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Policy brief: Alternatives to in-person American Society of Landscape Architects Conferences on Landscape Architecture

ABSTRACT Annual, in-person professional meetings at a centralized location yield several personal and organizational benefits. Yet, greenhouse gas emissions from conference organization, execution, and attendance contribute to the climate crisis. Within at least the last decade, the American Society of Landscape Architects (ASLA) has claimed to continually reduce the carbon footprint of the annual meeting and EXPO by performing a variety of actions. ASLA supports global and national greenhouse gas emissions reduction targets to limit global warming to 1.5°C and has committed to measuring, understanding, making public, and reducing the organization's emissions. To date, ASLA has not made such information public, if it exists. This study extends our previous work by estimating carbon dioxide emissions from 2018 and 2019 ASLA Annual Meeting and EXPO event venues, and 711 EXPO exhibitors' travel and attendees' hotel accommodations, using online carbon calculators, refereed literature, and building energy benchmarking data. Results indicated that meeting featured speakers and EXPO representatives originated from most of the same locations, thereby supporting potential future decentralized meetings. Additionally, conference attendees' and exhibitors' total estimated emissions equaled annual per capita emissions of an Ethiopian. Thereafter, we consider several alternative means of convening. Our estimations of various hybridized and virtual conference-

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related emissions indicate that hybridized meetings that require half of participants who originate from the most distant locations to attend virtually, and entirely virtual conferences, may meet emissions reduction targets. We recommend immediately convening in hybridized meetings that require no air travel until 2030, at the latest, and meeting virtually thereafter.

KEYWORDS climate change, equity, green meetings, sustainability, Paris Agreement

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INTRODUCTION

This policy brief examines alternatives to in-person ASLA Conferences on Landscape Architecture (formerly Annual Meetings and EXPOs) to significantly reduce conference-related carbon dioxide emissions and ASLA's contribution to the climate crisis. Since 1960, the ASLA Annual Meeting and EXPO has taken place in Washington D.C., 25 U.S. cities, Hawaii, and Ontario, Canada (Author, 2019), including nine of the ten most popular global conference locations (Spinellis & Louridas, 2013). Thirty-one of 60 meetings and EXPOs took place in U.S. coastal locations (Author, 2019). The 2021 ASLA Conference on Landscape Architecture took place in person in Nashville. In-person conferences are planned for 2022, 2023, and 2024 in San Francisco, Minneapolis, and Washington D.C., respectively.

Perceived benefits of ASLA Conferences on Landscape Architecture are numerous. Over the last decade, ASLA Conferences on Landscape Architecture each included over 110 education sessions on a wide variety of topics, two general sessions, 10 to 15 field sessions, about 5 workshops, and the EXPO, a trade show that is "consistently" rated the "'most valuable event' at the meeting each year" (ASLA, 2020). Organized social events at each conference include receptions, benefits, dinners, happy hours, organized walks, business meetings, and ceremonies. Moen (2014) found that all sixteen ASLA state chapter president respondents rated continuing education credits and conferences, meetings, and symposia as most important to professional learning and growth. Other questionnaire respondents indicated greater motivation to attend annual meetings for inspiration and ideas, to stay current with professional trends, and network

than to earn continuing education credits (Moen, 2014). Annual meetings and EXPOs also generate about one-third of ASLA's annual revenue. Sixty-two percent of the $4.22 million revenue (≈$2.62 million) from "Meetings and Special Programs" reported in the 2017–2018 ASLA operating budget is derived from EXPO exhibit sales (ASLA Board of Trustees, 2016). An early-bird registration fee of $645 for members (ASLA, 2019a), if applied to 2,800 of the 5,700 attendees ASLA anticipates each year, yields $1.806 million.

In what follows, we extend a previous study (Author, 2019) to estimate 2018 and 2019 meeting attendees' and EXPO representatives' carbon footprint from travel, hotel accommodations, event venues, and event organization, use, and disassembly. Thereafter, we examine various alternative models of convening and conclude with recommendations based upon ASLA's stated support of emissions reduction targets.

IN-PERSON MEETING-RELATED GREENHOUSE GAS EMISSIONS

Current Emissions-Reduction Actions

For at least the last decade, ASLA explicitly stated an intent to reduce the carbon footprint of the annual meeting and EXPO (ASLA, 2011, p.36; 2017a, p. 11; 2019a, p. 41). ASLA employs a general contractor that is a Platinum partner of the Green Meeting Industry Council, has implemented a mobile conference application, uses agri-based inks on 100-percent recycled paper, and electronically distributes conference session handouts (ASLA, 2021a). Moreover, "convention centers, hotels, and event venues in the cities selected…must demonstrate progress

toward improving their operational efficiency and reducing their environmental impact" (ASLA, 2011, p.36; 2021a).

At least four study results suggest that ASLA's efforts have little impact on reducing conference-related emissions. Moreover, literature indicates that ASLA should focus on eliminating the need for conference attendees to travel by air, which is extraordinarily difficult to decarbonize in comparison to modes of overland travel (Peeters, Higham, Kutzner, Cohen, & Gössling, 2016), and accounts for more than the 2 to 3 percent of total global human-induced carbon dioxide emissions due to fuel burn (Owen, Lee, & Lim, 2010) after including emissions from aircraft manufacturing, upstream fuel consumption, ground support equipment, and routine maintenance (Liu, Xu, Stockwell, Rodgers, & Guensler, 2016). First, Hischier and Hilty (2002) found that production and dissemination of booklets, programs, bags, and conference organization accounted for just under five percent of conference-related energy and emissions, whereas travel accounted for over 96 percent. Second, Stohl (2008) found that air travel accounted for 90 percent of personnel and scientists' business-travel-related emissions. Third, Jäckle (2019) showed that eliminating a 215-page program for each of 1,600 attendees may result in an overall emission reduction equal to less than the average attendee footprint at the conference that had the lowest per capita emissions weight of six conferences investigated; switching to vegetarian or vegan meals could result in a reduction of only 1 to 2 percent of total travel-related emissions. Finally, the comprehensive life cycle assessment conducted by Neugebauer, Bolz, Mankaa, and Traverso (2020) showed that conference travel had the highest environmental impact in eight of 11 categories. Among travel modes, air travel accounted for 60

percent of the environmental impacts in ten of 11 categories, six of which exceeded 90 percent. An analysis of three scenarios intended to reduce environmental impacts (i.e., reduction of material inputs vs. omnivore to vegetarian menu vs. travel) showed that replacing air travel with train travel would result in the greatest reduction potential in all 11 categories.

Estimating In-Person Conference- and EXPO-Related Emissions

After publishing a study (Author, 2019) of travel-related emissions from ASLA meeting education session featured speakers and attendees, we sought to gain a broader understanding of ASLA conference-related emissions. The bulk of work began by utilizing EXPO floor plans and exhibitor lists for the 2018 and 2019 ASLA Annual Meetings (ASLA, 2018; 2019b) to estimate the travel-related emissions of one exhibitor for each of 358 exhibits in the 2018 ASLA EXPO and 353 exhibits in 2019, which is comparable to the mean number of education session featured speakers that we estimated earlier (Author, 2019). In addition to using the web-based Carbon Footprint Calculator to estimate travel-related emissions, like before (Author, 2019), we computed estimations using two other sources. To estimate emissions that account for the increased global warming potential of aircraft emissions in the upper atmosphere, which is generally between 2 and 5 times greater than ground-based emissions (IPCC, 1999; Owen et al., 2010), we referred to Jungbluth and Meili (2019), who reviewed five major approaches for applying a radiative forcing index (RFI) factor that were available and in practice in the last seven years (Table 1). We also used the web-based International Civil Aviation Organization (ICAO) Carbon Emissions Calculator, which Baumeister (2017) states has been adopted by other

85 emissions calculators, is the most widely recognized in the aviation industry, and often cited in

86 many studies.

Table 1. Methodological Assumptions and Specifications for Estimating Travel-Related Carbon Dioxide Emissions of 2018 and 2019 ASLA EXPO Representatives.

Primary Travel Mode	Travel Duration from Workplace Origin	Primary CO_2 Estimation Source	Primary CO_2 Source Specifications	Secondary CO_2 Estimation Source	Secondary CO_2 Source Specifications	Tertiary CO_2 Source	Tertiary CO_2 Source Specifications
Local	Same as EXPO	None	t CO_2 = 0	None	t CO_2 = 0	None	t CO_2 = 0
Car	Not Phila. or San Diego, but ≤ 3h	Kalmus (2017, p.162)	2019 XSE, 3.5 L, 6 cyl. Automatic Toyota Camry; 26 mi/gal.; 11.3 kg CO_2/gal. gas	None	Mean of primary & tertiary source values	Carbon Footprint Calculator	2019 XLE/XSE SemiAuto-8 2WD Toyota Camry; 162.378 g CO_2/km
Train	3h 1min–6h, if available	Kalmus (2017, p.162)	0.16 kg CO_2/mi	None	Mean of primary & tertiary source values	Carbon Footprint Calculator	Long distance
Airplane	> 6h	Life Cycle Assessment (LCA) by Jungbluth & Meili (2019)	Short-haul flight = 340 g $CO_{2\text{-eq}}$/km; Medium-haul = 285 g $CO_{2\text{-eq}}$/km; Long-haul = 230 g $CO_{2\text{-eq}}$/km	International Civil Aviation Organization (ICAO) Carbon Emissions Calculator	One passenger, return trip, economy class	Carbon Footprint Calculator	one passenger, return trip, economy class, no radiative forcing index factor included

Notes. 1. Like Klöwer (2019), we classified short-haul flights as ≤ 1,500 km; EuroControl (2021) classifies medium-haul flights as between 1,501 km and 4,099 km; long-haul flights are ≥ 4,100 km. 2. We used a travel agency and metasearch engine website (kayak.com) to determine the most common routes from points of origin to the EXPO location, and a mapping website (gcmap.com) to determine the great circle distances (GCD) between airports. If multiple aircraft routes between an origin and EXPO location were available, we selected the direct route, which inherently decreased the emissions rate in our calculations.

EXPO Travel-related emissions. We identified 205 (≈ 57 %) exhibitors that participated in both EXPOs. Over 70 percent of product representatives likely traveled by air to the 2018 EXPO in Philadelphia, accounted for over 96 percent of exhibitors' travel-related carbon emissions, overall, and may have been responsible for a mean emission and global warming potential (GWP) value per exhibitor of 0.33 t CO_2 and 0.96 t CO_2 (Figures 1 and 2). Almost four times as many product representatives flew than traveled by car, but the GWP of air travelers' emissions equaled about 62 times that of car travelers'. If we include train travelers, about two-and-a-half times the number of product representatives traveled by air than land, but the GWP of air travelers' emissions still equaled over 46 times that of overland travelers.

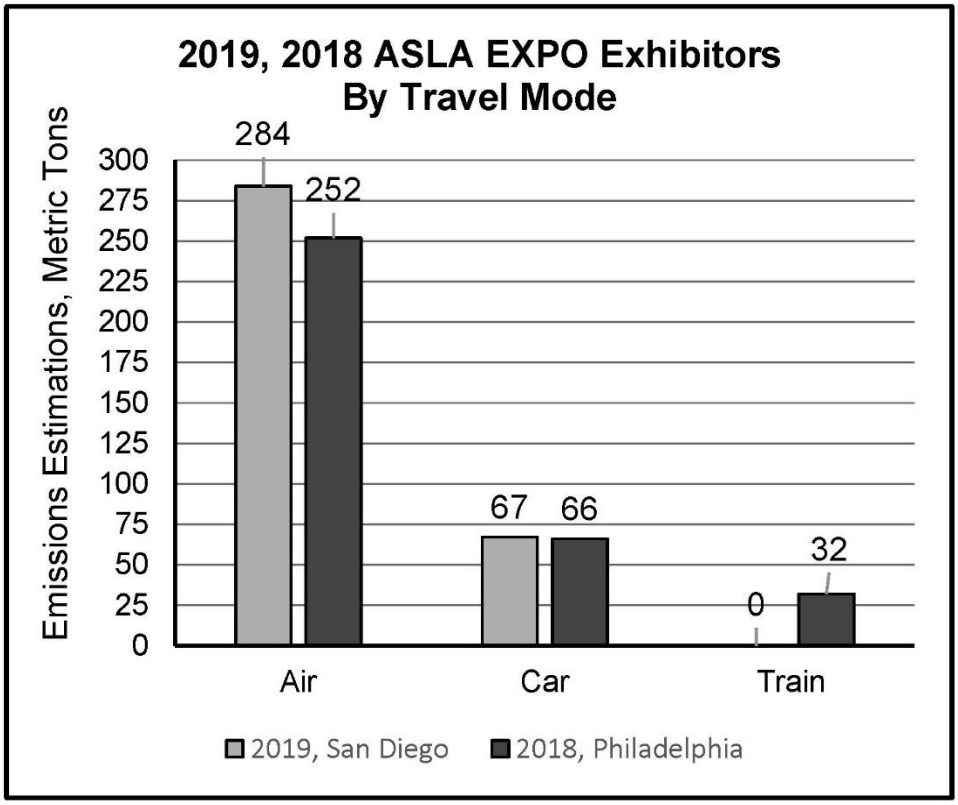

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Figure 1. 2019 and 2018 ASLA EXPO exhibitors' likely mode of travel. Excluded from the graph are two 2019 exhibitors who were likely local, two 2018 exhibitors who were likely local, and six 2018 exhibitors for which we could not identify an origin.

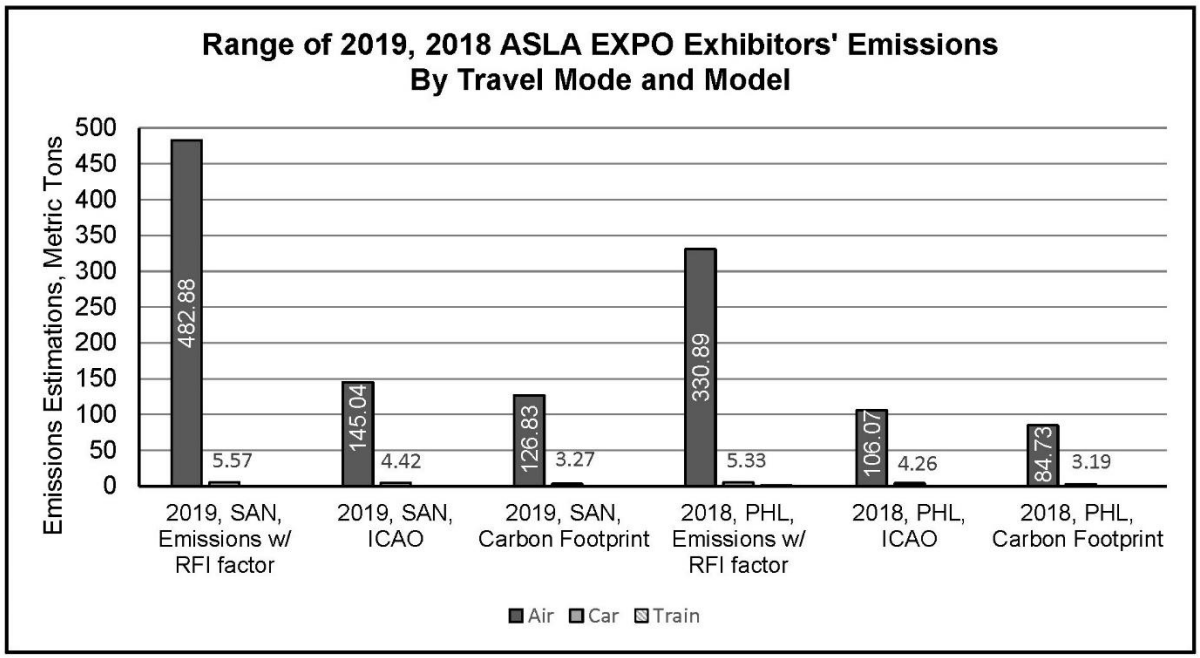

Figure 2. Emission estimations by travel mode, 2018 and 2019 ASLA EXPO exhibitors. The 32 exhibitors who likely traveled by train in 2018 may have emitted 1.80, 0.98, or 0.16 t CO_2, depending on the primary, secondary, or tertiary emissions estimation methods, respectively, we employed. Two 2019 and two 2018 exhibitors who were likely local and six 2018 exhibitors for which we could not identify an origin are excluded from the estimations presented in the graph.

Over 80 percent of exhibitors likely traveled by air to the San Diego ASLA EXPO in 2019 and may have emitted, on average, 0.37 t CO_2 or 1.38 t CO2, after including the RFI factor, which accounted for over 97 percent of travel-related carbon emissions (Figures 1 and 2). Again,

over four times as many product representatives may have traveled by air than by land. However, after accounting for the RFI factor, air travelers' emissions may have a GWP over 86 times that of overland travelers.

In both EXPOs, the greatest number of exhibitors by region appears to have fluctuated to coincide with EXPO locations. In 2018, most exhibitors originated from the Northeastern U.S. (*n* = 110, 30.73%), near the Philadelphia EXPO; in 2019, most exhibitors originated from the U.S. West Coast (*n* = 107, 30.31%) near the San Diego EXPO. After aggregating exhibitors by the nearest airport, we further investigated airports that served four or more exhibitors. Seventeen of 21 locations from which education session featured speakers originated most frequently in our previous study (Author, 2019) are represented in the 29 top locations from which 2018 and 2019 EXPO exhibitors originated (Appendix 1). Thus, utilizing future regional hub conference locations that we proposed before (Author, 2019) could maximize education session featured speakers' *and* exhibitors' participation each year and reduce conference-related carbon dioxide emissions by eliminating air travel.

Event venues. The venues within which the 2018 and 2019 ASLA EXPOs took place advertise green methods but building energy benchmarking data indicate that these result in small, positive environmental impacts. The San Diego Convention Center (SDCC) is a LEED-certified building that contains LED and CFL technology, energy-efficient dishwashers and boilers; water-efficient toilets, kitchen facilities, and irrigation, and drought-tolerant plants; recycles 100% of cardboard; composts inedible food; donates edible food; and diverts waste from landfills (visitsandiego.com/sustainability-community). However, an ENERGY STAR

score of 50 denotes that the SDCC is not a top performing building (i.e., > 75) and does not qualify for ENERGY STAR certification (Table 2). The Pennsylvania Convention Center (PCC) (2018), also a LEED-certified event venue, reported composting; recycling oil, metal, fluorescent bulbs, pallets, single-stream and show materials; employing a certified green cleaning service; and installing water-efficient fixtures. Additionally, PCC reported burning over 74,000 dekatherms (74,000 million BTUs) of natural gas, consuming over 34,000 CCF (>25 million gallons) of water, and over 24 million kWh of electricity in 2018. Host organizations like ASLA only utilize venues for a few calendar days, thereby making individual organizations responsible for a small percentage of costs and benefits. Accordingly, four calendar days (i.e., two operating EXPO days, one setup and one removal day) of emissions and energy use at the PCC for the 2018 ASLA EXPO (Table 2) results in emissions that are about equal to the travel-related emissions of 2018 EXPO representatives that we estimated using the Carbon Footprint Calculator (Figure 2), without radiative forcing.

Table 2. Building Benchmark Data, Pennsylvania and San Diego Convention Centers

	PA Convention Center, Annex, Philadelphia[a]	PA Convention Center, Exhibit Hall & Train Shed, Philadelphia[a]	4 days, PA Conv. Ctr. Exhibit Hall, 2018 ASLA EXPO	SD Convention Center, San Diego[c]	4 Days, SD Convention Center, 2019 ASLA EXPO
Electricity Use, kWh	2,347,061.27	15,565,827.84	170,584.41	17,695,130.40	193,919.24
Natural Gas Use, BTUs	13,742,244,000	51,168,058,000	560,745,841.10	25,053,865,272.76	274,562,907.10
Site Energy Use Intensity (EUI), kBTU/ft^2	40	90	NA	48.4	NA
Source EUI, kBTU/ft^2	NA	NA	NA	110.8	NA
Total Greenhouse Gas Emissions t CO_2e	3,008	7,542	82.65[b]	5,583.60	61.19
Water use, gallons	11,853,000	17,742,000	194,432.88	NA	NA

[a] Values from The City of Philadelphia, Office of Sustainability, Building Benchmarking Index (2020) 2018 calendar year.

[b] Education sessions and other activities related to the 2018 ASLA Conference occurred within the PA Convention Center Annex. We cannot estimate what percentage of the annex area ASLA used. Therefore, we cannot estimate the percentage of annex emissions for which ASLA may be responsible. Thus, our event-venue-related emissions from the 2018 ASLA Conference are likely low.

[c] Values from The City of San Diego, Department of Sustainability, reported 2019 data.

EXPO organization, assembly, use, and disassembly. We could not estimate emissions *post hoc* related to the organization and execution of the 2018 and 2019 EXPOs. However, a life cycle assessment showed that a 3-day exposition of 120 exhibits across 11,600 m^2 resulted in emissions of between 73 and 75 t CO_2e (Toniolo, Mazzi, Fedele, Aguiari, & Scipioni, 2017). After removing emissions from venue heating and lighting, emissions from event carpeting, tape, display panels, forklifts, cleaning and machine sweepers during organization, assembly, use, and dismantling equaled between 35.9 to 37.3 t CO_2e. For comparison, the 2018 EXPO included 352 exhibits across 6,819 m^2 (excluding aisles) and the 2019 EXPO included 353 booths across 6,633 m^2. Thus, a rough approximation based upon area alone may yield another 21.22 t CO_2 emitted during the organization and execution of each ASLA EXPO.

Hotel accommodations. Many ASLA Conference attendees and EXPO representatives needed nightly accommodations, which created carbon dioxide emissions. We located and multiplied mean emissions values of carbon dioxide equivalence per occupied room for Philadelphia and San Diego in the 2020 Cornell Hotel Sustainability Benchmarking (CHSB) index tool spreadsheet (Ricaurte & Jagarajan, 2020) by the number of meeting attendees and EXPO representatives, and the number of nights of accommodation likely reserved. For comparison, Stohl (2008) and Neugebauer et al. (2020) reported that hotel accommodations accounted for 5 and 8.62 percent of emissions estimations, which is close to our estimations for the 2019 meeting and EXPO, but lower than emissions from accommodations in 2018.

Summation of emissions and comparative impacts. Table 3 summarizes estimations of carbon dioxide emissions from the 2018 and 2019 ASLA Meetings and EXPOs. For airborne

meeting attendees and EXPO representatives in 2018 and 2019, the range of emission weight mean sums estimated from travel, event venue, hotel accommodations, and EXPO organization, use, and disassembly may be about equal to the 2018 per capita annual emissions of a resident in Ethiopia (0.44 t CO_2) or Gambia (0.48 t CO_2), without radiative forcing, or over three Ethiopians or Gambians with radiative forcing (Climate Watch, n.d.). In contrast, overland travelers could have emitted about as much as a resident of Bhutan (0.09 t CO_2e) or Niger (0.16 t CO_2) in 2018. For an ASLA airborne meeting attendee or exhibitor, 0.46 t CO_2 is between 4.26 and 9.38 percent of an annual U.S. per capita emission weight in 2030 that is associated with a global emissions cap of 30 (i.e., 10.8 t CO_2 per person), 25, or 20 Gt CO_2 (4.9 t CO_2) (Chakravarty et al., 2009). However, after factoring in radiative forcing index factors, 1.72 t CO_2 is between 15.93 and 35.10 percent of an annual per capita emission cap.

Overall, the four-day 2019 ASLA Conference in San Diego may have yielded about 2,925 to 10,216 t CO_2, which is equal to the per capita emissions of 6,648 to 23,219 Ethiopians, or between 201 and 703 Americans (M = 14.54 t CO_2 as per Climate Watch, n.d.). Convening for four days in 2018 resulted in between about 1,845 to 5,667 t CO_2, which is equal to the per capita emissions of 4,194 to 12,881 Ethiopians or 127 to 390 Americans.

Table 3. Summary of Emissions Estimation Means, in t CO_2, for 2018 and 2019 ASLA Annual Meeting and EXPO.

	2019, San Diego									
Emissions Source	**Meeting Attendees**	**Per Attendee, Exhibitor**	**Attendee Carbon Fund w/ RFI Factor**	**Attendee Carbon Fund**	**Attendee Carbon Foot-print w/ RFI Factor**	**Attendee Carbon Foot-print**	**EXPO Reps**	**EXPO Rep, LCA (includes RFI)**	**EXPO Rep, ICAO**	**EXPO Rep, Carbon Footprint**
Air Travel	5,826[a]		1.62000	0.60000	0.81313	0.43000	284	1.70000	0.51070	0.44660
Car Travel	522[b]			0.06000		0.06000	67	0.08300	0.06650	0.05000
Event Venue	6,500[c]	0.00903[d]					353			
Hotel Accommodations	6,348[e]	0.00876[f]					329[g]			
EXPO Org., Use, Disassembly	6,500[d]	0.00310[h]					353			
Means	By Air		1.64089	0.62089	0.83402	0.45089		1.72089	0.53159	0.46749
	By Car			0.08089		0.08089		0.10389	0.08739	0.07089
	2018, Philadelphia									
Air Travel	3,061[a]		1.53900	0.57000	0.75640	0.40000	252	1.31000	0.40000	0.34000
Car Travel	235[b]			0.06300		0.06300	66	0.08200	0.06600	0.05000
Train Travel	2,150[i]			0.05000		0.01000	32	0.06000	0.03100	0.01000
Event Venue	6,200[a]	0.0126[d]					358			
Hotel Accommodations	5,446[e]	0.0227[f]					319[g]			
EXPO Org., Use, Disassembly	6,200[a]	0.0032[h]					358			

Means	By Air	1.57755	0.60855	0.79495	0.43855	1.34854	0.43854	0.37854
	By Car		0.10155		0.10155	0.12054	0.10454	0.08854
	By Train		0.08855		0.04855	0.09854	0.06954	0.04854

[a] Values from Table 5 in Author (2019).
[b] Derived from percentage of educational session featured speakers who traveled by car in Author (2019).
[c] Total projected attendees in SAN2019 Conference on Landscape Architecture Program, p.41.
[d] Derived by dividing estimated emissions from four days of use at San Diego or Pennsylvania Convention Center (61.19 or 82.65 t CO_2, Table 2) by the sum of attendees and EXPO exhibitors. Source: The City of San Diego, Department of Sustainability, reported 2019 data; The City of Philadelphia, Office of Sustainability, Building Benchmarking Index (2020) 2018 calendar year.
[e] Sum of air and car travelers in 2019, or air, car, and train travelers in 2018.
[f] 2018 calendar year benchmark data from the Hotel Carbon Measurement Initiative (HCMI). Values based upon the mean hotel carbon footprint per occupied room, in kg $CO_{2\text{-}e}$, for Philadelphia (22.71 kg) and San Diego (8.67 kg), each as an "urban location," and presented in the 2020 Cornell Hotel Sustainability Benchmarking Study tool.
[g] We assumed that exhibitors who traveled a distance greater than 90 mi would reserve hotel accommodations. Additionally, we assumed three nights of hotel stays, which would total 166.83 and 8.65 t CO_2 for 2019 attendees and EXPO exhibitors, respectively, and 371.04 and 21.72 t CO_2 for 2018 attendees and EXPO exhibitors.
[h] Value based upon area of 2018 and 2019 ASLA EXPO exhibit spaces, excluding aisles, in comparison to the results of a life cycle assessment performed by Toniolo et al. (2017). We divided our estimation, 21.22 t CO_2, by the sum of attendees and EXPO exhibitors for each conference.
[i] Derived from percentage of educational session featured speakers who traveled by train in Author (2019).

ALTERNATIVE MODELS OF CONVENING

Emissions reductions target. In the first Nationally Determined Contribution (USA NDC, 2016) to the Paris Agreement, the U.S. intended to "achieve an economy-wide target" of emissions reductions equal to 28 percent relative to 2005 by 2025. As a signatory of the We Are Still In declaration (WWF-Climate Nexus-Ceres, 2017), ASLA committed to the goals outlined in the Paris Agreement, including meeting- and event-related emissions reductions, developing a plan and timeframe for becoming climate neutral, reducing travel-related greenhouse gas emissions, and completing a greenhouse gas inventory. ASLA's policy recommendations for the Biden-Harris Administration (ASLA, 2021b) include rejoining the Paris Climate Agreement and implementing a plan to reduce greenhouse gas emissions to levels recommended in IPCC (2018), which, depending on the model pathway that projects global warming equal to or slightly above 1.5° C, is between 41 and 58 percent by 2030, relative to 2010 levels, and 91 and 95 percent by 2050 (IPCC, 2018, p. 16). After rejoining the Paris Agreement (USA NDC, 2021), the United States' NDC committed to reducing economy-wide emissions 50 to 52 percent relative to 2005 levels by 2030. US emissions peaked in 2005 then began falling (Hausfather, 2017). In contrast, ASLA conference attendance and emissions have gradually grown (Author, 2019). Thus, the following synopsis of costs and benefits related to alternative models of in-person annual conferences is based upon emissions reductions ASLA publicly advocated.

Biennial meetings. Meeting every other year in-person, with or without a virtual meeting between in-person meetings, would basically halve conference-related emissions (Bousema et

al., 2020; Klöwer, Hopkins, Allen, & Higham, 2019; Ponette-González & Byrnes, 2011) while retaining the benefits of in-person meetings on a less frequent schedule. Biennial meetings may also decrease conference-related revenue by half without alterations to registration, sponsorships, and monetized conference experiences. However, meeting less frequently in person may increase the value of conference content and experiences by allowing more time for substantive innovation and collaboration between conferences. Accordingly, conference attendance may increase in comparison to current, typical conferences, and with it travel-related emissions.

Geographically centralized conferences. Convening in a centralized location, rather than in a city on a U.S. coastline, would reduce air-travel-related emissions (Klöwer, Hopkins, Allen, & Higham, 2019; Ponette-González & Byrnes, 2011; Stroud & Feeley, 2015) by as much as 4 to 44 percent in comparison to baseline estimations (Jäckle, 2019). In this scenario, international attendees, who account for between 8 to 16 percent of attendees but between 12 and 56 percent of travel-related emissions (Author, 2019; Ponette-González & Byrnes, 2011) would only participate virtually, if at all (Author, 2019; Jäckle, 2019). Besides, the results of one study show that intra-national interactions, rather than international, are 2 to 2.5 times more likely at "international" conferences, despite the origins of registrants (Derudder & Liu, 2016). Presenting and exhibiting at a meeting in a major U.S. city, the authors suggest, implies approval, status, and prestige.

Convening in a centralized location would afford almost all the benefits of typical in-person conferences but may require additional technical support and organization to include potential international speakers, product representatives, and attendees. Carbon dioxide

emissions estimations for the 2014 and 2015 ASLA Annual Meetings in Denver and Chicago (Author, 2019) suggest that geographically centralized conferences may still result in travel-related emissions of between 1,172 and 1,832 t CO_2 without radiative forcing and between 2,216 and 4,945 t CO_2 with radiative forcing, which would result in an emissions reduction of between 2 and 21 percent, below US and global targets for 2025 and 2030. Additionally, emissions from the operation of the event venue, organization, use, and disassembly of the conference, and hotel accommodations would still occur, as would waste and water use.

Alternating between centralized and decentralized in-person meetings. Ponette-González and Byrnes (2011) estimated that emissions reductions from domestic air travel equaled between 18 and 59 percent if meetings alternated between multiple regional sites and a single national site, and even greater reductions could occur (i.e., between 49 and 74 percent) if international travel is eliminated. However, these estimations are dependent on the location of the event and proximity to potential attendees. Alternating between regional and national sites may require additional infrastructure and planning and decrease revenue overall without reimagining the monetization of decentralized, regional conference registration and experiences. In this scenario, emissions reductions related to event venue operations, and event organization, setup, use, and disassembly, and hotel accommodations may occur but are difficult to estimate.

Hybridized meetings. Annual hybridized meetings entail traveling overland only to convene regionally in person while using teleconferencing software to view presentations and engage attendees in other regional "hubs" virtually. Hybridized meetings would eliminate air-travel-related carbon emissions, but still rely upon fossil-fueled event venues that are smaller but

more numerous (e.g., hotel conference rooms, university auditoriums), possibly fewer hotel accommodations, and ground-based transport (i.e., buses, trains, and cars) that contribute to climate change. Yet, hybridized annual meetings could temper economic losses in cities that typically welcome large business sector events, or increase economic activity in more cities that serve as hubs. Exhibitors, researchers, and practitioners could still meet; attendees may still inspect actual products and observe trials. Products on display in regional meetings may be localized and better suit attendees' interests and professional needs, particularly when measures to adapt to regional effects of the climate crisis become more common and necessary. Additionally, conference attendance, diversity, and exposure to content may increase; access to information may extend beyond an in-person, regional event, and product representatives may see up to a 70-percent return on investment in the EXPO, as one precedent reported (Pearlman & Gates, 2010).

Coroama, Hilty, and Birtel (2012) documented a two-site international conference (Japan and Switzerland) that described techniques ASLA could utilize. Speakers pointed to podium monitors during presentations, which allowed the remote audience to see and understand presenters' gestures. Organizers projected video of the remote audience on a screen positioned perpendicular to the presenter to make visible remote audience reactions. Camerapersons captured dynamic views of the audience and magnified views of those posing questions. Organizers also provided a teleconferencing station for small, impromptu, and informal group meetings over coffee, and another in a quiet area for more formal meetings. Majorities of attendee questionnaire respondents were very or fairly well satisfied with the interactive Q & A

sessions, sensing the presence of the remote audiences, spontaneous and formal cross-site meetings. Respondents' opinions regarding conference social interaction and networking rated positive yet lower than quality of content, cost and time efficiency of participation, environmental impact, and experience of different cultures. Analysis of conference attendees' probable travel behaviors had the conference been entirely in-person in one location or another indicated that the two-site conference attracted more attendees and reduced travel-related emissions by 1.5 to 3.5 times per capita and between 37 and 50 percent overall (Coroama et al., 2012), which is slightly lower than the 58-percent reduction estimated by Bousema et al. (2020).

Two other study results are relevant. Orsi (2012) found that air-travel-related emissions from an in-person conference would have decreased by about one-third had attendees instead traveled to the nearest organization chapter city. Emissions dropped another 12 percent with a two-venue conference, and 35 percent with a three-venue conference. Additionally, Jäckle (2021) found that conference-related emissions would decrease between 51 to 55 percent if participants from the most distant origins attended online; reductions of up to 79 percent resulted if the other 90 percent of participants traveled overland between 5 and 20 hours. If the half of participants who originate from locations closest to the conference attended in person while all others attended virtually, emissions would drop 95 to 98 percent.

At least three organizations have begun utilizing a hybridized conference model that ASLA may follow. In addition to in-person presentations for the 2022 annual conference, the Council of Educators in Landscape Architects (CELA, n.d.) is providing a limited number of virtual oral, panel, or film presentations. The 2021 annual fall meeting of the American

Geophysical Union (AGU, n.d.), which has had over 22,000 registrants since 2017, is providing in-person, hybridized, and online-only oral, poster, and (e)lightning presentations, as well as in-person exhibit spaces and virtual exhibition packages. Finally, in 2021 the American Association of Geographers (AAG, n.d.), which has a five-year mean attendance of about 8,400 attendees, has collaborated with another annual conference and six regional AAG divisions for in-person and virtual presentations. In 2022, the AAG will convene in a centralized location while providing in-person, hybridized, and virtual presentations and attendance. All 2022 AAG exhibitors will receive a virtual exhibit space at no cost. Registration rates for virtual attendees and presenters at the 2021 AGU and 2022 AAG meetings are lower than rates for in-person attendees and presenters, whereas rates for the 2022 CELA meeting are the same regardless of attendance option.

Virtual meetings. The evident costs of convening future ASLA Conferences on Landscape Architecture virtually include the removal of an opportunity to visit, engage in active leisure, and independently explore and relax in the event destination, which was a primary motivation of Americans' conference attendance in one study (Tretyakevich & Maggi, 2012). Attendees may view specifications, photographs, and videos of EXPO products, rather than the actual objects. Comparatively, registration and exhibitor fees, and perhaps sponsorships, may yield less revenue in comparison to business-as-usual conferences. Consequently, different, or new means of monetizing conference experiences, other ASLA products (e.g., magazine production and advertising) and events, and or annual membership fee structures would be needed, along with a critical review of annual expenditures and operations. Additionally,

eliminating future in-person events would decrease the economic benefits that event venues and host cities receive, including revenue from hoteling, feeding, and entertaining event visitors.

Oester, Cigliano, Hind-Ozan, and Parsons (2017) identify several possible technical limitations of virtual conferences including restrictions on the number of attendees; an inability to ensure attendance; potential attendees' limited access to electricity, computers, and or bandwidth, particularly in developing countries; and the possible exclusion of interactive workshops. In contrast, at least four studies show that virtual conferences attract more attendees, some of whom are outside of the organizing professional association, must care for others, or have budget constraints (Bousema et al., 2020; Klöwer et al., 2019; Pandian, 2018; Raby & Madden, 2021a). Klöwer et al. (2019) noted that attendance at the virtual European Geosciences Union conference increased from 16,000 to 26,000 (62 percent), between 2.5 and 4 times the current annual attendance of ASLA conferences. Moreover, Raby and Madden (2021a) recognize that online conferences allow attendees flexibility with time on the day of the conference, require less planning for travel (i.e., air and car) and hotel accommodations, and physical exertion from traveling. Increased attendance may require additional marketing but decrease the overall revenue gap between in-person and virtual conference registration fees. Requiring that attendees complete quizzes for continuing education units, as was done during ASLA's 2020 reVISION, would ensure attendance. Uploading recordings, digital posters and text-based discussions should prevent concentrated demand (i.e., "bottlenecks") for streaming content while offering high- and low-bandwidth connections could expand access to audiences that may have service restrictions (Klöwer et al., 2019). Lortie (2020) suggests that Zoom,

Twitch, or any streaming platform that allows sharing data or screens would allow for the conduct of virtual workshops on all the topics that Oester et al. (2017) list (i.e., statistics, mapping, remote sensing, and modeling).

Performing professional development online instead of in-person may yield the same or slightly better effect on learning, but acceptable modes of delivering continuing education at the state level may need to change. Following a meta-analysis and review of 15 independent data sources, Gegenfurtner and Ebner (2019) found that webinars are "trivially more effective in promoting student achievement than other learning environments," (p. 16) including face-to-face instruction. Moreover, longer webinars resulted in greater knowledge and skills when comparing pre- and posttest scores. Non-significant differences between learners in higher education and professional training, between knowledge tests and performance ratings, and across multiple separate or single combined webinar events indicate that future continuing education may take place predominately and effectively online, though some webinar platforms may be more effective than others. In the Commonwealth of Pennsylvania, at least, the Covid-19 health emergency prompted the creation of a waiver to permit 100 percent, rather than half, of the required 24 continuing education clock hours for the 2019-2021 biennium to be completed online (Pennsylvania Department of State, 2021). With support from ASLA, state boards of landscape architects may need to revise codes accordingly to address the climate emergency and permit the completion of a greater percentage of continuing education online.

The greatest cost of virtual conferences to attendees may be related to networking, which is difficult to perform remotely (Raby & Madden, 2021a, 2021b). Oester et al. (2017) reported

that 89 percent of conference attendees established new professional contacts in their area of interest; between 50 and 70 percent of respondents gained exposure to new techniques, skills, and novel ideas; and convening in person "led to new initiatives, publications, and enhanced multidisciplinary learning" (p. 2). However, several study results present a mixed view of networking. van Riper, van Riper, Kyle, and Lee (2013) found that the formation of social networks through new and existing relationships and "within and outside areas of expertise" resulted in strong, positive associations with respondents' ratings of conference satisfaction, but may not "build a sense of community" in respondents' area of expertise. Forret and Dougherty (2004) found that increasing internal workplace visibility significantly related to the number of respondents' promotions, total compensation, and perceived career success; socializing (i.e., attending social functions, playing golf, tennis, etc. with co-workers or clients) and maintaining external contacts were not significantly related. Participation in professional activities, such as speaking engagements and conference attendance, significantly related to total compensation only. Wolff and Moser (2009) found that building, maintaining, and using external and internal contacts over three years collectively had a significant effect on concurrent salary. Maintaining internal contacts at one's employer had a significant positive effect on salary growth and concurrent career satisfaction but did not significantly contribute to growth in career satisfaction. Again, using external contacts had the weakest effect on measures of career success. Finally, Wynes, Donner, Tannason, and Nabors (2019) showed that emissions from traveling by air, primarily to conferences, did not significantly relate to an index measure of researchers' productivity, total or normalized citations, or the average number of authors per paper (i.e., a

measure of collaboration that may stem from networking at conferences). Furthermore, Wynes et al. (2019) suggested that increased air travel may not relate to professional success as measured by salary.

Time zone differences among attendees, presenters, and exhibitors may result in scheduled discussion and interaction periods outside of regular business hours, which may limit or exclude participants, especially potential international attendees. A direct equivalent of spontaneous meetings in hallways, bars, or restaurants may not exist for virtual conferences. However, Lortie (2020) suggests that Google Hangouts, Microsoft Teams, Qigochat, Slido, and uMeeting are tools that may afford impromptu meetings. Klöwer et al. (2019) recommends Discord and Slack. Raby and Madden (2021a) found some support among virtual conference attendees for peer-to-peer meetings, mentoring, pub quizzes, debates, and special interest group meetings using Zoom meeting and breakout rooms, but overall dissatisfaction with the lack of social interaction. Oester et al. (2017) questioned whether virtual meetings can offer genuine, memorable, and authentic impressions. Indeed, slight delays between actions of virtual attendees cause our brains to work harder toward synchronicity (Wiederhold, 2020). We cannot see and interpret body language, may be distracted by "chat" content, find other attendees' faces too large and threatening or too small and distant (Wiederhold, 2020).

Our personal, individual desire for three to four days of social interaction outside of education sessions and the EXPO each year is countered by the centuries-long collective good ASLA members would be doing by almost eliminating conference-related carbon dioxide emissions, in addition to water and land use demand (Gössling & Peeters, 2015) and waste. Two

studies indicate that a virtual meeting may result in about 1 t CO_2, which is between less than one percent and six percent of emissions from an in-person meeting (Pandian, 2018; Raby & Madden, 2021a). Jäckle (2021) estimates that a virtual conference may result in between 0.06 to and 12.95 t CO_2, or as much as 10 percent of an in-person conference. Thus, ASLA members would meet US and global emissions reduction targets well before 2050 and immediately stop contributing to Arctic sea-ice loss (Stroeve & Notz, 2018), labor productivity loss in developing, equatorial regions (Chavaillaz et al., 2019); and near-term heat-related (Vicedo-Cabrera et al., 2021) and future human deaths (Nolt, 2011; 2013; 2015; Parncutt, 2019) that are associated with greenhouse gas emissions and climate change. In addition to the potential for increased attendance, virtual conferences afford a greater number of potential contacts one could make in comparison to an in-person conference (Raby & Madden, 2021a); require less time and money for travel, hotel accommodations, food and drinks; and more flexibility in accessing content and participating. One study suggests that developing a virtual conference platform may demand an initial expense equal to 30 percent of the cost of organizing and executing an in-person meeting (Raby & Madden, 2021a), but subsequent future use of the platform could equal about 8 percent. Finally, the dissonance between ASLA's professed values and actions (i.e., on climate change and equity) would diminish, the potential for *ad hominin* attacks would decrease, and the credibility of the Society and public policy support for which ASLA advocates could increase (Attari, Krantz, & Weber, 2016; 2019).

RECOMMENDATIONS

Based upon our analysis of alternative modes of convening annually within the context of emissions reductions ASLA supports, hybridized and virtual meetings should result in the greatest potential emissions reductions. To assess this hypothesis, we estimated and compared emissions ranges for virtual and various hybrid meeting models using methods from Jäckle (2021). For one hybrid model, we commanded software (XLSTAT in Excel) to compute the mean sums of 2,000 random selections without replacement for 90, 75, and 50 percent of EXPO representatives' and education session featured speakers' emissions weights. For the other, we calculated the sum emission weight ranges after removing 10, 25, and 50 percent of the highest emitting, most distant EXPO representatives and education session speakers from our datasets. To calculate the ranges of emissions for virtual meetings, we inserted into formulae Jäckle (2021) presented an electricity generation rate of 85 lbs. per kWh (EIA, 2020), the number of total participants from Author (2019) (Table 3) for each meeting, and the number of conference hours (25.5 for 2019; 28 for 2018), which excludes galas, dinners, and meetings and includes discrete hours without overlap devoted to general and education sessions, workshops, and the EXPO.

Our estimations indicate that virtual ASLA meetings and the hybridized conference model that requires 50 percent of the most distant participants to attend virtually only may meet the 50 percent emissions reduction target, relative to 2005 or 2010, by 2030 recommended by the IPCC (2018) and the USA NDC (2021) and supported by ASLA (2021b) (Figure 3). Relative to our 2019 San Diego in-person emissions estimations, a hybridized conference model that requires 50 percent of the most distant participants to attend virtually only may approach a 50

465 percent emissions reduction target. Relative to 2018 Philadelphia in-person emissions
466 estimations, hybridized conference models that require virtual attendance by 25 and 50 percent
467 of the most distant participants may approach 50 and 90 percent reduction targets, respectively.
468 Note that our 2018 estimations classified 50 percent of education session speakers and about 28
469 percent of EXPO representatives as local or overland travelers even prior to requiring additional
470 virtual participation. Thus, centralized conference locations that have limited access to overland
471 travel modes, particularly train travel, will require greater virtual participation to meet emissions
472 reduction targets.

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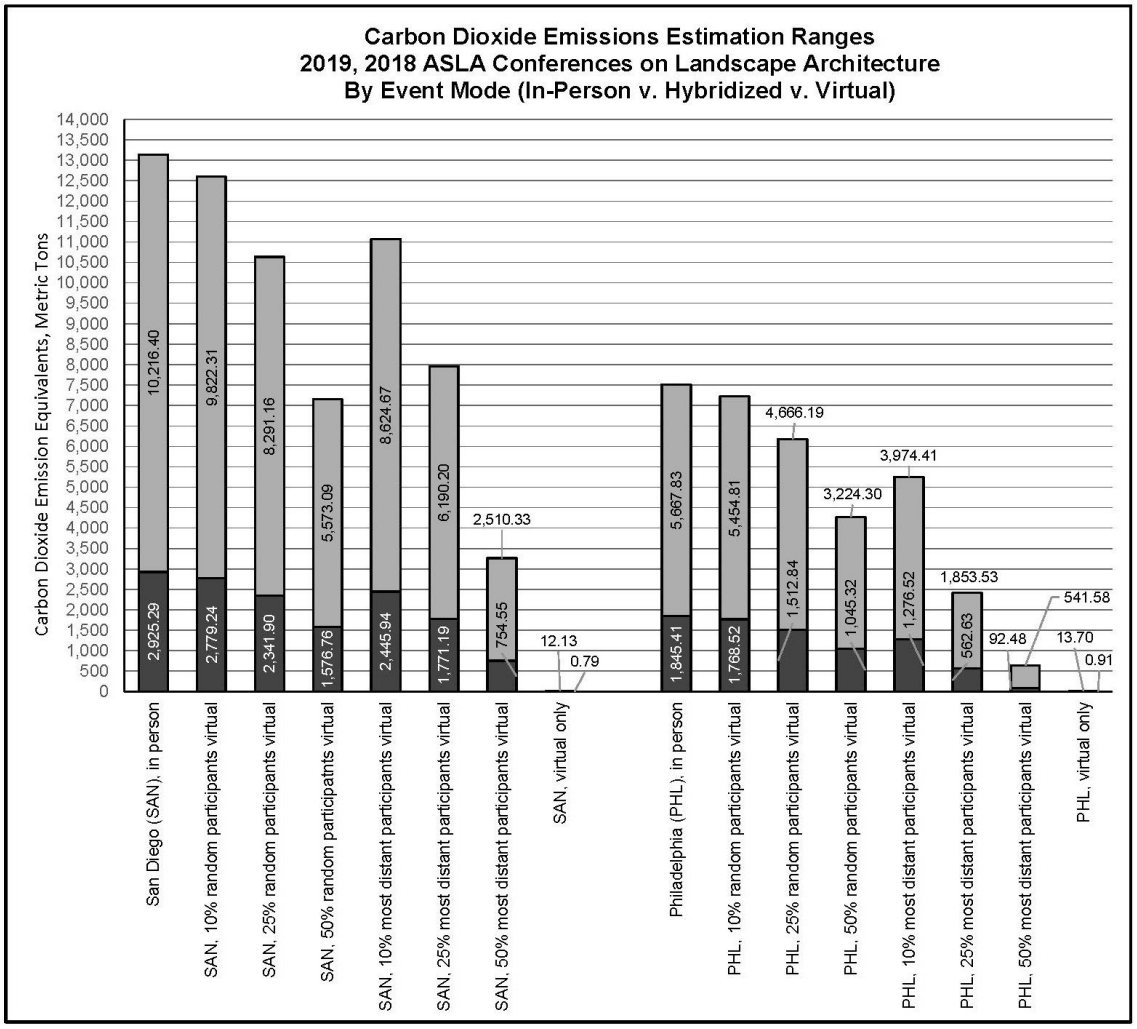

Figure 3. Carbon Dioxide Emission Estimation Ranges for 2019 and 2018 ASLA Conferences on Landscape Architecture by Event Mode. Dark gray columns represent minimum estimates; light gray columns represent maxima. Participants include conference attendees' and EXPO representatives' emissions.

Thus, we recommend immediately transitioning to hybridized annual meetings that require no air travel until 2030, at the latest. Thereafter, we recommend virtual annual meetings only. However, if or when hybridized meetings occur, emissions estimations should be performed and compared to those from business-as-usual conferences to determine whether the transition to virtual conferences should happen sooner. Carbon offsets are not valid alternatives to behavioral changes that result in actual emissions reductions and should not be purchased in lieu of our recommendations (Anderson, 2012; Hagmann, Ho, & Loewenstein, 2019; Werfel, 2017; Wilde, 2020). Until such time that ASLA convenes virtually, annual ASLA Conferences on Landscape Architecture will contribute to the climate crisis. ASLA must wholly avoid claims of being green and sustainable.

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