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THE RIVER RUNS

News from the Cowpasture River Preservation Association

INSIDE THIS ISSUE:

Springtime on the Cowpasture River. *Photo taken near the home of Peggy Van Yahres in Spring 2021. Photo by Peggy Van Yahres.*

(*Please send us your best photos of the Cowpasture River and the surrounding wildlife.)*

From the President

The first and probably last snow of this winter is falling as I compose this message for the CRPA spring newsletter. The winter of 2023 has been unusually mild and even though I have missed a proper sledding snowfall, I am anxious to return to warmer weather outdoor activities!

As you read through this newsletter, you will find that the CRPA board members, assisted by Lynne Griffith, have been busy arranging a variety of field trips for the members. A trip to check out "The Wonder of Vernal Pools" is scheduled for April 1st. A trip to "Explore Karst Topography" will take place May 13th. An expedition to "Assess Your Farmland Soils" is scheduled for June 3rd. In addition, a river float will be scheduled later in the month on the lower portion of the Cowpasture River. On September 16th, members may take a guided hike on the Millboro Elementary School nature trail and then to start the new year, a trip to "Explore Wood Duck Boxes" is scheduled for January 13th.

I hope many members will participate in these outdoor activities and will also attend the Annual Meeting on May 20th and join the fun at the Annual Summer Picnic! I am anticipating enjoying most, if not all of these events, especially today as I look out the window at a beautiful snow covered landscape.

I wish you all well and look forward to seeing you outside soon!

Yours truly,
Elizabeth Dudley

WATER FLOW DATA

If you would like to check out the water flow data for the Cowpasture River from the National Oceanic and Atmospheric Administration (NOAA), you can do so at the following sites:

Clifton Forge — https://water.weather.gov/ahps2/hydrograph.php?gage=cowv2&wfo=rnk

Williamsville — https://water.weather.gov/ahps2/hydrograph.php?gage=bprv2&wfo=rnk

Executive Assistant's Corner

As we approach spring and look back over the winter season, we are so grateful to the many people who have already stepped up and donated to our organization during the new annual campaign season that kicked off on November 1, 2022. Thank you for your support. We could not do any of this without you.

We have so much to look forward to this spring and summer. Elizabeth already filled you in on the upcoming field trips which are detailed on page 5. Our annual meeting will once again be held at the beautiful Camp Mont Shenandoah. Many thanks to Ann Warner, the camp owner and director, who has hosted us for several years now. Our speaker will be Brian Watson, the Aquatic Resources Biologist and State Malacologist with the Virginia Department of Wildlife Resources (VDWR). He will talk about mussel restoration in the Cowpasture River and beyond. He will speak about the mussels that were put into the Cowpasture River at the Walton Tract, and he will also discuss a major nearby restoration project that was started with the James Spinymussel in Mill Creek at Camp Accovac. In addition to our speaker, we will also vote on our new board nominees, Tom Watts and Tuck Carter. We are grateful for their willingness to serve our organization. You can read all about them on page 13. If you are unable to attend the meeting, please fill out a proxy ballot on page 15 and mail it to us no later than April 30, 2023. We want your vote to count.

Many thanks to board member Catherine Roland for organizing our summer river float being held on June 10, 2023. We will be floating a different section of the river this time. We will put in at the Sharon public access point and take out at the Steel Bridge. We're excited to have a chance to get back out on the river. We hope you will consider joining us in the fun.

Finally, I would be remiss if I did not mention our bi-annual Walton Tract Clean-Up. It's such an important contribution to our community, and believe it or not, it's a lot of fun, too. We have great conversations with great people while picking up trash. It's such a win-win! Come on by if you can.

October 2022 Walton Tract clean-up crew.

JOIN US FOR OUR SPRING RIVER CLEAN-UP AT THE WALTON TRACT

Saturday, April 15, 2023 — 1:00—3:00 pm

Please help us collect litter along the Cowpasture River at our adopted site in the national forest. Volunteers will meet at the Walton Tract lower public access point ("rope swing"). To sign up, email Lynne Griffith at directorcrpa@gmail.com or call 540-620-7795. Details will be provided upon your RSVP.

River Memory from Dave Peters

We had booked a short, three-stop cruise, of which the third stop was Cuba. By cruise time, however, Cuba had been closed again to us by our government. However, since the cruise was part of a larger travel plan, we didn't cancel. As it worked out, one of the other two stops was cancelled, as well, so it was mostly an at sea cruise. The library on this ship was very small, and most books were in other languages. However, Sandra did find one book she thought I might read. It is by Clay Risen titled "The Crowded Hour (Theodore Roosevelt, the Rough Riders, and the Dawn of the American Century)." I began reading, thinking this will be the closest connection to Cuba that we will have on this trip. Wow! There in print was someone I remember from my days growing up on the Cowpasture River. Yes everyone, there was a Rough Rider who loved the Cowpasture River. I knew him while growing up on the river as Dr. George P. Hamner.

"George Hamner became one of the more popular men in the Rough Riders camp after he devised a mortar and pestle out of an empty coconut shell in which he ground up roasted beans" to quote one line in the book. When I knew him as a young kid, he was in his 80's and drove up in the summer from Hollywood, Florida to stay with us and spend some time on the Cowpasture. He would also visit relatives in Nelson County. He was related to Earl Hamner of "The Waltons" fame." While flexing a fly rod he would tell me about being Roosevelt's clerk and about the battles. How I wish I had listened more carefully.

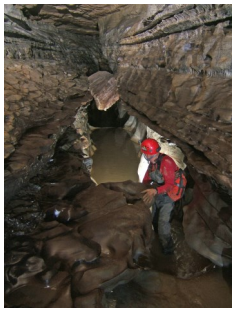
The CRPA Third Annual Artist Retreat at Fort Lewis Lodge and Farm May 7-10, 2023


Photo by Erin Cowden

We reached our goal of 30 artists within 10 days of launching the registration for the Artist Retreat on our website. The artists represent a variety of media and come from across the state and Washington, DC. 12 are returning, and 19 are new to the event. We have three people who are on the waiting list. If you are interested in attending, please contact Lynne at director@cowpastureriver.org so that she can add your name to the waiting list. With any luck, you might still be able to get in. You won't want to miss such a special event.

Check Out Our Upcoming Field Trips

Saturday, April 1, 2023 at 6:30 p.m. — The Wonder of Vernal Pools (led by Arne Peterson) Join Arne Peterson for the insights and sounds of a vernal pool in springtime. We'll check out the peepers, wood frogs, salamanders and fairy shrimps. You will need a strong flashlight, waterproof boots and a lawn chair. After the sun goes down, we will sit around the campfire and discuss what we observed . Feel free to bring snacks and drinks. Meet up at Arne's place (address to be given upon RSVP). Limited to 12 people. The cost is $10.



Bill Jones in action!

Saturday, May 13, 2023 (12:00 noon—4:00 pm) — Exploring Karst Topography (led by Bill Jones). Meet up with Bill Jones at Windy Cove Church at 12:00 noon where we will caravan together in three cars to explore the local karst topography. The complete trip will encompass 47 miles and will take a total of four hours. Limited to 12-14 people. The cost is $10.

Saturday, June 3, 2023 (9:00 am—12:00 noon) — Assessing Your Farmland Soils (led by Matt Cauley). Plants are amazing things. They actually have "spirits" that can help you see into the soul of the soil beneath them. Many plants are site-specific and are finely attuned to the soil's chemical and physical characteristics. This field experience will help you learn to recognize key indicator plants and what they tell you about your soil. Limited to 10 people. The cost is $10.

Matt Cauley

Saturday, June 10, 2023 (Start time to be determined) — Summer River Float. Join us for our annual summer river float. We will start at the Sharon public access point and take out at the Steel Bridge. There is plenty of parking in both locations. We will arrange rides for people to get their cars from the public access point once we arrive at the Steel Bridge. More details will be forthcoming. There is no charge for this event.

Arne Peterson observing a wood duck box.

Saturday, September 16, 2023 (Start time to be determined) — Nature Trail Hike (led by Arne Peterson). Join Arne to take a hike on the Millboro Elementary School nature trail (about 9/10ths of a mile), followed by a discussion on how to attract large cavity nesters, such as owls, kestrels and wood ducks. You will need good hiking shoes. The cost is $10.

Saturday, January 13, 2024 (Start time to be determined) — Exploring Wood Duck Boxes (led by Arne Peterson). Join Arne and spend a half day inspecting wood duck boxes and maybe even find an owl to take out of the box. You will need waterproof boots and leather gloves for removing owls. The cost is $10.

Registration for each field trip will open up 30 days prior to each event. We ask that you register via our website.

A Call for Evaluation of the Role of Regional-Scale Environmental Toxicity In Population Declines of Northern Bobwhite Quail

Excerpts from an article written by S.B. McLaughlin, J.C. DiNardo, G. Brelsford, and W.T. Wilson (The entire article, along with additional data tables and figures, is published on the CRPA website under the "Latest News" section.)

The disappearance of the Northern Bobwhite quail from much of its regional range in the eastern United States over the past six decades has been a major ecological, aesthetic and recreational loss for the region. Many land management practices that can affect quail habitat distribution and quality have doubtlessly played an important role in the loss of quail from its original range. However, the current absence of quail from even high quality habitat within its normal range suggests that there are other critical factors that should be examined to provide the integrative understanding of multifactor stress abatement that will ultimately be required to restore this valuable species to its native range. These include several toxic compounds derived from fossil fuel combustion and other industrial processes that produce organic chemicals that adversely affect biological processes. Among the emissions from fossil fuel combustion are acidic compounds derived from sulfur (S) and nitrogen (N) as well as toxic trace metals such as mercury (Hg) and lead (Pb). In addition, regional use of agrochemicals and fluorocarbons from industrial processes have produced multiple compounds with a strong potential to enter and disrupt avian food chains.

We believe the unexplained decline of quail across its broad range is a signal, a critical challenge, and an opportunity to identify the principal interacting stressors that are now adversely affecting the health of a broader range of terrestrial ecosystems and resident populations, including humans. This challenge comes at a time when there are alarming indications that there have been other significant regional declines in several components of our terrestrial ecosystems, notably insect populations (Wagner, 2020) and other bird species (Evers et al., 2012). Human health has also been a component of our terrestrial ecosystem for which pollution has been estimated to be responsible for 9 million premature deaths per year (Fuller et al. 2022). More than ever, defining the role of interacting stresses in driving biological responses is important for broader understanding of ecosystem health.

The quail's broad native range, its iconic importance as an aesthetic fixture in rural culture, and its strong support from the hunting and sporting dog training community make it perhaps the most appreciated and valuable among the eastern bird species. As a ground nesting species that moves, feeds, and nests at ground level, the bobwhite receives the vertically integrated accumulation of products of both wet and dry deposition of air pollutants that occurs at ground level. The strong dependence of young chicks on the high protein content of insects increases the

probability that food chain accumulation of toxicants will adversely affect them at this critical life stage. From a research logistics perspective, the existing quail breeding and pen rearing industry that currently exists to support put and take hunting, would likely be a valuable asset as a supply system for both eggs and chicks to support research opportunities. In addition, genetic research at Texas A&M University that has sequenced the quail genome (Seabury, 2014) may be critical to both future breeding and management research to improve quail resistance to environmental stresses.

To provide strong evidence of causality for observed patterns of change in quail populations within a region in which many environmental conditions have changed across space and time, it will be important to evaluate concurrent changes in factors which have also changed over similar times and spatial scales and which have a plausible mechanistic link to quail survival and health. This approach of coupling broader regional response patterns with patterns and plausible mechanistic linkages to natural and anthropogenic stresses proved valuable in linking regional declines of some tree species with patterns of anthropogenic stress from air pollutants (McLaughlin and Kohut, 1992). What we propose is a focus on a multifactor stress component analysis that considers the spatial and temporal distribution of several potential chemical stressors that have changed across the range of quail population loss over time. Among the more obvious pathways by which quail health may be affected are buildup of toxic elements in food chains (trace metals), liquid uptake of dissolved toxics and acidity in chemically enriched dew that supplies some of the water intake needs of quail, and effects of wet and dry deposition of acidity on the calcium physiology of terrestrial systems (McLaughlin and Wimmer, 1999) including insects that supply calcium used in egg formation.

We believe a careful review of census data that define the spatial and temporal scale of changes in quail populations within the region combined with changes in regional patterns of pollutant inputs would be productive. Particularly important are analyses of individual and combined interactive toxic thresholds for various toxic elements that adversely affect bird growth and physiology through food chain accumulation. Such an effort would suggest whether future focused research in these areas would be productive to further understand and improve quail populations in this region. We focus here on defining relationships among quail health and four of these potential stressors as a potentially productive beginning to defining where strong and potentially interactive effects among them may occur.

Defining and Evaluating Quail Population Declines Over Time. We have used the annual state level National Breeding Bird Survey data (USGS, 2018) to estimate population changes in quail in 5 states that covered the eastern US over both North/South (Texas to New York) and East/West (Virginia, Georgia, to Iowa) gradients. The series were developed around annual interval data that extended from 1966 or 1967 to 2019 for each state. The individual data series for each state were then normalized to express the annual data as a percentage of the average of the 5 maximum annual counts for each series. We summarized across states by then averaging the normalized decline data for each year across the five states. The data indicated that on average populations had declined to 50% of maximum values by 1988 and to 25% of maximum values by 1994. The strongest declines had occurred in New York and Virginia over the 1967-2019 interval.

Changes in Land Use Patterns

The importance of changes in farming practices over time has long been recognized as one of the very important stresses on bobwhite quail populations and involves sizes of fields and cultivation practices in fields, conversion of cropland to planted forests, pesticide use, and introduction of diseases in pen released birds (Fies, et al.,1987 , Brennan, 1991). We certainly agree with the need to consider these many factors in reversing the quail population decline, but wanted to evaluate how consistently some macro indicators of cropping selection and intensity related to observed population decline patterns. Did changes in these patterns suggest that synchronous land use changes in the five study states were likely triggering influences for the decline or were they perhaps just contributors?

Our analyses shown in Tables 2a, 2b and 2c examined changes in average farm size (and potential field sizes), the acreage of grass based hay produced (a measure of grassland cover) and acreage in soybeans and corn produced per farm (a measure of the relative importance of intensive row cropping). Our conclusions were as follows:

1. There has been no obvious significant influence of average farm size on quail population declines during our study interval. Average farm sizes changed little over the period of quail decline so large changes in field edge areas and associated quail cover seem unlikely to have occurred during this time.

Table 2a: Total Farm Acres (M) and Average Farm Size (Av Acres)

Year	Georgia		Iowa		New York		Texas		Virginia	
	Total	Average	Total	Average	Total	Average	Total	Average	Total	Average
2021	10.2	247	30.5	359	5.9	207	125.0	510	7.7	186
2015	9.8	234	30.6	352	7.0	205	128.5	520	8.2	176
2010	9.7	219	30.6	342	7.1	197	131.6	530	7.7	186
2005	10.7	218	31.2	351	7.4	206	130.0	568	8.5	179
2000	10.9	222	32.5	346	7.6	205	130.9	573	8.7	180
1995	11.5	235	33.0	330	7.9	208	132.0	545	8.8	180
1990			33.5	325						
1985			33.6	303						
1980			33.5	325						
1975			34.8	262						

2. Quail populations have declined in two states in which grass hay production acreage has decreased (NY and Iowa) one in which it has increased (Texas) and two in which it has remained the same (VA and Georgia) since the 1950s. No consistent effect of this component of grassland cover was apparent.

Table 2b: Non Alfalfa Hay Production (K Acres)

Year	Georgia	Iowa	New York	Texas	Virginia
2020	570	330	760	4900	1106
2010	650	320	910	5100	1250
2000	650	430	1050	4200	1200
1990	570	300	1120	3800	1020
1980	460	520	1400	2540	880
1970	427	702	1377	2125	903
1960	433	1280	1957	1733	907
1950	977	2246	2319	731	1107

3. Production acreage in corn and soybeans, more intensively cultivated crops, has gone down dramatically in GA, increased sharply in New York and Texas, and remained about the same in Iowa and Virginia during the past 50 years as quail populations declined. So, we did not see changes in the larger scale land use patterns that would have been expected to act as triggers for the observed decline in quail populations among these 5 states and regions.

Table 2c: Corn and Soybean Production (K Acres)

	Georgia			Iowa			New York			Texas			Virginia		
	Corn	Soy	Total	Corn	Soy	Total	Corn	Soy	Total	Corn	Soy	Total	Corn	Soy	Total
2020	420	100	520	13600	4450	18050	1030	315	1345	2250	120	2370	540	510	1050
2010	295	270	565	13400	9800	23200	1050	280	1330	2300	205	2505	490	560	1050
2000	360	170	530	12300	10700	23000	980	135	1115	2100	290	2390	470	490	960
1990	650	900	1550	800	1210	2010	1210		1210	1650	220	1870	530	540	1070
1980	1600	2200	3800	14000	8300	22300	1350	20	1370	1500	700	2200	830	630	1460
1970	1750	490	2240	10760	5709	16469	847	6	853	670	170	840	692	372	1064
1960	2304	106	2410	12658	2615	15273	653	6	659	1391	84	1475	741	334	1075
1950	3295	78	3373	9837	1960	11797	673	9	682	2959	10	2969	973	202	1175

Atmospheric Emissions from Coal Fired Power Plants

This past century has seen dramatic increases in emissions of pollutants from use of fossil fuels both from coal combustion in large power plants and petroleum derived transportation fuels. While the level of emissions has varied by region, the dynamics of increases have been similar across larger regions (See Figure 2).The primary pollutants of interest have been sulfur and nitrogen compounds which have been shown to acidify lakes, streams, and forest soils and to reduce productivity of both forests and aquatic systems where deposition is highest. In addition to N and S, a wide variety of other hazardous pollutants including mercury, lead, and arsenic which have negative impacts on terrestrial biota are emitted in significant quantities by coal-fired power plants (See Table 3). It is important to note in Figure 2 that the most rapid increases in power plant emissions occur in the 1960 -1990 time interval when quail populations began their decline. On the other hand, our analyses (not shown here) indicate that S and N emissions for our 5 states declined by an average of about 90% from 1990 to 2019 without producing any apparent recovery in quail populations during that time. So, changes in quail populations that occurred during the period of rapidly increasing emissions were either of a more persistent nature for which a threshold was reached or are perhaps more closely influenced by other factors.

Figure 2. SO2 emissions from 3 eastern states from 1900 to 1980 show parallel trends in the timing of increases and reflect regional synchrony in industrial development over time

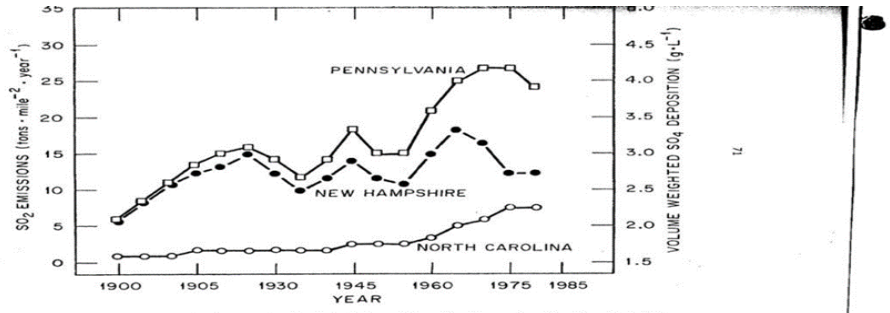


Fig. 23. Historical emissions and calculated deposition for Pennsylvania, New Hampshire, and North Carolina emphasize regional.

Atmospheric Mercury Emissions

In addition to its release from coal fired power plants (See Table 3 - EPA, 2022), mercury is released from a wide variety of industrial plants, including wastewater treatment plants, cement plants, and incinerators. Mercury has long been recognized as a highly reactive neurotoxin in humans, but recent research indicates it is accumulating in terrestrial ecosystems and is building up in insect eating birds, such as forest songbirds (Evers et al. 2012). Effects of mercury across the landscape now appear to be far more severe than originally thought including the near disappearance (45% decline in 20 years) of wood thrush from the Adirondack mountains (Sweiger et al., 2006). This response has paralleled the decline in quail populations in the region. Documented impacts of elevated mercury levels in birds include lower reproductive success and abnormal behavior (William and Mary, 2014), neurological/physiological problems, and death.

We note here a study on Hg concentrations in bobwhite quail in Virginia (Turnquist and Evers, DC, 2012) that concluded, based on low Hg concentrations in wing feathers of field sampled quail, that Hg was not a toxic problem for Virginia quail. We suggest that quail wing feathers may not be an optimum comparative sampling tissue, particularly for this fast flushing bird. We consider that concentration of Hg in blood or internal organs would be a much more direct and better indicator of levels of physiologically active mercury.

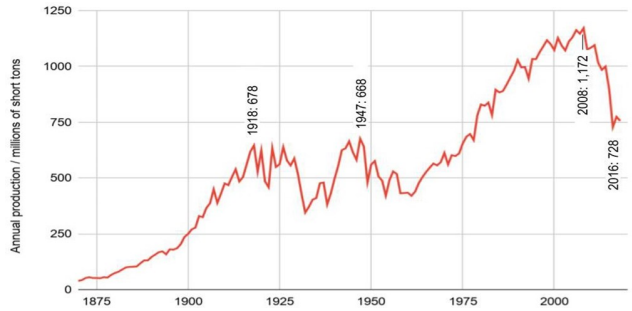
Table 3. Contributions of Coal Fired Power Plants to Selected Hazardous Air Pollutant Emissions

Hazardous Air Pollutant	Percentage of Point Source Emissions
Acid Gases (HCL and HF)	76%
Arsenic	60%
Beryllium	28%
Cadmium	30%
Chromium	20%
Cobalt	34%
Lead	15%
Manganese	46%
Mercury	46%

Atmospheric Lead Emissions

Lead is another byproduct of fossil fuel production and consumption (gasoline) as well as mining activities and it, like mercury, has been shown to damage developing neurological systems in humans**.** It can also accumulate in soils and sediments over time and cause damage to plants and animals. The long term record of lead emissions in the US (Figure 3) shows a strong increase in total lead emissions during the period leading up to and continuing with quail decline through year 2000. If one plots lead air quality over the last 30 years, however, one can see the positive effects of the switch to unleaded fuels in highway vehicles beginning around year 1995. Results of field sampling (Schmude et al., 2018) to determine lead uptake based on analysis of lead concentrations in feathers of field collected quail in Texas indicated that lead levels in 25% of sampled birds exceeded the toxic threshold (4 ppm dry weight), while 6% had Pb concentrations of 5 times the projected effects threshold.

Figure 3: Historical Emissions of Lead in the US 1876—2016

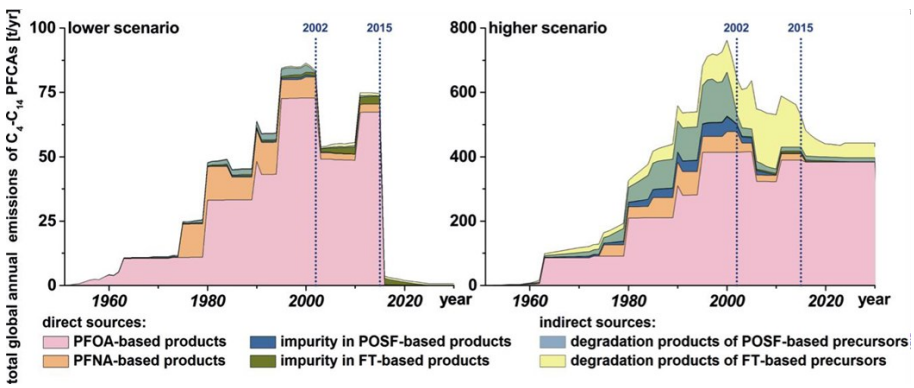


Release and Toxicity of Polyfluorocarbons (PFAs and PFSOs)

Since the invention of Teflon in 1938 the development of a diverse class of polyfluoronated synthetic organic chemicals has expanded to meet the diverse needs of industries. These industries include organic chemicals, plastics, and synthetic fibers, pulp and paper, textile mills, etc. Along the way it was discovered that PFAS can be toxic to humans, are not easily degraded over time and with decades of use have now shown up in surface water, drinking water, soil, plant and animal tissues and human blood serum across the globe (EPA, 2021). In a recent survey of regional drinking water supplies, public water systems in 33 states serving 6 million people had PFAS levels with at least one sample above the toxic threshold of 70ng/l. Recent studies to assess reproductive toxicity of mixtures of PFOA and PFOS demonstrated that these two compounds can act synergistically to cause adverse reproductive and growth effects in bobwhite quail at a level of 0.06 ppm (60 ng/l), a level of below the EPA joint exposure drinking water standard for adverse effects. The higher toxicity of the combined vs individual component exposures is an extremely important finding as we consider how to most realistically study real world mixtures of toxic substances.

Figure 4. Estimates of the historical global emissions of PFOA and Related Products 1960-22020.

Upper and lower level estimates of the total global emissions of PFOA and related products are shown in Figure 4. It is immediately apparent from this figure that rapid increases in global emissions of PFOA's were occurring in the same interval as that in which populations of quail were declining in the Eastern US.



Evaluating Concurrent Trends: Sensitivity and Causality

In Table 4 we have combined the comparative trend patterns for four potential causative pollutant stresses that may have influenced the timing and level of response of the quail decline. These include emissions of acidity (S & N), and lead, mercury, and PFA'S vs the 5 state average pattern of quail population decline as well as the population decline in Virginia. The degree of correlation R between two variables allows one to calculate the percentage of total variability (R2) expressed by the dependent variable as a reflection of the variations in the independent variable over time. Table 4 indicates that 3 of the 4 independent variables (Hg, Pb, and PFOA+PFS) were strongly and negatively related to low values of quail survival (i.e., high levels of decline of quail populations). These variables appear to contribute over two thirds of the variability in 5-year interval quail decline time series expressed over the 40-year study interval. Correlations were similar in sign, but less significant for the comparisons that were restricted to Virginia alone. Emissions of S and N, which peaked well before the peak of the quail decline were inversely related in time to decline (i.e., lowest emissions associated with low survival) at either single state or 5-state scales.

While proof of correlation is not the same as proof of causality, it can lead us to explore more effective pathways that lead to proof of causality. The required response characteristics needed to establish proof of causality include sensitivity, consistency, and the existence of a plausible

Table 4. Correlation coefficients between 4 indicators of hazardous pollutants and rate of decline in bobwhite quail populations in 5 eastern US states.

Response Variable	Indicator of Pollution				
	Correlation	S+N	PB	HG	PFOA
5 State Average of D5*	R	0.83	-0.79	-0.88	-0.78
	R2	0.69	0.62	0.77	0.61
Virginia D5	R	0.91	-0.46	-0.83	-0.64
	R2	0.83	0.21	0.69	0.41

Note: *D5 is the decline in Quail population estimate on a 5 year interval basis compared to the five maximum annual counts within the 45 year sampling interval. Small numbers were associated with low populations.

mechanism linking causative factors to an observed response - in this case - quail decline. Our analysis suggests that three of the stress parameters examined meet the prescribed combination of relationships needed to establish proof of a causal linkage to quail decline. As both individual and combined toxicants, we consider Hg, Pb, and PFOA as critically important candidates for further productive studies to strengthen the evidence and understand the nature of cause and effect linkages with quail decline.

Conclusions

We believe that sufficient data exist to conclude that atmospheric pollution has played a significant role in contributing to the widespread decline of bobwhite quail populations in the Eastern United States. Because field exposures to air pollutants involve concurrent exposure to multiple pollutants with the potential to affect multiple neurological and physiological processes, it will be important to study the potential interactive effects of pollutants combinations if we wish to better understand and perhaps remediate the regional reductions in quail populations. Field and lab based toxicological studies examining individual and combined effects of lead, mercury, and PFAs should be undertaken to better define the combined toxicity of these pollutants on quail and on their sources of food and water. In addition, the effects of acidic deposition on quail reproduction derived from calcium depletion and associated egg structural and physiological integrity should be explored.

We suggest, for many reasons, that bobwhite quail should be promoted as a model indicator species to study regional scale effects of air pollutants on terrestrial ecosystems in the Eastern United States. This recommendation is based on the documented existence of regional scale decline of quail across the region, widespread knowledge of and support for the species, specific habitat and feeding preferences that would make it susceptible, availability of a ready supply of birds and eggs for testing from commercial producers, and previous research findings with several pollutants. A well-coordinated program of extensive future experimentation could answer many important questions about ecosystem level responses to the current regional mix of air pollutants in the Eastern United States. Such experimentation should focus on the effects of both individual and combined pollutants and on interactions with other environmental stresses on decline of this species. The answers so provided would likely have important implications for the future ecological health of this important bird species, as well as for some of the ecological systems that support many more species, including man.

References listed under "Latest News" on the CRPA website, along with the entire article.

Meet Our New Board Member Nominees

Please meet our board nominees who will be on the ballot at our upcoming Annual Meeting.

Tom Watts —Tom is the current president of Lynchburg Camp, an organization that has a long history of supporting the CRPA. He was elected into Lynchburg Camp in 1982 as the first third generation member. His time on the Cowpasture River started at birth, and he has enjoyed it ever since. His time at Lynchburg Camp allows him to enjoy all facets of the Cowpasture River, along with his wife of 40 years, children, and grandchildren. His goal is to always contribute to the Lynchburg Camp Family, as well as other friends along the river.

In 1971, Tom graduated Cum Laud with a Mechanical Engineering Degree from Virginia Western. From 2000 to 2010, he served as President and Equity Partner of Tread Corporation, a multinational company manufacturing support equipment for the commercial explosives industry.

From 2010 to present, he serves as President and owner of Progressive Solutions of Virginia, specializing in consult mentoring of senior management teams and used-equipment brokerage to explosive related companies.

Tuck Carter — I was born in the C&O Hospital in Clifton Forge where I grew up. My love for the Cowpasture River came from the hours spent with my siblings boating, swimming, and fishing there. We never tired of it. I attended Madison College (JMU) where I met Chris. We graduated in 1977 in the last graduating class of Madison College, married and set out on our life in Charlottesville. I first taught special education in Greene County. Two years later, we began to grow our family and started our wholesale bakery/bread business. We have three children and nine grandchildren who keep our lives busy and fulfilling. Our sons now own and manage the business which services restaurants and institutions in seven states. We feel very fortunate that in 2010 we found our small getaway right on the river in Millboro Springs. We experience so much joy watching the wildlife, birds, and of course, the ever-changing and beautiful Cowpasture River!

SAVE THE DATE

2023 Virginia Water Monitoring Council Conference

Tuesday, September 26, 2023 -- Henrico, VA
Henrico County Training Center
7701 East Parham Road, Henrico, VA 23228

Conference and registration information will be posted at https://vwmc.vwrrc.vt.edu/conferences/. Submit speaker suggestions to VWMC@vt.edu.

CRPA's Annual Meeting & Dinner

SAVE THE DATE!

SATURDAY, MAY 20, 2023

Join us for good company and excellent food at our Annual Meeting and Dinner

5:00—6:00 pm Social Hour and Raffle

6:00—7:00 pm Catered Dinner

7:00—8:00 pm Presentation by Brian Watson (Topic — Mussel Restoration)
Business Meeting — Vote on New Directors for the Board

WHERE:
Camp Mont Shenandoah
218 Mont Shenandoah Lane
Millboro, VA 24460

COST
$35 per person — please pay in advance
$25 for children (ages 12 and under)
No refunds after May 13, 2023

RSVP: Sign-up and pay online at www.cowpastureriver.org.

If you have any problems, email Lynne Griffith at directorcrpa@gmail.com or call 540-620-7795.


Photo from John Fowler

Registration deadline is May 13, 2023 (or, AT LEAST email your intentions by that date — we have to guarantee the number attending to the caterer).

IF YOU CANNOT PARTICIPATE at the CRPA Annual Meeting, please return this proxy vote by April 30, 2023 along with any unpaid dues* to: **CRPA, Box 215, Millboro, VA 24460.**

I am unable to participate in the 2023 Annual Meeting and do hereby name the following Director (circle one) to be my/our Proxy.

David Burnett	Linda Cauley	Margo Clegg	Caryl Cowden	Elizabeth Dudley
Michael Hayslett	Kim Manion	Norwood Morrison	Tom Reycraft	Catherine Roland
Harold Smestad	Ann Warner	Nan Mahone Wellborn	Andrew Young	

Signed _____ Date_____ Signed _____ Date_____

Signed _____ Date_____ Signed _____ Date_____

Please note: Unsigned proxies will be void. Unpaid dues will disqualify your vote. If you contributed to the 2022 annual campaign, or have sent dues in 2023, you are in good standing with respect to the vote.

But, in case you're behind in your dues …

* Membership Categories (check one):

____ Member ($25 minimum per individual)

____ Streamside Level ($50)

____ River Guardian ($100)

____ Headwaters Circle ($250)

____ Watershed Steward ($500)

____ Wallawhatoola Level ($1000)

____ Bedrock Patron ($1,500)

____ Endowment Contributor ($3,000+)

Name _____

Address_____

_____

Phone _____

Email _____

The CRPA Nominating Committee has chosen the following individuals to fill the open and/or expiring board member terms:

- Tom Watts (3-year term)
- Tuck Carter (3-year term)

Nominee Biographies:

Tom Watts— Tom is a longtime member of Lynchburg Camp where he currently serves as President. Tom has a background in mechanical engineering and is a consultant and broker with explosive-related companies.

Tuck Carter — Tuck grew up in Clifton Forge and spent her childhood enjoying the Cowpasture River. She and her husband ran a wholesale bakery/bread business for many years. They own a home on the Cowpasture River in Millboro Springs.

Thank you for being a part of the CRPA annual elections process!

STANDARD
PRESORT
U.S. POSTAGE PAID
PERMIT NO. 38
DALEVILLE, VA

Post Office Box 215

Millboro, VA 24460

(540) 620-7795

Protect The Things You Love

Please join us today. The river needs your time, talent and support!

Your donations are tax deductible!

❒ *$25 Adult Membership (minimum annual dues per individual*

❒ $50 Streamside Level *Donation*

❒ $100 River Guardian *Donation*

❒ $250 Headwaters Circle *Donation*

❒ $500 Watershed Steward *Donation*

❒ $1,000 Wallawhatoola Society *Donation*

❒ $1,500 + Bedrock Patron *Donation*

❒ $3,000+ Endowment Contributor *Donation*

❒ Memorial *Donation* $_____

in memory of _____

❒ *$12 Junior Membership Dues*

❒ I am a NEW member! ❒ I am RENEWING

❒ This is a gift membership for _____

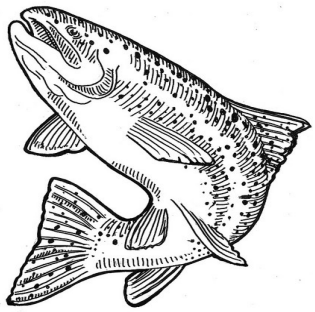
NAME(S): _____

ADDRESS: _____

_____ _____

CITY — STATE — ZIP PHONE

E-MAIL: _____



❒ I prefer to NOT have my name published as a contributor.

❒ Please send my newsletter by email version only.

❒ I am interested in becoming a volunteer and/or river monitoring.

(Note: A financial statement is available upon written request from the Virginia Department of Agriculture and Consumer Services — Office of Charitable and Regulatory Programs.)