other chemicals, can cause them to be rapidly absorbed. Absorption of these toxins may cause abnormalities in larvae and behavioral anomalies in adults, both of which could eventually lead to mortality<sup>61</sup>. Dying larvae have been found to exhibit signs of illness consistent with stress and starvation due to exogenous chemicals, which may be produced via agricultural contamination<sup>62</sup>.

#### Recovery Efforts

In 1970, *A. californiense* numbers declined to near extinction at Lagunita, CA, further resulting in their listing as "vulnerable" by the IUCN in 1990<sup>63</sup>. Recovery efforts are focused on protecting and managing sufficient habitat within the metapopulation areas to support long-term viability<sup>64</sup>. They also focus on the reduction and removal of previously listed threats. When shifting towards the assessment of effort for long-term persistence, protection of established areas are of utmost importance. A lot of remaining habitats are not formally protected because they are primarily on private property, meaning they can't be federally mandated<sup>65</sup>. Other locations, however, have implemented the use of wire fencing around pools. Linear mounds of friable soil have also been installed to encourage small mammal activity and enhance terrestrial habitat<sup>66</sup>.

Most efforts for species preservation and recovery have been on the local and state levels. For example, Stanford University agreed to mow the grass at the bottom of lakes rather than disc them so burrow larvae are not disturbed. Mowing is known to reduce the height of weed growth on the lake floor, whereas discing is more intrusive by turning the vegetation underneath the soil at the bottom of the lake. In this case, the mowing would be less hazardous to buried animals than would discing. Also, mesh screens have been installed over the lake drains and lakes are being drained more slowly, and only during midsummer after breeding season<sup>67</sup>. Aestivation sites around Lagunita Lake in particular have been identified and protected, along with the encouragement of maintaining rodent populations around the lake<sup>68</sup>. Another community effort would be the installation of a system of drift fences combined with tunnels underneath Junipero Serra Boulevard to reduce automobile related mortality. Routing systems like this have been used in Europe and Massachusetts with encouraging results<sup>69</sup>.



## CONCLUSION

In order to have a current understanding of *A. californiense*, their biology and habitat must be examined extensively and taken into consideration for future population stabilization efforts. There are two main options that have shown to be the most promising conservation efforts to date. First, the management of manmade ponds in the central California midlands so that they coincide with the full and dry periods of natural vernal pools, thus providing controlled viable mating locations<sup>70</sup>. Second, due to the tendency of *A. californiense* to take residence in rodent burrows, another practical option for conservation is controlling the population size of ground squirrels. By maintaining the ground squirrel carrying capacity to a low of ten to twenty percent, there will be plentiful burrow options for the salamanders without increased risk of predation<sup>71</sup>.

Ideally, future conservation would uphold the current population and restore numbers to their full native range<sup>72</sup>. This can be done by continuously monitoring the population numbers, putting habitat protection ordinances in place, maintaining genetic structure and diversity with regards to ecological distribution, and reestablishing populations in historically occupied areas<sup>73</sup>. Another potential option would be controlled breeding programs and the creation of federally protected areas that contain sustainable habitats with adequate rodent burrows and vernal ponds. The conservation of amphibians has shown the importance of suitable aquatic breeding grounds with a fairly large buffer zone of terrestrial grassland habitat<sup>74</sup>. According to Trenham (2001), the buffer zone should include a mixture of grassland and woodland with an area of about 170 meters. Wang et al. (2011) stresses the importance of vernal pools, both natural and manmade, to maintain effective population size by guaranteeing adequate breeding grounds.

The importance of maintaining an endangered species has serious ecological impacts to the natural diversity of complex biospheres<sup>75</sup>. Within one endangered species lies the genetic impacts of biodiversity and demonstrates the demand for environmental monitoring.

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## **How Police Militarization has Affected Protesting in 2021**

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The power of the people lies with the use of their voice and how they choose to exercise their rights. For more than two centuries, the United States has boasted rights such as freedom of speech, the right to vote, and the right to peacefully assemble. Just as those rights were not extended to all Americans from the beginning, we are now seeing a double standard in how protests are being handled by the police and government. With protests occurring over the death of George Floyd, the media is flooded with images of Black Lives Matter but also the police using methods such as tear gas, rubber bullets, and excessive force against those speaking out. This is not the first time America has seen large protests and riots due to police brutality. In Los Angeles, the case of the police beating of Rodney King would be one of the first publicly documented cases caught on video camera, sparking protests and riots. Since then technology and the equipment the police have within their arsenal has changed drastically.

The idea of police militarization began in 1993 with the era of crime control and the creation of the 1033 program. This program allowed for excess military equipment to be doled out to small towns around America to make sure they stayed tough on crime. The trend more rapidly progressed after 9/11 and the need to feel secure in any small town. This has allowed for police to slowly shift into a more aggressive cadre that focuses more on the weapons and equipment at their disposal and less about those on the other end. While we have seen on social media the actions of some protestors looting and becoming violent, it is important to understand what has triggered these actions. The police forces that are supposed to be deescalating these situations are instead making them worse through the use of their weaponry creating agitation and aggression at these protests.

Within the world of police training and work exists the levels of force that are used for an officer to know when he is allowed to go one level above the person he is responding to. These steps were created to avoid excessive force but also to help officers stay safe when a perceived threat is visible. The levels of force are important to understand when examining why so many people are calling out the police during these times for being excessive. They help not only keep an officer and civilian safe, but also avoid escalating a situation by drawing weapons unnecessarily. The levels of force are as follows: the first is the officer's presence, this means that an officer has arrived on the scene of a call and no physical or verbal interaction has occurred. Next is verbal commands, this is when the officer begins to make demands to the civilian. An example of this would be requesting to put their hands on their head. After verbal commands come soft and hard hand controls; soft hand controls include using pressure points to gain control while hard hand controls include using punches and kicks. After this are less lethal weapons which include batons, tasers, and pepper spray. These are weapons used to debilitate but not lethal enough to kill. Finally is lethal force, which is the last resort for an officer and is the gun on his utility belt.

In order to determine what level of force the officer uses the Plus One Theory is applied. This means that the officer can go one step above the level of force being used by the person they are encountering. For instance if the officer responds and the person encountered has a knife, that is considered lethal and the officer can go one level above and draw his gun from his belt. What is lacking during these protests is the step-by-step process or officers issuing verbal commands to those being compliant and they are still being hit with some sort of force. It is not hard to imagine that peace can turn to anger when police pepper spray or tear gas crowds simply marching or protesting on their knees.

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For the most part, officers are not firing off these tools without an order from someone above them in the chain of command. An example of officers being directed to fire both rubber bullets and tear gas at protestors was in Huntsville, Alabama where Police Chief Mark McMurray gave the orders for his men to fire rubber bullets at protestors on June 3rd<sup>1</sup>. This would create tension within the community as the police chief defended his actions against a city council that would condemn him. If ever there is a time when an officer feels that they or a fellow officer is committing a wrong against society, they should be turning in their badge. However, a combination of things such as the blue wall of silence, intimidation, and possibly the enjoyment of holding an authoritative power over others keeps that from happening. In the United States, it is well known that the police have a power that typical civilians do not. During protests, this dynamic is amped up as police may feel a temptation to exercise this authority over protestors. Recently, we have seen cops across the country being called out and put under investigation for the use of excessive force against protestors. In Los Angeles, seven police officers have already been resigned to duties that are not in the field while another 56 cases are currently under investigation for "...misconduct, violations of Department policy, and excessive force"<sup>2</sup>.

The identity of a police officer is wrapped in the ideology of protecting citizens and serving the community. This commentary has taken a different approach by showing how the encouragement of militarization and the lack of attention to training has caused a monumental problem today. Protestors today are seeking a change, to fix the problems that have systematically been placed into our system for years and are being judged for their anger when things go wrong. What people are failing to understand is that this country has failed to support and fix a multi-generational problem extending far beyond the police. This is one small piece of a larger more dangerous puzzle for a community who has sought equal treatment for more than a century now. Weaponizing those who have an ongoing history of oppression and bias against the black community and expecting different results during high intensity protests is insanity. Without proper training that moves away from the use of force and focuses more on de-escalation we are doomed to repeat these outcomes at protests time after time.

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## **Pandemic Politics: Derailed Campaigning during the 2020 Elections**

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Images of politicians shaking hands and speaking to crowds are often at the forefront of constituents' eyes as the election year picks up speed. This has not been the case as the COVID-19 pandemic has stopped much of what people have known of a "normal" election year. In March 2020, citizens witnessed a Democratic debate between presidential candidates Bernie Sanders and now President Joe Biden with no live audience. Rallies with gatherings of thousands were stopped as social distancing was enforced, and many states postponed primary voting days later into the year while encouraging absentee voting from home. With the unpredictable circumstances surrounding the 2020 election year, what did a campaign look like amid the COVID-19 pandemic?

Both a wondrous gift and curse, social media has impacted much of how campaigns operate. Millions of dollars are spent on social media ads each year to pop up on the screens of Facebook users simply scrolling through their timelines. "In the 2019-2020 election cycle, total political advertising spending reached \$8.5 billion across TV, radio and digital media. This was 30% higher than the \$6.7 billion projected earlier this year, and 108% more than spending in 2017-2018, which was a record at that time"<sup>1</sup>. Amidst COVID-19, many candidates have used their platforms on social media to garner support in place of door-knocking and face-to-face interactions. This remains true for presidential candidates Biden and President Donald Trump who were active Twitter users during the 2020 election season. Even local West Virginia candidates who utilized Facebook live to boast the platforms they were running on have taken advantage of what social media has to offer. Trends like these affect different age gaps accordingly as younger generations tend to use social media more than older generations. While older generations are well known for high voter turnout, social media and a combination of the current political atmosphere could work to change this norm. According to data from the 2020 election year, "...70% of young people had gotten information about the 2020 election on social media and 36% reported posting political content in the week prior"<sup>2</sup>. This data may be connected to the higher youth vote reported from the 2020 election, signaling a generation of young people who want to be civically involved via advocating and voting.

With citizens being encouraged to stay home, there leaves little else to do but sit and scroll through social media, allowing increased exposure to social media efforts of campaigns. The cautionary tale with using social media has always been to fact-check what you see on your timeline, but some citizens fail to do this as headlines are pushed to the front of their feeds based on the likes and interests of the user. These headlines can come in the form of negative ads towards candidates or towards parties as a whole. In 2016, "fake news" was the term often attributed to these articles as former President Trump and other politicians attacked media outlets over accusations of falsifying information or misleading the public. Following these accusations, social media platforms such as Facebook and Twitter acted to implement fact-checking policies and continue to update these policies today to combat false information being spread. Facebook uses a non-partisan company called International Fact-Checking Network while Twitter handles its fact-checking internally<sup>3,4</sup>. This can be seen by the now familiar labels accompanying tweets and posts that contain a warning that the post may contain false information. Not long after the announcement of President Biden's victory, Twitter started fact-checking former President Trump himself and eventually banned his Twitter account after he violated their Glorification of Violence policy shortly before the storming of the United States Capitol on January 6th, 2021<sup>5</sup>.

While national attention is hyper-focused on the presidential election, it seems that campaigning methods on a local level were most affected. With limited in-person interaction, typical methods used by local candidates were unusable due to COVID-19.

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With the lack of traveling due to “safer-at-home” guidelines, signs and billboards may not have the effect campaign managers have seen in the past. Social distancing also makes the method of door-to-door campaigning impossible as well as rallies or local events such as parades and festivals usually attended by candidates walking around and talking with constituents. People tend to value the face-to-face conversations had with candidates more than the piece of mailing they get from candidates and throw away without reading. A study in 2017 comparing the effectiveness of face-to-face interactions to digital ones found that a face-to-face request was 34 times more effective than an emailed request<sup>6</sup>. If you apply this data to campaigning, you are more likely to have people answer political surveys if asked in person as well as a number of other political actions such as signing a petition, volunteering to help campaign, and most importantly, voting.

Many campaign methods remain effective and may be modified in response to the pandemic. As mentioned before, social media remains one of the strongest tools for campaigning as people spend more time on their phones due to the inability to do other activities. Campaigns still have the ability to email, call, or survey constituents as well as purchasing television ads. These methods do hinder upon the amount of money a campaign has access too as well as the number of volunteers a campaign has. Many candidates depend on fundraising to utilize these resources and may find little luck in fundraising as the economy has taken a downturn through the loss of jobs and lack of spending due to the pandemic. According to WV MetroNews, candidates were not predicted to raise many dollars in West Virginia during the pandemic but rather rely on their individual wealth to loan to their campaigns<sup>7</sup>. Examples would include 2020 Republican primary candidates Governor Jim Justice and opponent Woody Thrasher. Candidates also advertised for the use of absentee ballots this election season in the hopes of voter turnout remaining the same or possibly increasing.

While it was questionable if campaigning would go back to normal as states began to open back up, former President Trump continued to hold rallies for his supporters nearing election day. As the Georgia U.S. Senate run-off election took place, Republicans and Democrats alike held rallies (differing in social distancing guidelines) despite rising COVID-19 case numbers as both parties scrambled for control of the Senate. The most significant take-away from this election cycle is that campaigning and elections continued to persist even in the most unprecedented of times.

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