

The Entomological Society of Manitoba

Newsletter



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About the ESM Newsletter

The Entomological Society of Manitoba Newsletter is published three times per year. It is a forum whereby information can be disseminated to Society members. As such, all members are encouraged to contribute often. The Newsletter is interested in opinions, short articles, news of research projects, meeting announcements, workshops, courses and other events, requests for materials or information, news of personnel or visiting scientists, literature reviews or announcements and anything that may be of interest to ESM members.

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Editors' Comments

Hello 2021!

Hopefully everyone had a great (but different) holiday season and is ready for the winter semester. We are starting the year off right with a jam-packed newsletter full of insect facts and updates!

In case you missed it, this newsletter contains the highlights of the 76th Annual Meeting of the Entomological Society of Manitoba. This year was a bit different due to the pandemic but the virtual meeting was a fun and safe way to reunite members of the society.

This issue also contains interesting articles on stored product pest insects and the Mormon cricket (Spoiler Alert: It is not Mormon, or a cricket!). And an update on new pesticides being used in the province.

In the next issue the newsletter would like to feature some arthropod pets that the members of the society keep at home. Please submit your pet pictures and names!

Happy reading and happy 2021,

Kelsey Jones and Kateryn Rochon

President's Report

By Jeff Marcus

Greetings ESM members!

I write to you in early January 2021, at a time when current events cast a long shadow over my academic work. The second wave of COVID-19 infections continues throughout the world, causing severe illness, death, and economic disruption. My children lost one of their grandparents in March during the first wave of the pandemic, and due to pandemic restrictions, she died alone. Also due to the restrictions, many months later, I have yet to be able to comfort grieving family members in person. The University of Manitoba is now entering its second term of nearly complete online learning and the students in my research laboratory have been working remotely for the last 9 months. Many of us struggle to maintain human connections, while at the same time following public health orders to stay apart and stay at home.



If all of that were not enough, in recent days, political unrest in the United States (my country of origin) has escalated. Protestors stormed the US Capitol Building as legislators tried to complete their work ratifying the results of the 2020 Presidential election. My brother-in-law is a police officer in a nearby community in Virginia and at the request of the Mayor of DC, his department dispatched 20 squad cars into the District of Columbia to help restore order. Events in far-away places can start to seem very personal, very quickly.

I think it is safe to say that we live in interesting times, perhaps even difficult ones. However, as challenging as they may be, we are not helpless. Over the last few months, my lab has donated dozens of boxes of disposable gloves and thousands of filter pipette tips to Shared Health Manitoba and Cadham Laboratories to protect health care workers and support the Manitoba COVID testing regime. Other research laboratories had donated countless additional supplies. Meanwhile, the Department of Entomology has loaned a Kingfisher nucleic acid extraction instrument to the National Microbiology Laboratory to support the Canadian national COVID testing program. I know researchers who have volunteered to help at COVID testing sites and to conduct contract tracing, and who plan to volunteer to assist with the vaccination program. Others have used their scientific training to write editorials for the CBC or the Winnipeg Free Press to help shape Manitoba's pandemic policies. Still others have collected food for food banks to distribute to those in need. My family scoured our local neighborhood for apple trees in the fall. After getting permission from property owners, we picked the trees clean and donated hundreds of kilograms of fruit to Harvest Manitoba. In myriad ways, we can still make things better for ourselves, for our community, and for everyone.

Among all of this other activity, the good work of the Entomological Society of Manitoba continues. Recognizing that in society at large as well as within the discipline of Entomology, people have not

always had equal access, recently the ESM council has adopted a policy on Equity, Diversity and Inclusion that parallels a similar policy recently established by the ESC. Thank you to Past Presidents Erica Smith and Alejandro Costamagna for their leadership in establishing this new policy. Thanks also to Chairperson Desiree Vanderwal and the Scholarships & Awards Committee (with the approval of the ESM Executive), who established a new ESM Student Service Award to recognize exceptional student volunteers and increased the monetary value of many of the other student awards that they administer. Finally, to renew connections among entomologists in a time of social distancing, we held ESM's first-ever virtual student symposium and Annual General Meeting. Thank you to Jason Gibbs for organizing the meeting and bravely navigating through the logistical issues related to using digital platforms to deliver what turned out to be an excellent event.

In the upcoming year, ESM will continue to find ways in which we can have a positive impact on our members in uncertain times. If you have suggestions for us, please tell me or another member of the Executive so that we can continue to move things forward.

Wishing you a happy and healthy 2021. May it be a year filled with good news and plentiful arthropods!

From the Regional Director

The Entomological Society of Canada (ESC) is working to create a more inclusive and diverse society through new Director positions for 1) Equity, Diversity, and Inclusion. And 2) Students and Early Professionals. The new Entomology Enthusiast membership provides additional access for non-professional entomologists to join and access the opportunities within the ESC. If you are not part of the national society or have allowed your membership to lapse, please consider joining or renewing your membership.

<https://esc-sec.ca/joinrenew/>

Jason Gibbs
Regional Director to the ESC



Are you passionate about insects, but not as a professional entomologist? Enjoy collecting, learning about or sharing your interests in bugs with others? If ‘YES’, you are encouraged to become an “Entomology Enthusiast” member of the Entomological Society of Canada (ESC).

Who is an Entomology Enthusiast?

- An individual engaged in entomological pursuits such as collecting, studying, observing or photographing insects as a pastime.
- BUT not eligible for any other ESC membership category. That is, someone who doesn’t derive a significant amount of their income from entomological activity, such as those working as or training to become a professional entomologist.

What are the Benefits of an Entomology Enthusiast?

- Approximately 50% discount from Regular ESC membership fees
- On-line access to all issues of the Canadian Entomologist, all Memoirs ever published, and the Bulletin of ESC
- Discounts for entomology books from some publishers
- Reduced registration fees for the ESC Annual Meeting
- Opportunities to interact with entomologists from across Canada

Amateur naturalists working with insects or their allies are eligible for two ESC programs:

- Research funding of up to \$1000 through the Carr award program
- Funding of up to \$500 for public education related to insects through ESC Public Encouragement Grants (apply through your regional entomological society) Enjoy and learn with others who are passionate about insects!

Join us today:

<https://esc-sec.ca/joinrenew/>

76th Annual Meeting of the ESM

The 76th Annual Meeting of the Entomological Society of Manitoba was held virtually using Zoom on 4 December 2020. The pandemic made organizing a traditional scientific meeting challenging and in-person meeting impossible. There were thoughts to cancel the scientific meeting. However, a decision was eventually made to hold a student competition. In the end the meeting included a symposium for students and postdocs with eleven contributed presentations. Presentations covered a wide range of topics in systematics, ecology and behaviour. Eight speakers were included in the student competition. A panel of judges awarded the prize to Justis Henault of the University of Winnipeg. Abstracts will be published in a future issue of the Proceedings of the ESM.

The Annual General Business Meeting was held in the afternoon.

ESM 2020 Programme Committee

Chair: Jason Gibbs

Past Chair: Jeffrey Marcus

Registration: Kathy Cano, Sarah Semmler

Participants: 48 people attended the student symposium and 39 people attended the AGM

ESM Student Awards 2020

Prepared by Désirée Vanderwaal

ESM Student Achievement Award: Awarded to a student who is in or recently completed a Bachelor's degree program. This award recognizes students who have shown exceptional interest in entomology as evidenced by their insect collections, insect photography, published articles of entomological interest, insect experiments and/or outstanding contributions during summer employment.



This year's winner of the ESM Student Achievement Award is Jade Tanner (University of Manitoba), who will soon graduate with a B.Sc. with a minor in Entomology. Jade worked for Agriculture and Agri-food Canada surveying pollinators in southern Manitoba, and most recently held an NSERC-USRA to work in the lab of Jason Gibbs. Jade is currently working towards her Honours thesis in the same lab. Jade has been studying the nesting biology of solitary bees at Birds Hill Provincial Park, while also collecting data to better understand the patterns of diversity in the park's bee. Her supervisor notes that she has much to contribute, given her broad interest and knowledge of plant and insect diversity.

ESM Student Service Award: Awarded to a student at the graduate or undergraduate level. This award recognizes a student who has promoted the goals of the Entomological Society of Manitoba (i.e., to foster the exchange of information on entomology and to further the spread of entomological knowledge) through their volunteer activities.

The inaugural winner of this award is Emily Hanuschuk (Department of Entomology, University of Manitoba). Emily is nearing completion of her MSc. During her degree studying “the effects of human disturbance on wild bee communities and pollination networks in southern Manitoba” in the lab of Jason Gibbs. Emily’s list of contributions is too long to list here, but highlights include serving as the Youth Encouragement and Public Outreach coordinator for the ESM; the President of the Department of Entomology Graduate Students Association; the student representative for the Biological Survey of Canada; and playing active roles in public outreach with the Forte Whyte Alive Bumble Bee Survey and Science Rendezvous Science and Engineering Fair.



Orkin Student Award: This award is designed to foster and encourage student interest in general Entomology including natural methods of insect pest control and the proper use of insecticides. Candidates must have a demonstrated interest in entomology, superior scholastic ability, high research potential, originality and industriousness in their university courses and/or summer work.

This year’s winner of the Orkin award is Katherine Hunt, a third year Biology major at Brandon University. Katherine is an academically gifted student, who was awarded an NSERC USRA to work



in the lab of Bryan Cassone (Brandon University). Her project involved the integrated pest management of wireworm, which included province-wide surveillance and assessment of insecticide applications for control. According to her supervisor, Katherine was “incredibly enthusiastic and truly loved spending time in the lab learning about entomology and all of the research techniques” and is an “incredible oral communicator”. Katherine has indicated that she is keen to complete her Honours degree and then proceed to graduate school. The committee agreed with the nominator that Katherine has great potential as an Entomologist.

The ESM Graduate Scholarship: This scholarship is awarded to students in a M.Sc. or Ph.D. program related to entomology at the University of Manitoba, University of Winnipeg or University of Brandon. Students must be enrolled in their graduate program for at least 12 months prior to Oct 1 of the award year. This award recognizes superior scholastic ability, high research potential, and excellent communication skills.

This year the committee felt that there were two extremely deserving applicants, so the ESM Executive agreed to support a tie with each winner being awarded the full value of the scholarship. The two winners are Cody Koloski (Brandon University) and Melanie Lalonde (University of Manitoba).

Melanie Lalonde earned an M.Sc. from the University of Manitoba (Biological Sciences) in 2017 and has been working towards her Ph.D. (Biological Sciences) at the UofM since then, under the supervision of Jeffrey Marcus. The title of her thesis is “The New World diversification and origins of the Buckeye butterflies (genus *Junonia*, Nymphalidae: Nymphalini)”. Melanie is the recipient of numerous prestigious awards, including the E. Scherer Memorial Scholarship (UofM) and the Doctoral Award for Indigenous Students (UofM). Melanie shows much promise as a researcher and already has an impressive publication record and has made numerous presentations at local, national, and international meetings. She is also a generous volunteer, donating her time to the discipline (including reviewing manuscripts; participating in a survey for the Nature Conservancy of Canada; and curating the family Nymphalidae from a large insect collection donated to the museum at the Wallis Roughly Museum of Entomology) and to outreach activities (including many public talks, demonstrations, and interviews).



Cody Koloski has been working towards his M.Sc. (Environmental and Life Sciences) at Brandon University since 2018 under the supervision of Bryan Cassone. His project is a continuation of his Honours project, exploring the genetic basis of DEET’s mode of action in ticks. Cody is the recipient of numerous prestigious awards including the Silver Medal in Biology (BU) and a Fredrick Banting/Charles Best Canada Graduate Scholarship. Cody has already published some of his work in refereed journals and presented at an international conference. While continuing his MSc work, Cody also served as the project leader of a Public Health Agency of Canada funded

surveillance program for California serogroup viruses in Manitoba. Cody is also a gifted communicator, and served as the coordinator of the Let’s Talk Science program at BU.

Ten things you didn't know about your friendly campus neighbours

Kelsey Jones

At the University of Manitoba, Agriculture and Agri-food Canada maintains the largest live collection of stored-product insects in Canada. Although these insects are not as aesthetically pleasing as patterned butterflies or brilliant colored beetles, they are cool in their own unique ways. To convince you that Manitoba should be proud of our great collection, I have compiled a list of 10 cool facts you should know about stored-product insects.

1. **Domesticated Insects.** Just like your cats and dogs, humans have successfully domesticated the granary weevil, *Sitophilus granarius*. The granary weevil has no wings, so it disperses through humans trading cereals. It goes undetected in most grains because it completes its lifecycle within the seed as a legless larva. The earliest record of the granary weevil dates back to 7000 years ago in Europe during the Neolithic Period. During this time, humans were settling down, farming and trading wheat. Since the first record, the granary weevil has never been found in a natural environment – making it the only known completely domesticated insect.¹



2. **Dinner Parties with Symbionts.** The cigarette beetle, *Lasioderma serricorne*, and the drugstore beetle, *Stegobium paniceum*, are known to feed on a wide variety of stored products including tobacco, pepper, dried leaves, and spices. These food sources often contain low nutrient content, materials that are difficult to digest and toxic substances. Symbiotic fungi are key in helping them digest these materials and provide insects with the nutrients needed to survive.²

3. **Solving Earth's Greatest Problems.** The yellow mealworm, *Tenebrio molitor*, is able to digest otherwise indigestible plastic through the help of bacterial symbionts. This insect could be the future solution to the degradation of these environmentally unfriendly materials.³

4. **Ancient Artisans.** The maize weevil, *Sitophilus zeamais*, has been associated with stored products for thousands of years. In the Early Jomon Period, people decorated pottery with cords, beans, fingernail impressions and weevils! Pottery has been found with maize weevil impressions from over 10,000 years ago.⁴

5. **Winter Warriors.** Stored-product insects are worldwide pests, and many species seek refuge in silos, grain mills, factories and other indoor places over the winter in cooler parts of the world. However, some stored-product insects have developed extremely high tolerances to cold conditions. For example, the Australian spider beetle, *Ptinus tectus*, has been seen laying eggs at temperatures as low as 5°C.⁵ And the khapra beetle, *Trogoderma granarium*, can survive up to 15 days at temperatures as low as -20°C.⁶



6. **Outer Space Explorers.** The confused flour beetle, *Tribolium confusum*, has been sent to outer space. Researchers wanted to know if a zero gravity environment would influence wing development of these pesky insects. Scientists sent larvae to space for 42 hrs but no major developmental differences occurred.⁷

7. **Ultimate Test of Survival.** The Northern spider beetle, *Mezium affine* are able to survive and remain active for nearly three months in the absence of food and water. It is thought that the fused elytra on these species help prevent water loss.⁸ *Tenebrio molitor*, the yellow mealworm is even able to extract water from the air. This helps them to survive on extremely dry food sources.⁹



8. **True Crime Enthusiasts.** Dermestid species aid investigators in determining time of death in both outdoor and indoor locations for criminal investigations. In indoor locations, not many insect species are present but your friendly roommate the dermestid beetle always seems to be lurking around. They have also been enlisted to help clean flesh and tissue off of museum specimens.¹⁰



9. **Slumber Parties with Egyptian Pharaohs.** A number of stored-product insects have been found in Egyptian tombs of pharaohs and other prominent figures. These include the granary weevil (*Sitophilus granarius*), the smooth spider beetle (*Gibbium psylloides*), the lesser mealworm (*Alphitobius diaperinus*), the cigarette beetle (*Lasioderma serricornis*), the black carpet beetle (*Attagenus unicolor*) and more.^{1,11,12} These insects are found associated with the food offerings given to the dead, and also the wrappings used to preserve mummies.¹² Ancient Egyptians attempted to ward off these insects by developing a spell (spell 36) for “apshai-insect” (crawling insects).¹³

10. **Professional Nappers.** The khapra beetle, *Trogoderma granarium*, can survive food deprivation through diapause for up to 6 years. Unlike other insects in diapause the larvae will sporadically feed and molt. However, with each molt they will shrink a little bit. This is called retrogressive molting which reduces the insects food requirements until more is available.¹⁴



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Images: Canadian Grain Commission

Incredible Creatures:

Mormon Crickets: Don't Let The Name Fool You

By John Gavloski

This year there was no shortage of grasshoppers and crickets to be seen. But every now and then you get a chance to see one of the rarer species. Such was the case in early-September when someone brought a relatively large, wingless grasshopper in to be identified. It was a Mormon cricket. Although large and somewhat intimidating looking, they are harmless, and not a crop pest in Manitoba. In this month's Incredible Creatures we will explore the interesting biology, habits and culinary uses of the Mormon cricket.



Not really a cricket

Mormon crickets (*Anabrus simplex*) are relatively large insects, and can get to about 3 to 5 cm long. The name Mormon cricket refers to an invasion of agricultural lands farmed by Mormon settlers in the Great Salt Lake Basin in the 19th century. Despite its name, it is actually not a cricket. It belongs to a group known as the shield-backed katydids. Mormon crickets are one of only a few species of shield-backed katydids that are ground-dwelling. A few things stand out about the appearance of Mormon crickets. There is the “shield” behind the head, which is called a prothorax. Females have a long tube-like appendage extending from the abdomen, called an ovipositor, that is used to lay eggs. The Mormon cricket in the photo is a female. The ovipositor should not be mistaken for a stinger. Both sexes have long antennae. They do not have functional wings, and are flightless.

Moving with the Swarm

The Mormon cricket occurs at relatively low density throughout most of its range. They are a relatively rare sighting in Manitoba. At certain times and places, however, such as parts of the western United States, population explosions can occur. High population densities may cause morphological changes in Mormon crickets, similar to what happens in locusts. Large numbers of the crickets can form roving bands. These bands may include millions of individuals and may have densities of up to 100 individuals per square meter. Infestations may last years, and have a gradual increase and then decrease in population. Factors that trigger these infestations are not well understood, but are thought to be weather-related. In the northern Great Plains states and Canadian prairies, individuals are on average smaller, are usually non-migratory, and are generally a lighter colour than in areas where swarming is more common, such as Utah, Idaho, Nevada, and some other western U.S. states.

Aside from eating plant material, Mormon crickets will also eat other insects, and can be cannibalistic. This potential for cannibalism may be a factor in the movement of swarms; crickets may need to move constantly forward to avoid attacks from behind.

Mormon crickets as Food

Historically, Mormon crickets were used in some traditional Native American diets. The crickets were captured in large quantities using various methods, such as driving them into trenches or ditches, or scooping up the crickets by the bushel when they were clustered under vegetation and too cool to be active. Once captured they were roasted and ground into a flour. The flour would last a long time if kept dry. One use was to make a bread that was very dark in colour.

We are fortunate not to have to worry about Mormon crickets as a crop pest in Manitoba, and finding one can be considered a treat. And they are another example of where a potential pest can also be a valuable resource.

Ed's note: John Gavloski is an entomologist living in Carman, Manitoba. He writes a monthly article called "Incredible Creatures" for several rural newspapers in Manitoba. They are written at a basic level to introduce people to some of the common yet often not well known creatures in Manitoba, and hopefully enhance appreciation for wildlife. The following article was published in October 2020.

Extension Entomology Update:

New Insecticides

By John Gavloski, Entomologist, Manitoba Agriculture and Resource Development

Prepared January 15, 2021

Every fall we update the Guide to Field Crop Protection, a resource used by farmers and agronomists to select what pesticide or practice they will use to control a specific pest. Ideally, insecticide applications are done when an economic threshold for the pest, should it exist, is surpassed. Several new insecticides have been added to the guide for this year. Some of them are generic versions of existing products, while others are new chemistries. One even belongs to a new insecticide group, having a unique mode of action. There are now over 30 groups of insecticides, based on mode of action classification. These groups are further subdivided into one of five categories based on their targeted physiology; nerve and muscle, growth and development, respiration, midgut, and unknown or non-specific. Here are a few of the new insecticides added to the guide for 2021.

Teraxxa F4, Cimegra: The active ingredient for these two products, broflanilide, belongs to a new insecticide group, group 30. It affects the nervous system of the insects. The crops they are used in and the way they are applied differs between these products. Teraxxa F4 is a seed treatment registered for wireworm control in wheat, oats, barley, rye, triticale and canary seed. Four different fungicides, from four different fungicide groups, are also included in this seed treatment. Cimegra is sprayed in furrow in either potatoes or corn. In potatoes it is registered for control of wireworms, and in corn it is registered for wireworms and corn rootworm. Broflanilide actually kills wireworms, which is different from some of the other insecticides registered for wireworms, such as the neonicotinoids, which prevent feeding but do not result in high levels of mortality. Broflanilide is not systemic, so is not expected to translocate through the plant to the pollen and nectar.

Vayego: This is a new addition to the diamide group of insecticides (group 28), which includes well known insecticides such as Coragen and Lumiderm. Insecticides in group 28 affect nerve and muscle action. The active ingredient in Vayego is tetraniliprole. It is registered for various insects in potatoes, corn, soybeans and fruit and vegetable crops. Like some of the other members of this insecticide group, it has good residual activity (kills targeted pests for a long time).

Bioprotec CAF: Although a new product for the guide, based on company marketing, this is not necessarily a new product. Bioprotec is another formulation of *Bacillus thuringiensis* (*Bt*) subspecies *kurstaki*. This subspecies of *Bt* is specific to larvae of Lepidoptera. It can also be used in organic production. *Bt* based insecticides (group 11) disrupt the midgut membranes of specific groups of insects. Bioprotec is the same active ingredient as Dipel, which has been included in our guide for many years. The main uses would be on vegetable crops, but there are some registered field crop uses, such as European corn borer in corn, European skipper in timothy, and sunflower moth in sunflowers.

Decis 100 EC and IPCO Syncro: These are both pyrethroid insecticides (group 3A), which affect the nervous system of insects. Both are new formulations of insecticides previously in the guide. The version of Decis is currently being marketed for use in field crops in Manitoba is Decis 5 EC. This new formulation, Decis 100 EC, is formulated so there is 100 grams of the active ingredient (deltamethrin) per liter, whereas Decis 5 EC has 50 grams of deltamethrin per liter. The rate of application for Decis 100 EC is thus half that of Decis 5 EC. The active ingredient in IPCO Syncro is permethrin. This product is essentially the same formulation as Pounce and Perm-UP, two other versions of permethrin that are already being used in field crops.

The 2021 edition of the Guide to Field Crop Protection should be available in early-March. A pdf version is also available on the Manitoba Agriculture and Resource Development website at: <https://www.gov.mb.ca/agriculture/crops/guides-and-publications/index.html>.

Webinar Series

This series is co-hosted by the working parties 7.03.05 (Ecology and Management of Bark and Woodboring Insects) and 7.03.16 (Behavioural and Chemical Ecology of Forest Insects) and will focus on the *Behavioural and Chemical Ecology of Bark and Woodboring Insects*.

The format of the talks will include a short introductory talk by the webinar coordinator (5-10 min) followed by 2-3 short research talks (45-50 minutes total) and concluding with an open discussion period with the speakers (ca. 25 min) so that the total length of each webinar will be ca. 90 minutes. The series starts on January 21 with a webinar on “Plant defense and biotic and abiotic stressors” coordinated by Dr. Nadir Erbilgin (see the full list of webinars with dates below):

January 21 - Plant Defense and Biotic and Abiotic Stressors, **Nadir Erbilgin**, University of Alberta

February 04 - Visual Ecology of Forest Beetles, **Johannes Spaethe**, University of Wurzburg

February 18 – Finding a point source of odor in a turbulent world: mechanisms and constraints, **Ring Carde**, University of California-Riverside

March 04 - Climate Change Effects on Bark Beetle Range Expansion, Community Associates and Outbreak Dynamics, **Barbara Bentz**, USDA Forest Service, Rocky Mountain Research Station

March 18 – Behavioural and Invasion Ecology of *Hylurgus ligniperda*, **Ecki Brockerhoff**, Swiss Federal Research Institute WSL

April 01 -Chemical Ecology of *Ips typographus* – Norway spruce Interactions, **Sigrid Netherer**, University of Natural Resources and Life Sciences, Vienna

****Please note that all webinars will start at 16:00 UTC (11 AM EST; 8 AM PST).****

To track participation and protect against unwelcome visitors we ask that you register for the webinar series (you will receive a confirmation email after you register and then the week of each seminar an email with the zoom link for the webinar). If you registered for the last webinar series we ask that you please register again as we have reset the database. To register for the webinar series please use this link:

https://www.fabinet.up.ac.za/index.php/event/IUFRO_WP_7.03.16/

The webinars are co-hosted by the Forestry and Agricultural Biotechnology Institute, University of Pretoria, the Institute for Forest Entomology, Forest Pathology and Forest Protection, BOKU, the Universidad de la Republica, Uruguay and the Canadian Forest Service. If you are unable to attend a webinar live but would like to view it, we will be posting recordings of the webinars at a YouTube channel:

<https://www.youtube.com/channel/UCE1bhBiFrYSbUSb09LipkZw>.

Upcoming Meetings

ESA Eastern Branch Virtual Meeting

March 22-24, 2021

ESA Southeastern Branch Virtual Meeting

March 29-31, 2021

ESA Pacific Branch Virtual Meeting

April 5-7, 2021

ESA International Branch Virtual Meeting

April 26-28, 2021

2020-2021 Executive

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