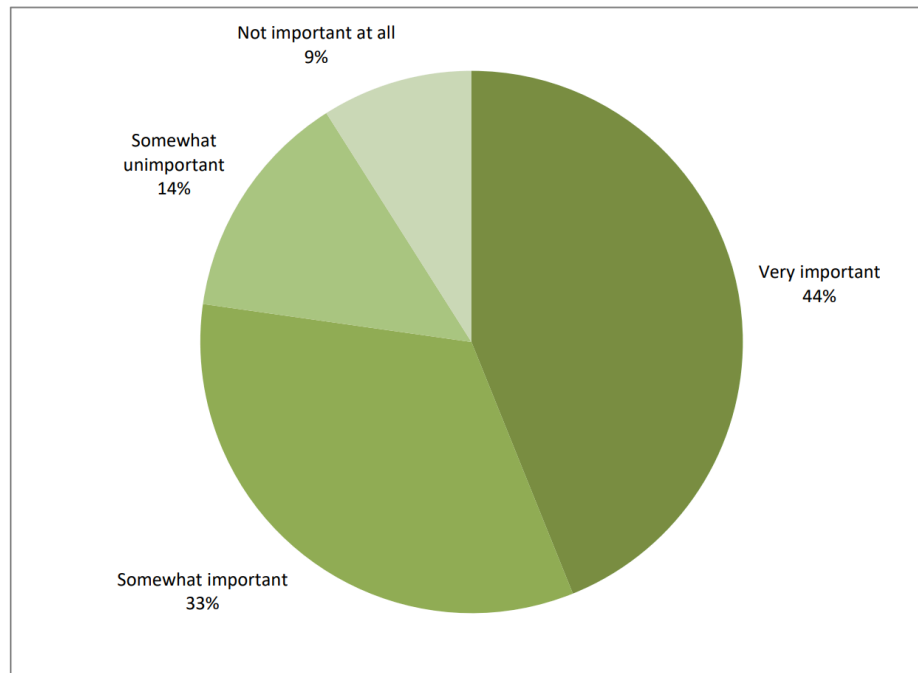


**Exploring Snow in Citizen Science
Projects to
Learn about Climate Change &
Microplastics**

**Monday, December 2, 2019
4 – 5 pm**



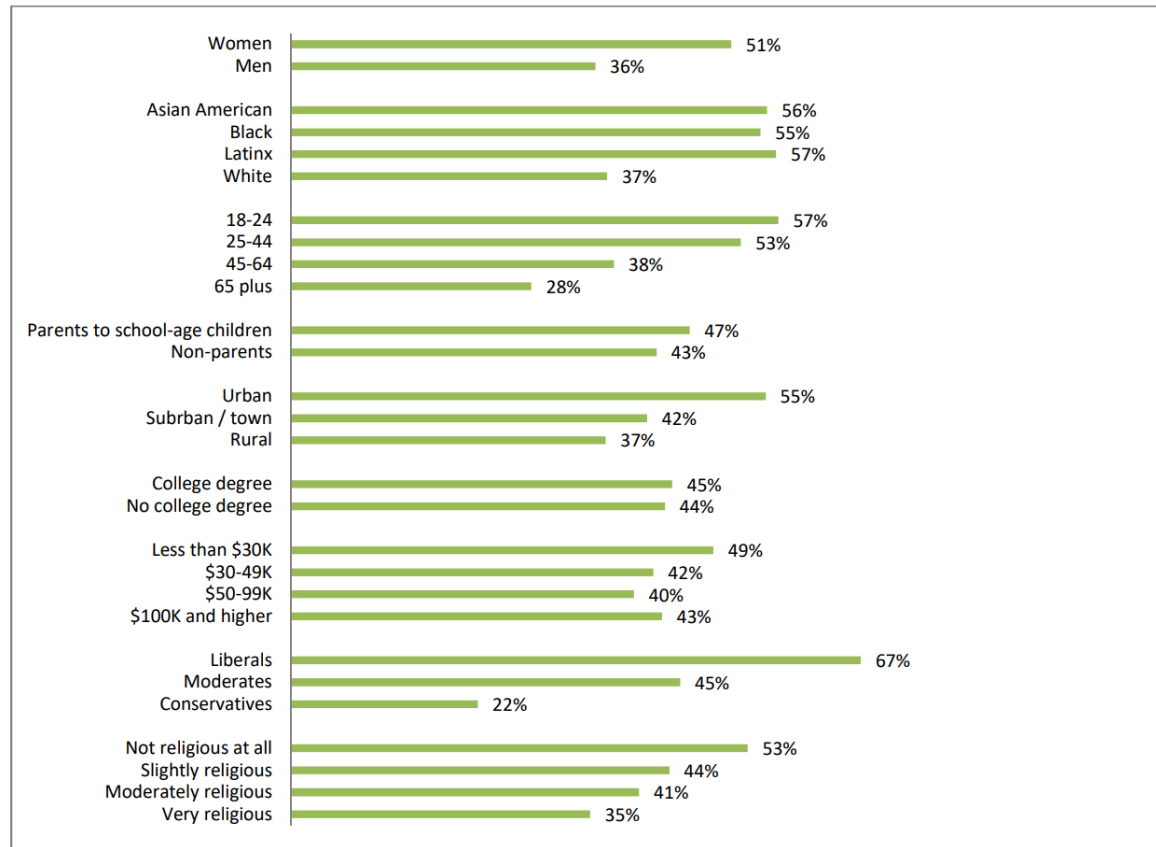
Views on Teaching about Climate Change



Source: (Pizmony-Levy, O. & Pallas, A. 2019). Americans Endorse Climate Change Education. New York: Teachers College, Columbia University

Views on Climate Change/Global Warming by Key Demographics

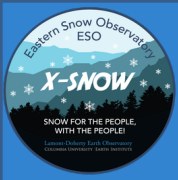
“% say “very important”



Source: (Pizmony-Levy, O. & Pallas, A. 2019). Americans Endorse Climate Change Education. New York: Teachers College, Columbia University

Citizen Science Projects

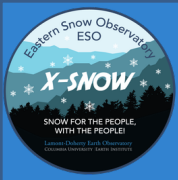
Local, place-based and
crowd-(student) sourced activities
to collect, analyze and report data
to advance scientific knowledge and increase
public participation in research



X-Snow Training workshop

December 2nd, 2019

Marco Tedesco, Patrick Alexander, Laurel Zaima,
Paolo Colosio, Elizabeth Fischer, Shujie Wang, Raf Antwerpen,



The X-Snow Project



Welcome to X-Snow !

How to become a snow scientist ...



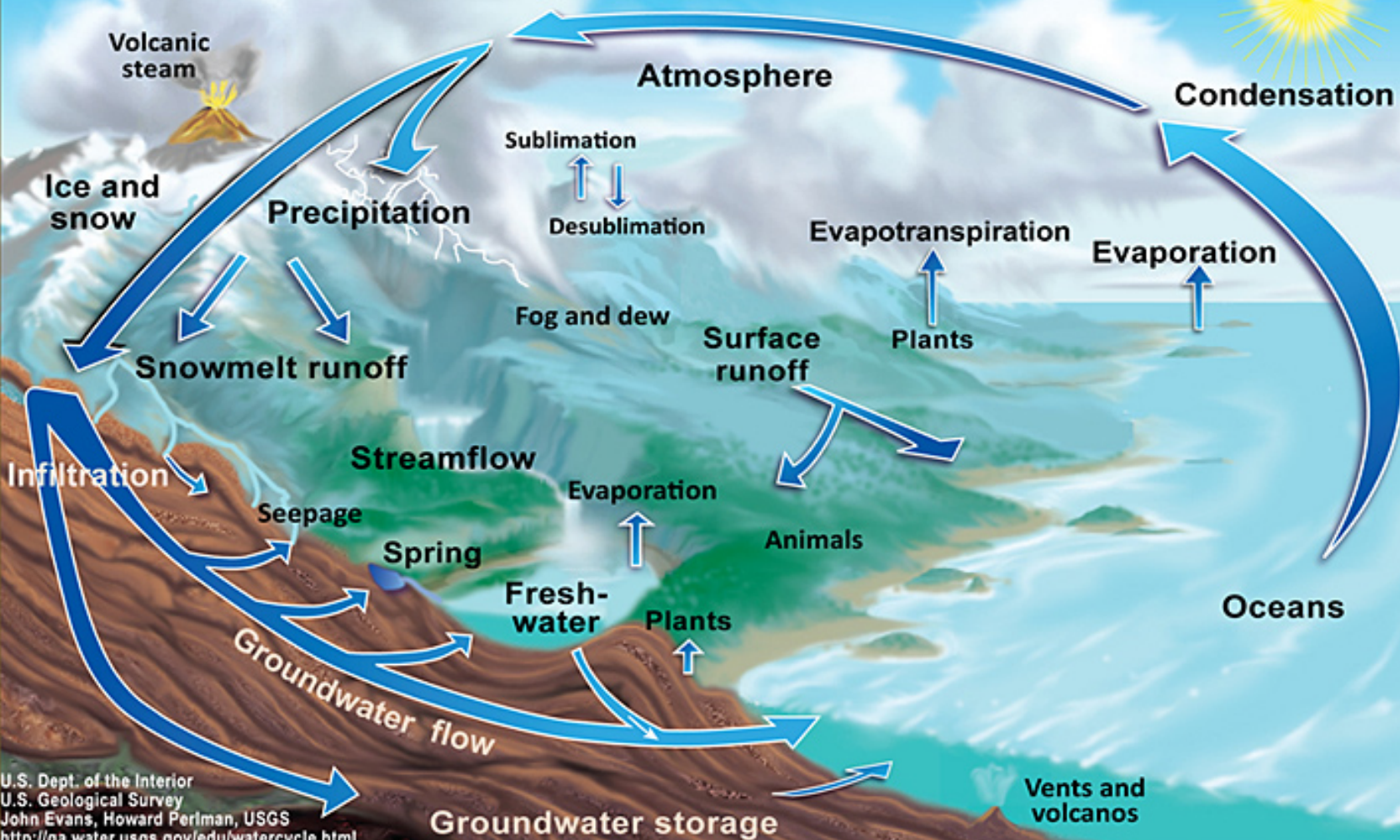
The Importance of Snow

1. Seasonal snow is an important part of Earth's climate system.
2. Snow cover helps regulate the temperature of the Earth's surface
3. Once snow melts, the water helps fill rivers and reservoirs in many regions of the world
4. In terms of area, snow cover is the largest single component of the cryosphere
5. About 98% of the Earth's snow cover is located in the Northern Hemisphere
6. On a smaller scale, variations in snow cover can affect regional weather patterns.

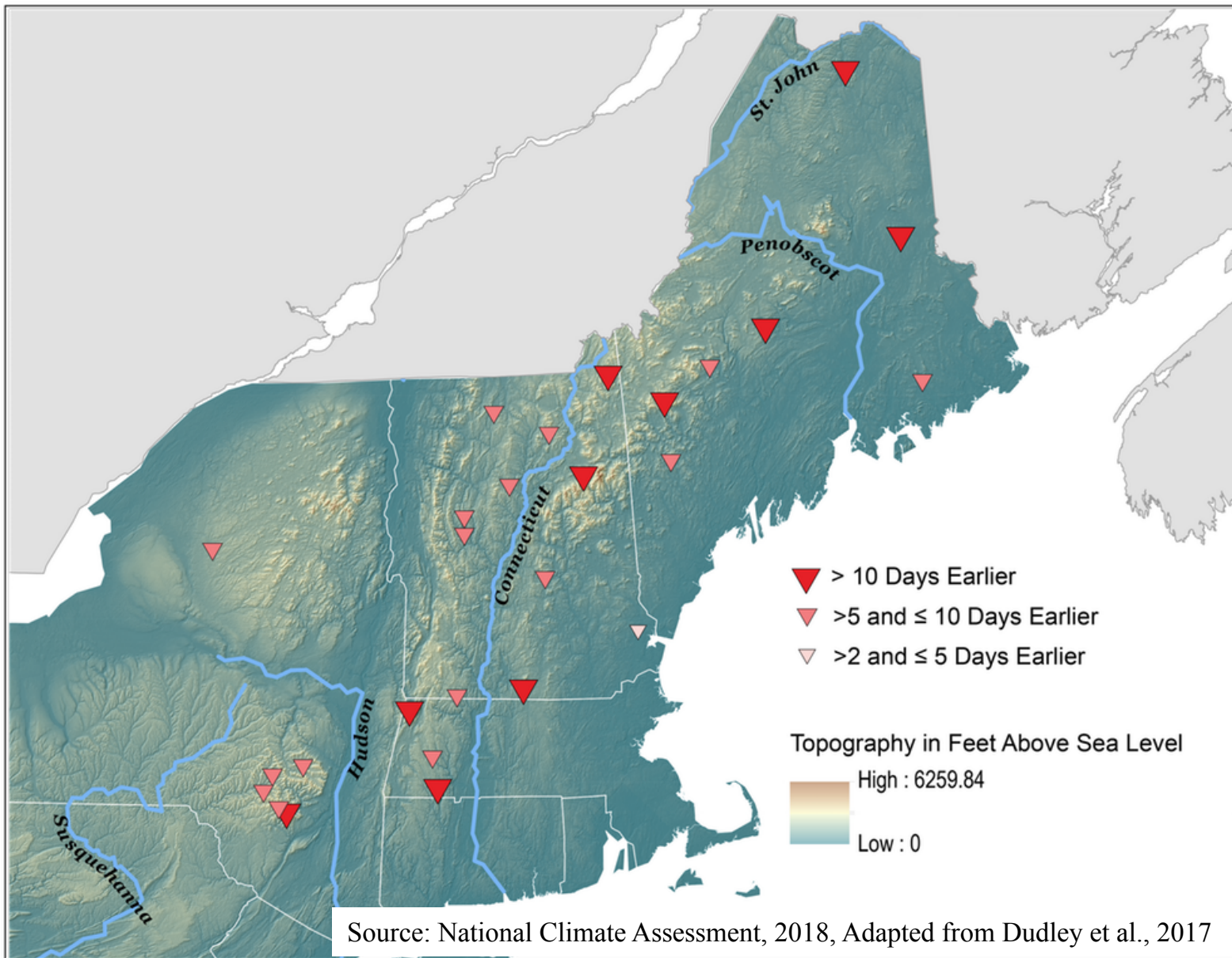




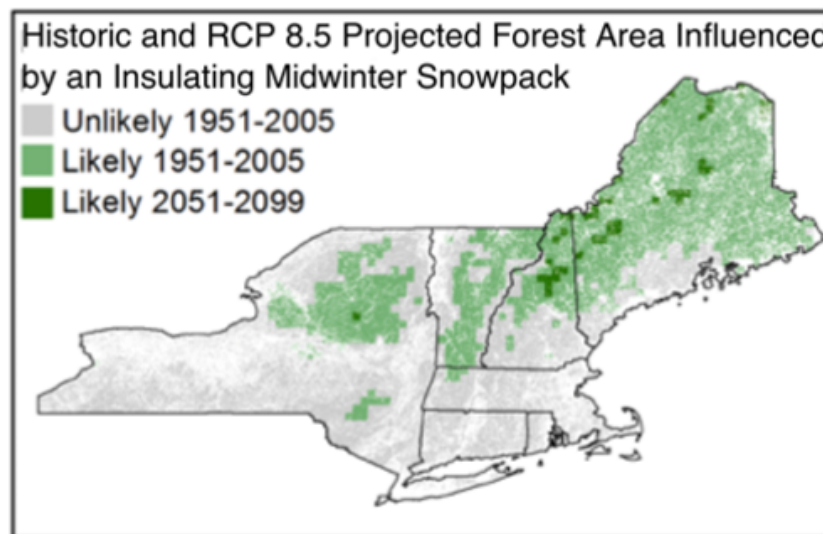
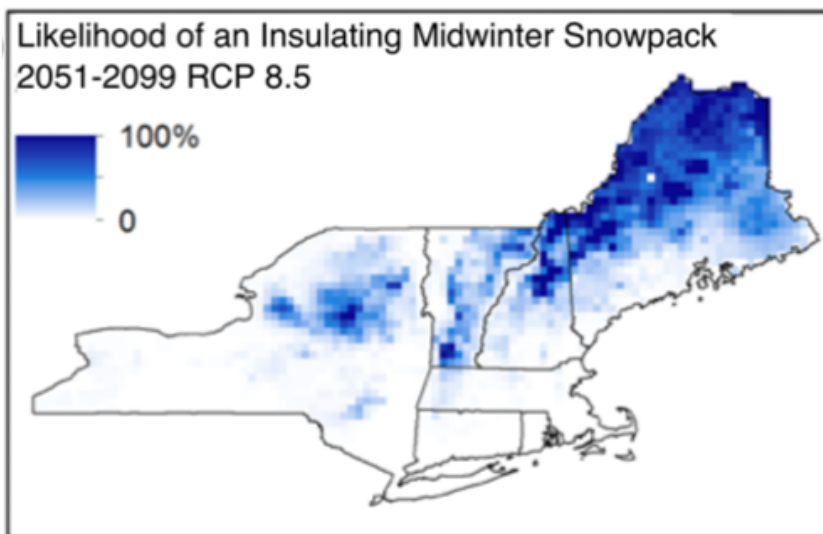
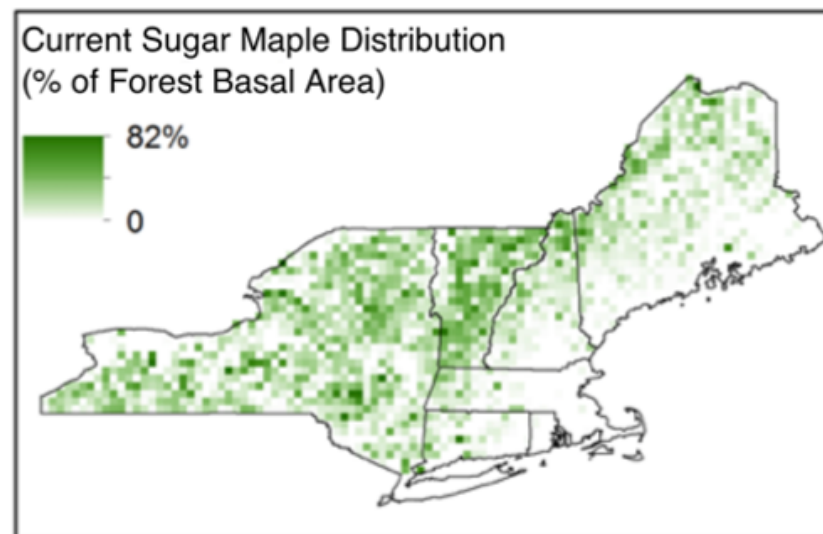
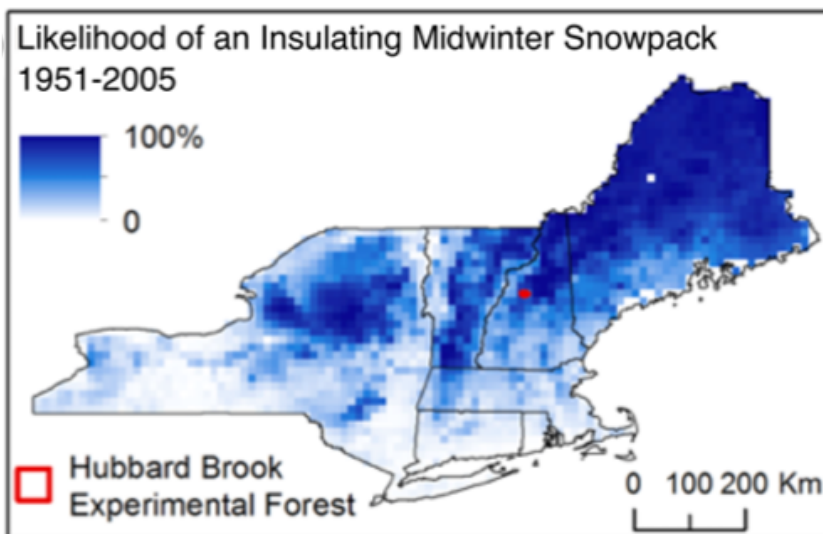
The Water Cycle



Climate Change Drives Earlier Spring Snowmelt



Shrinking Snowpack Impacts Winter Growth of Trees



The Cost of Snow: An Example

POWDER

THE SKIER'S MAGAZINE

TRAVEL GEAR LOCKER VIDEOS THE MAGAZINE



RULES
OF
MODERN

#4

EXPECT LOW COSTS &
FULL SERVICE.

EXPECT SATISFACTION &



PHOTO: Franklin towers

Low Snow Years Cost Ski Towns \$1 Billion

Skier numbers dropped by 10 percent on average during low snowfall years over the last 15 years

March 9, 2018 | By Jack Foersterling



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Skier numbers dropped by 10% on average during low snowfall years over the last 15 years

While 2018 was defined by record-breaking snowfall across most of the west, according to the report, **freak snowstorms are a symptom of a general warming trend.**



Climate Change Increases Extreme Weather

“Some extreme weather and climate events have increased in recent decades, and new and stronger evidence confirms that some of these increases are related to human activities.”

CNN.com / WEATHER

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Winter storm paralyzes much of East Coast

Weather blamed for 20 deaths from Nebraska to New Jersey

Tuesday, February 18, 2003 Posted: 1:54 AM EST (0654 GMT)

NEW YORK (CNN) -- A deadly snowstorm pounded the mid-Atlantic and Eastern states Monday, piling up record snowfalls in some areas, shutting down airports, stranding holiday travelers and paralyzing transportation.



A man digs a car out of snowdrifts Monday in Philadelphia, Pennsylvania.

The storm has been blamed for 20 deaths since it swept through the Midwest on Friday and moved east.

U.S. government offices, closed Monday for the Presidents Day holiday, will be shut down in the nation's capital again Tuesday because of the foot and a half of snow that blanketed the Washington area. Emergency services will be operating.

In Garrett County, Maryland, as many as 40 inches of snow covered the ground, the National Weather Service said.

In Berkeley Springs, in the northeastern West Virginia, 37 inches had fallen by mid-afternoon, the weather service said.

By day's end, more than a foot of snow was expected over much of New Jersey, southeastern Pennsylvania, northern West Virginia, Maryland, northern Delaware,

Story Tools

VIDEO

A far-reaching winter storm dumped a thick blanket of snow onto New York City, snarling transportation and causing gridlock throughout the city. CNN's Jamie Colby reports (February 18)

“... Winter storms have increased in frequency and intensity since the 1950s, and their tracks have shifted northward over the United States.”

– National Climate Assessment



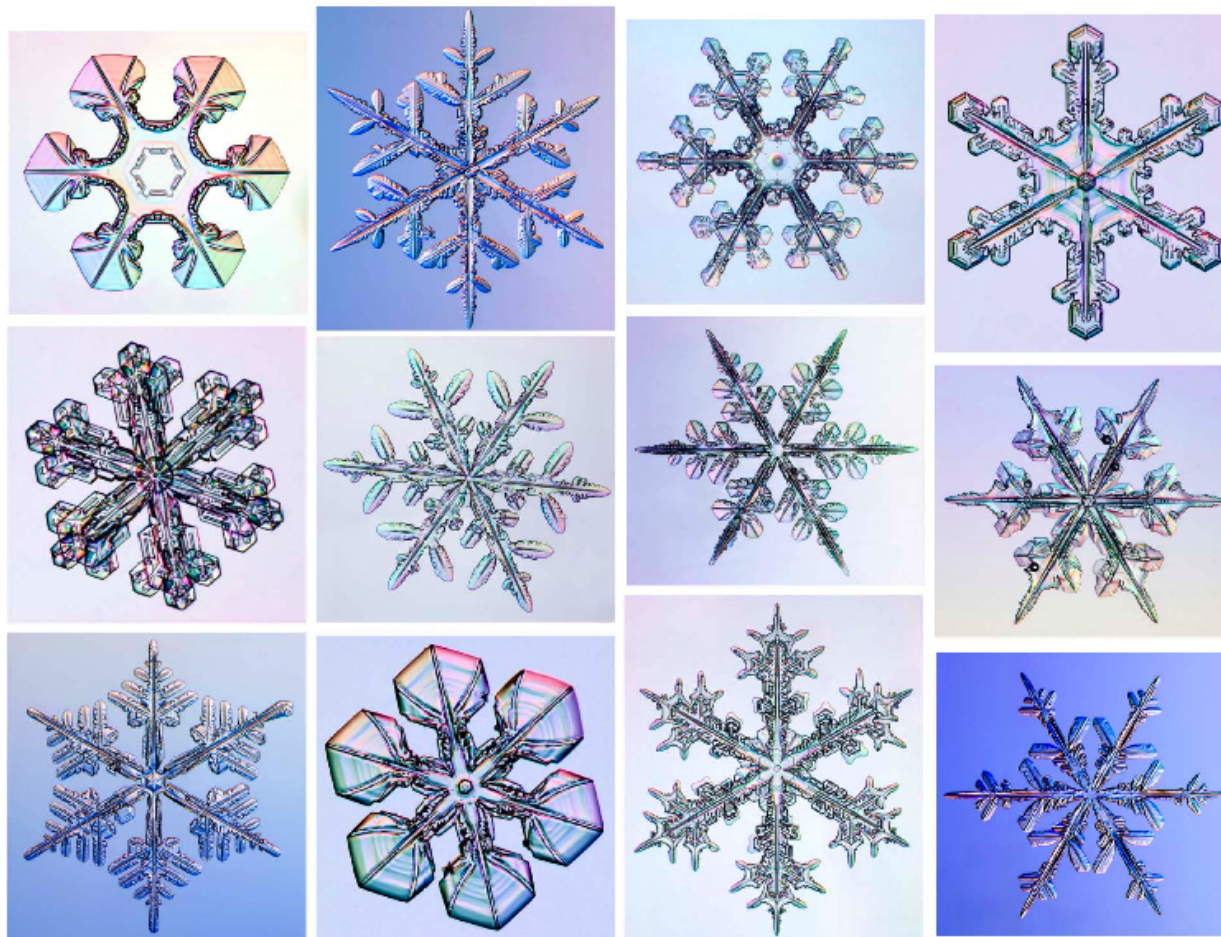


Studying Snow from Space



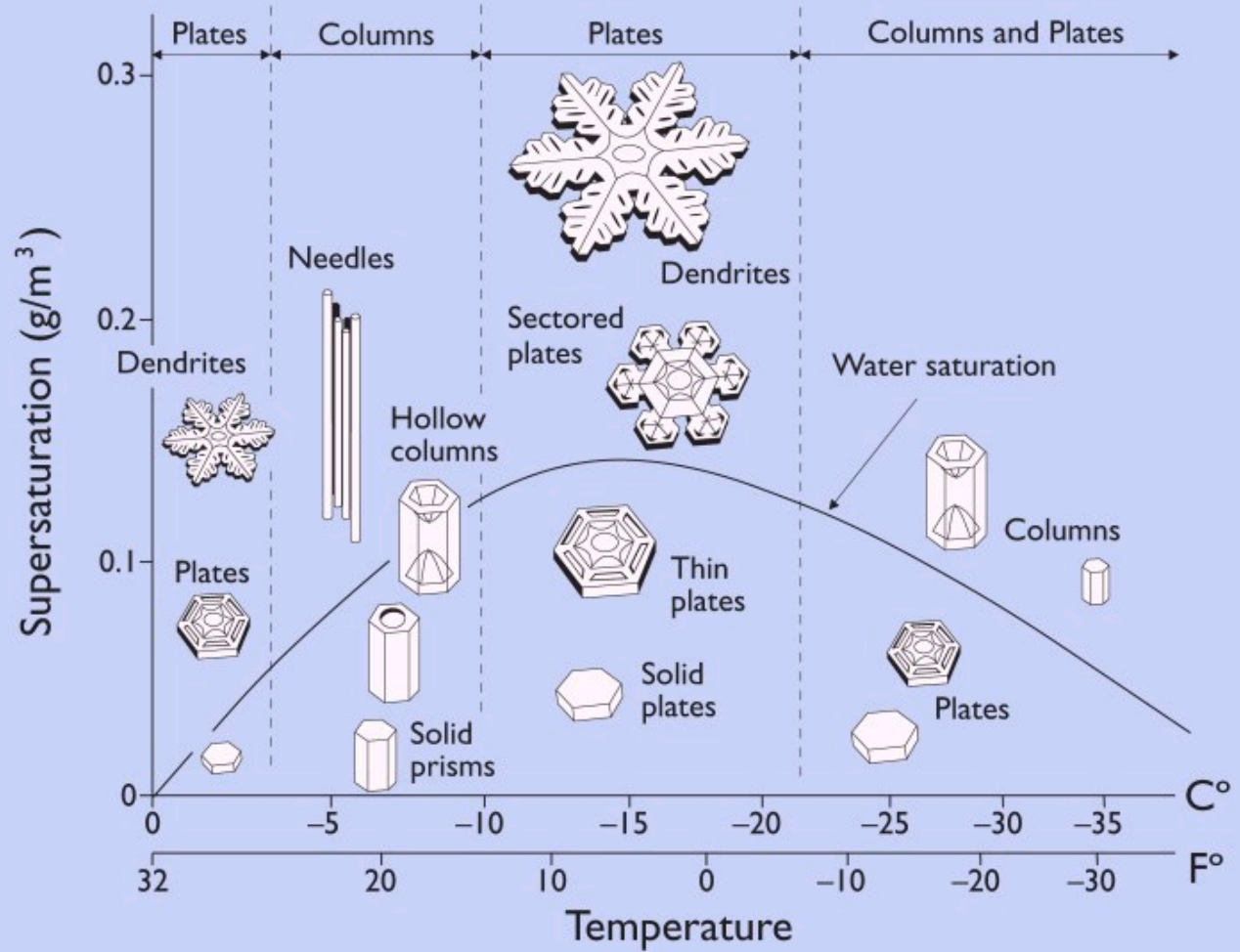
Marco Tedesco, Patrick Alexander, Laurel Zaima,
Paolo Colosio, Elizabeth Fischer, Shujie Wang, Raf
Antwerpen,

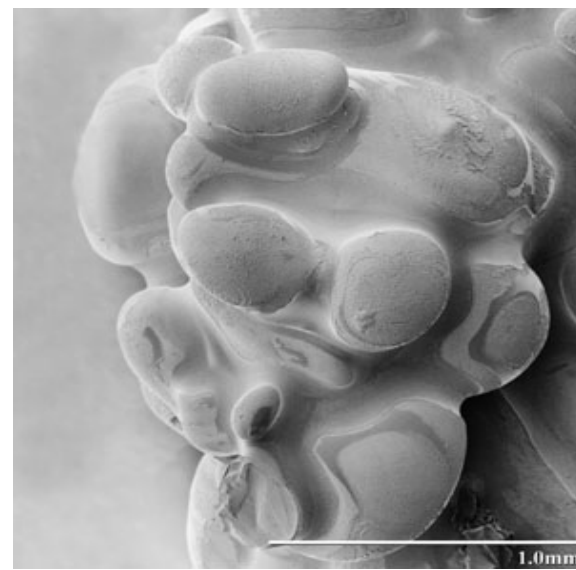
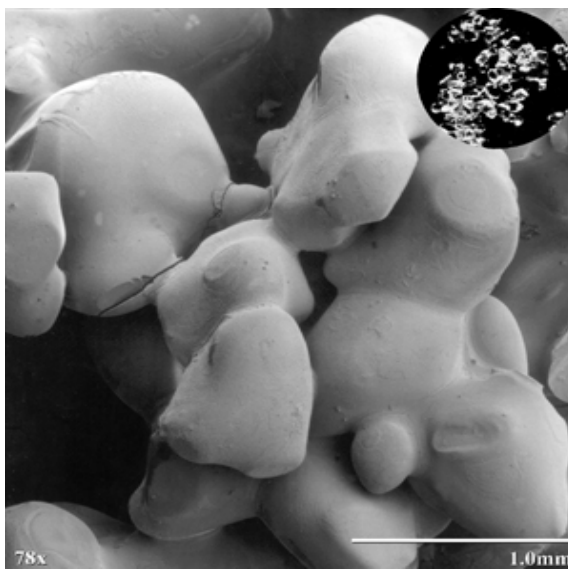
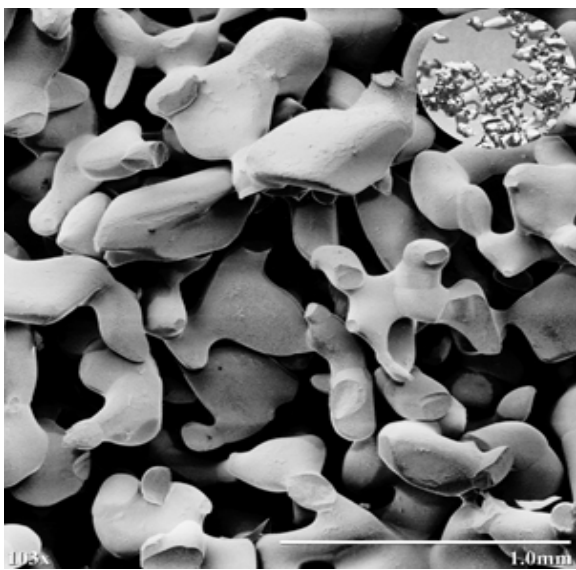
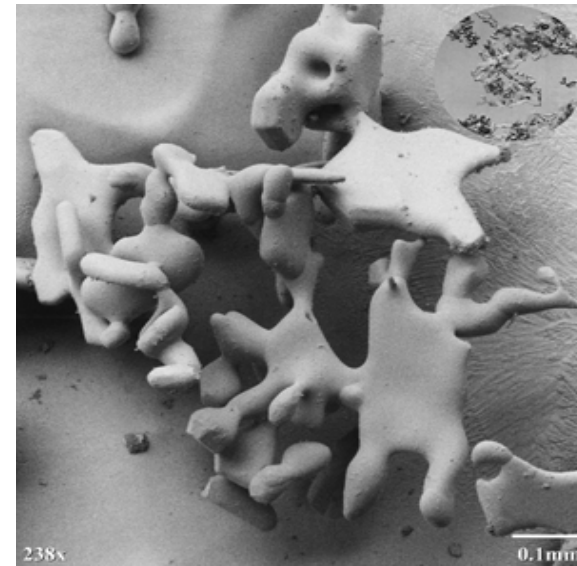
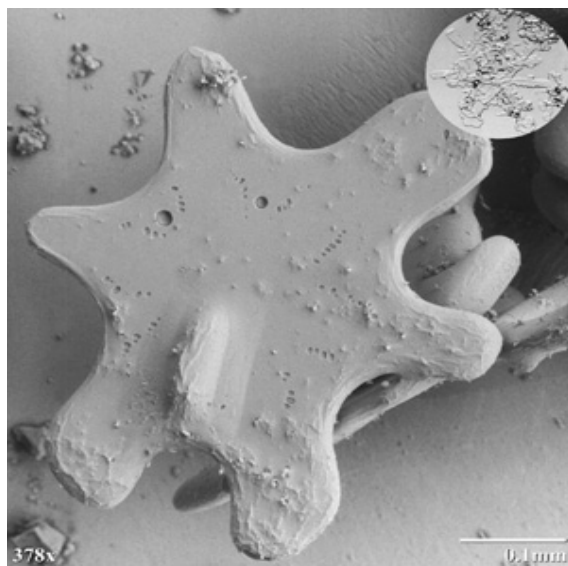
Snowflakes: Hieroglyphs from the Sky



Ken Libbrecht©

Supersaturation is a state of a solution that contains more of the dissolved material than could be dissolved by the solvent under normal circumstances.





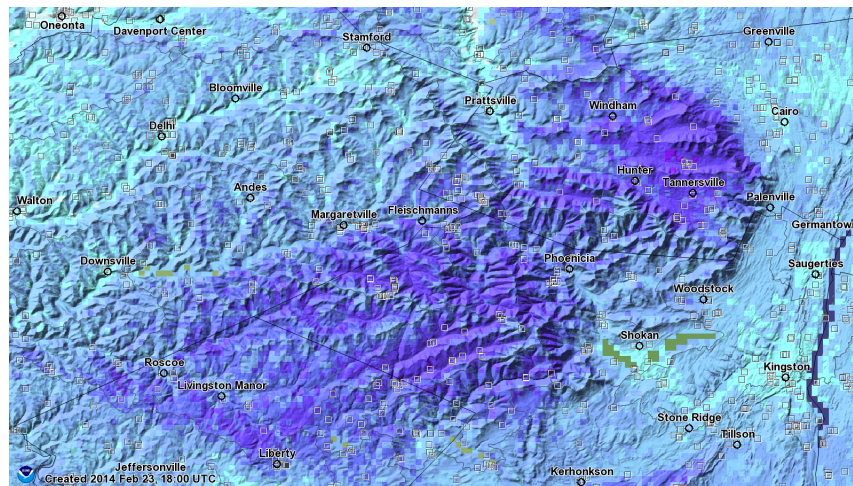
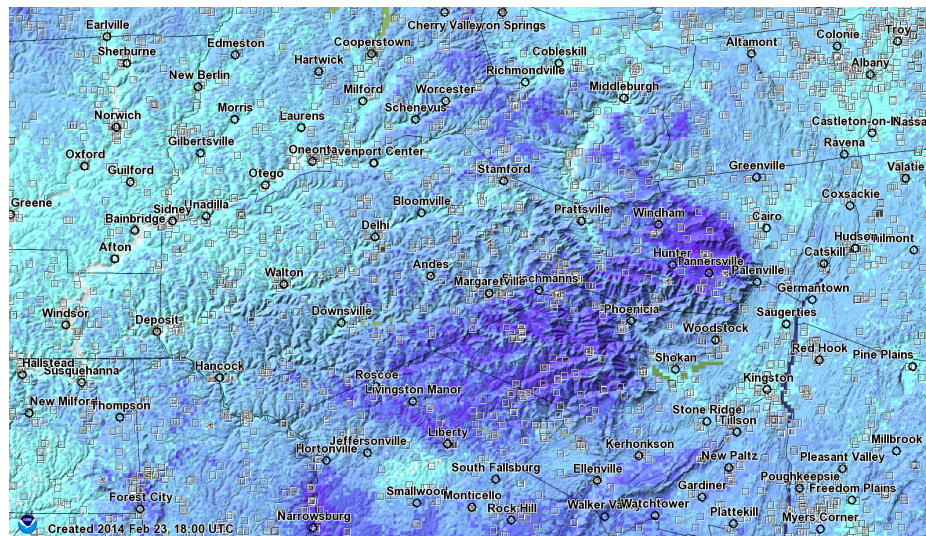


Why X-Snow

- East coast snow currently under-represented in the snow community, given the strong emphasis on West coast snow
- NYC and New York area heavily depends on snow for water resources
- Snow impacts commercial and human activities
- Validation for models and remote sensing products. Satellites can only obtain data on snow mass and extent.
- Training of citizens for better understanding environmental issues and educate more people
- Citizens have the **POWER** to help scientists ! X-snow !
- Because it is both **IMPORTANT** and **FUN** !!!

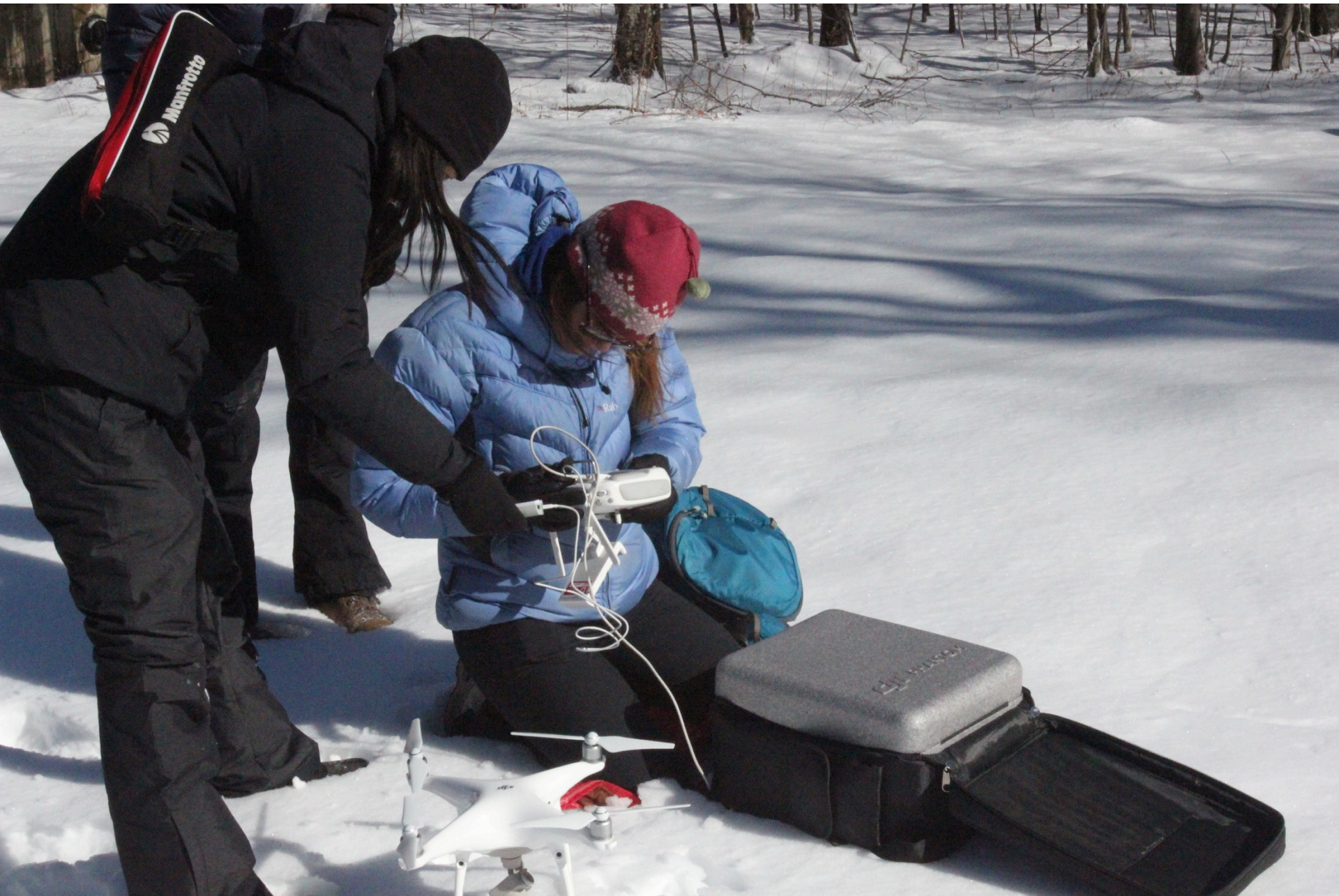


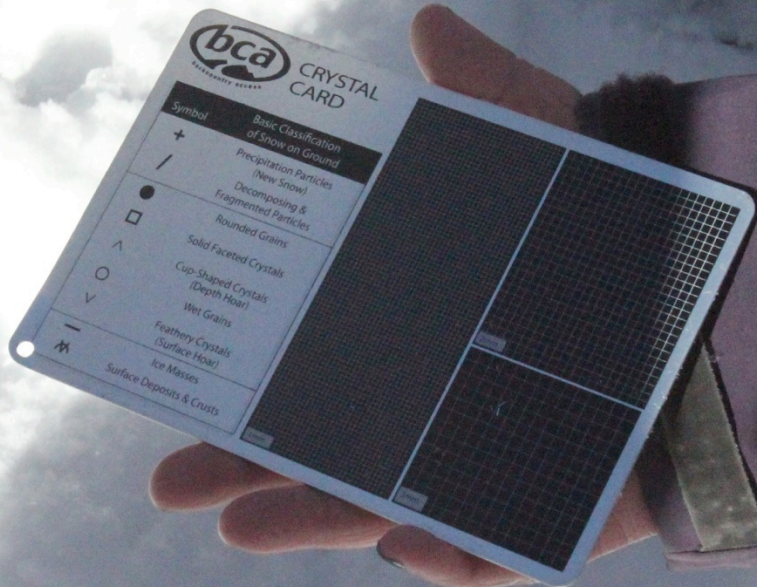
2018 X-Snow Debut











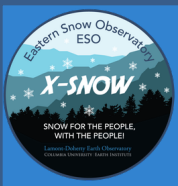




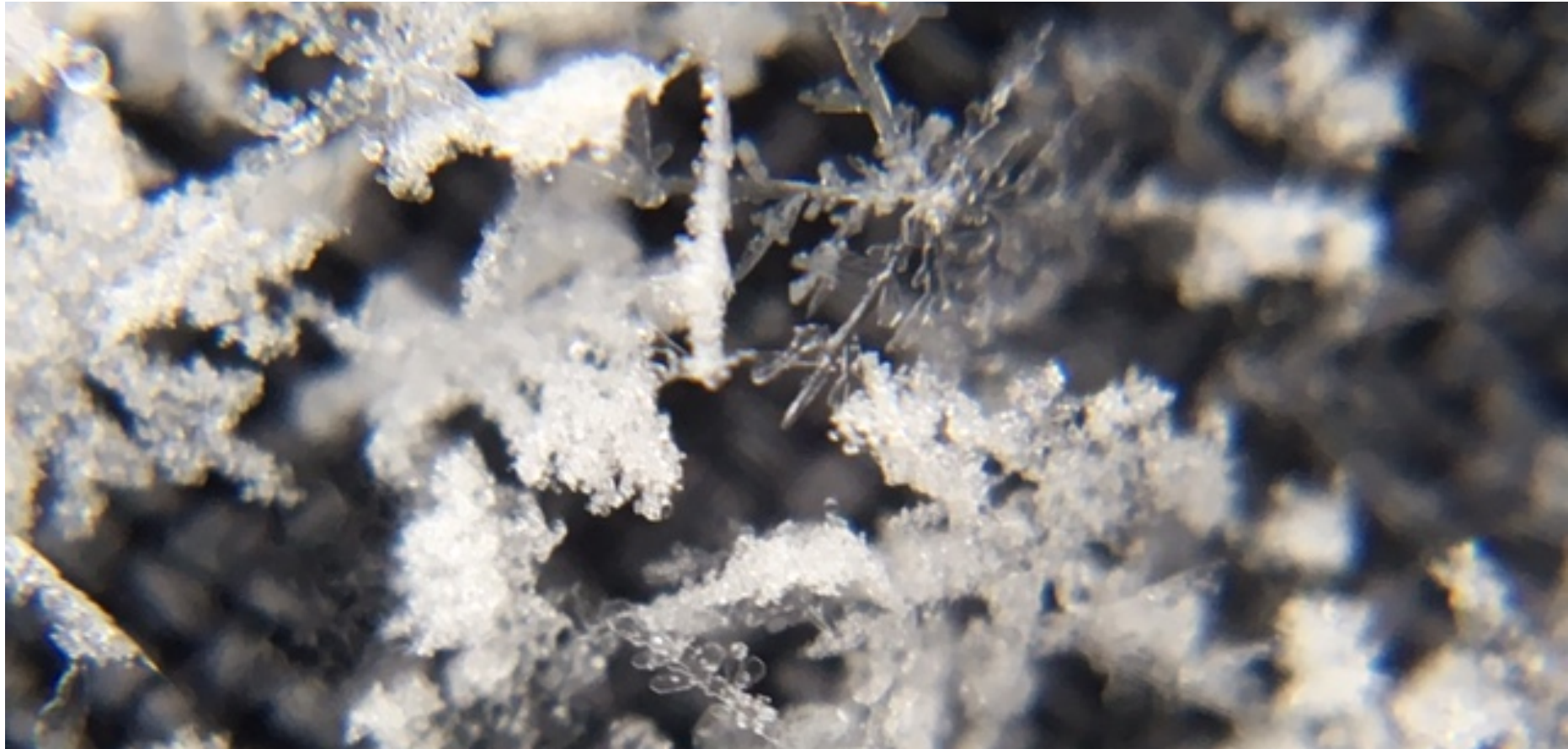


Snowflakes from a Smartphone





Snowflakes from a Smartphone





Snowflakes from a Smartphone





Drones

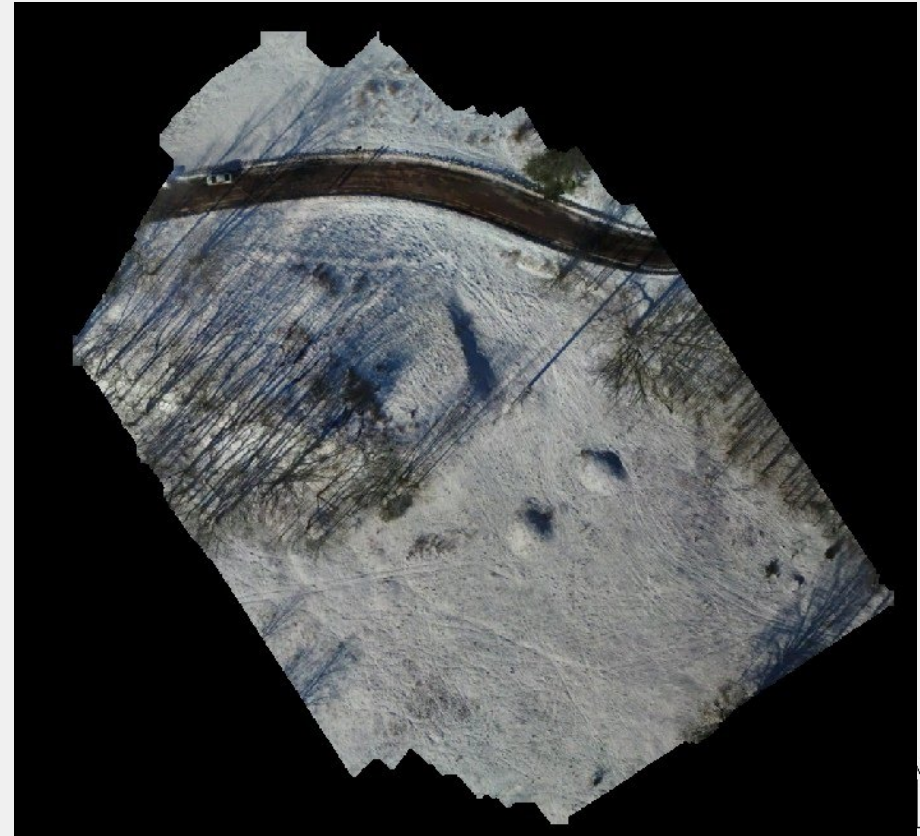
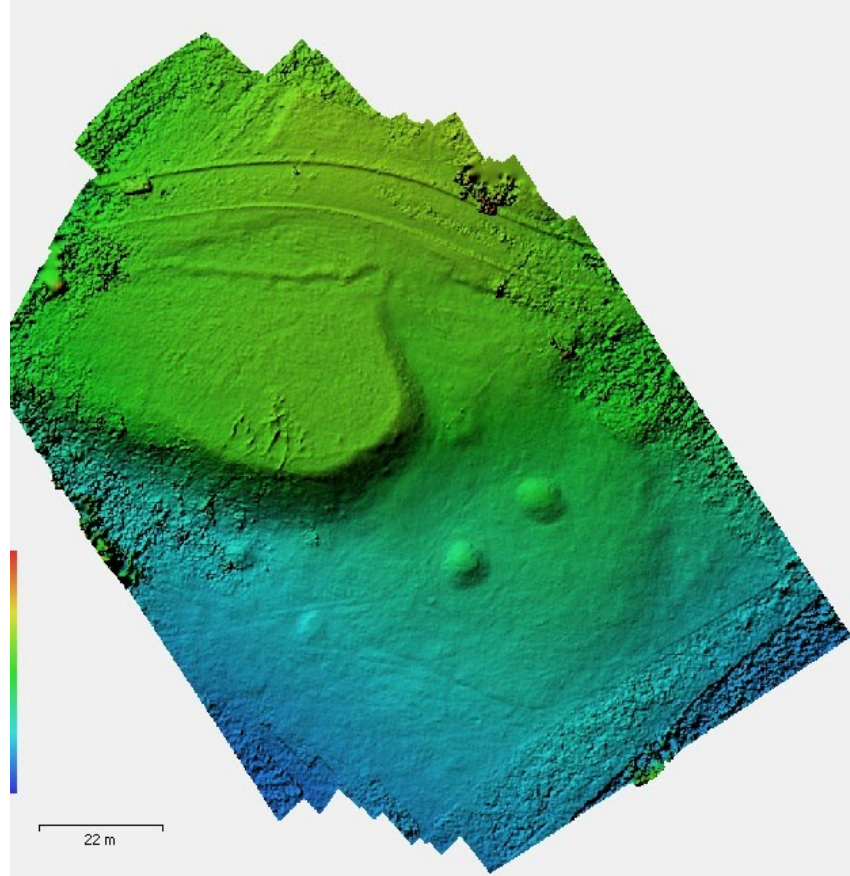




Drones

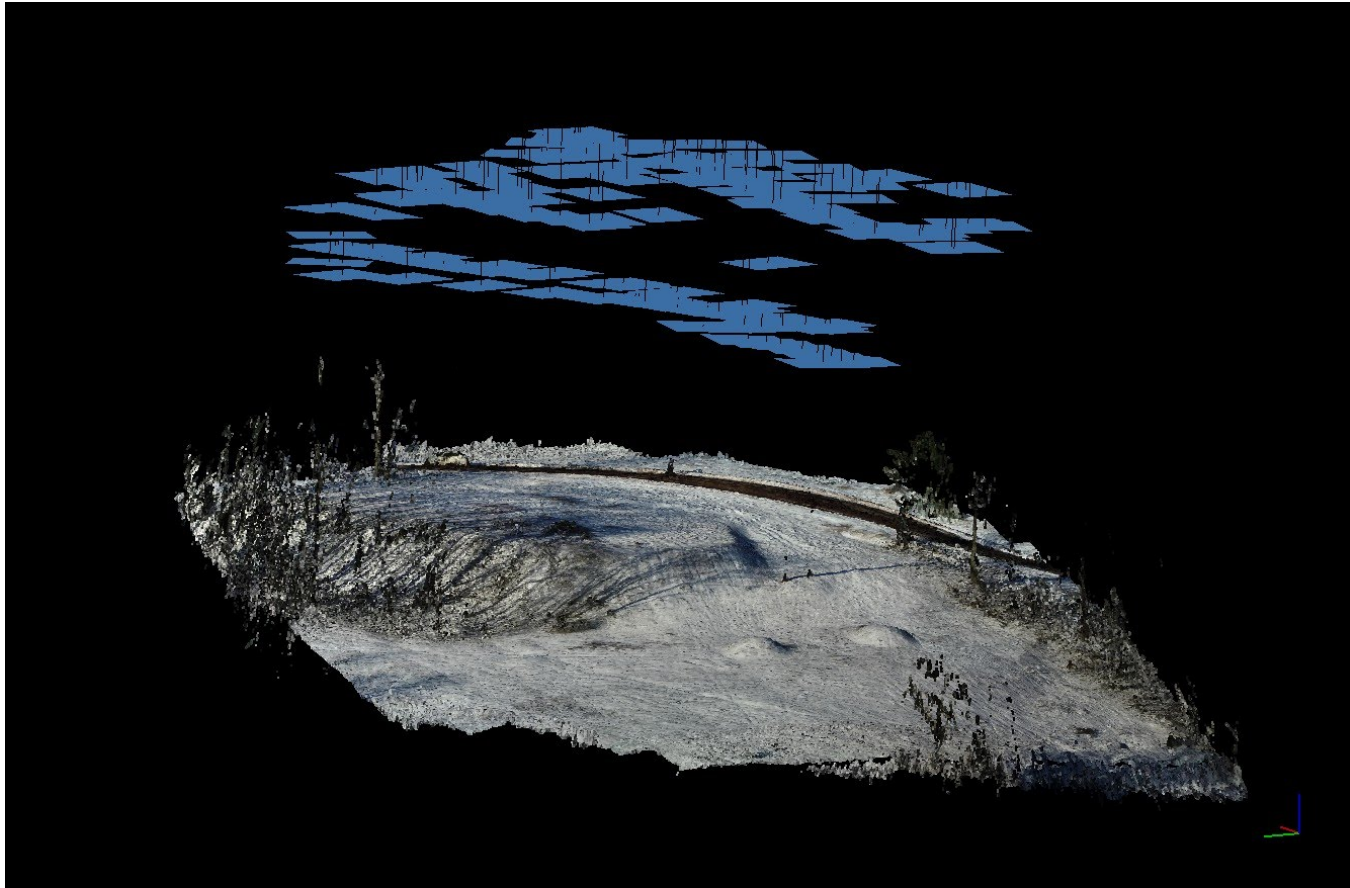


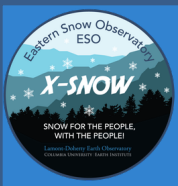
Snow depth from drone





3D Reconstruction





But, we need your help to tell the full story!

So... Let us pretend there is a lot of snow around us

What you can do!

Project Dates: Winter

Audience: Students and participants of all ages

Preparation:

- Pick a spot where the snow has not been touched.
- Note down the date and time, location, and take a photo of your site.
- Note down any weather conditions (clouds, temperature, rain/snow conditions).
- Repeated measurements at the same location over time are great!



What you can do!

Snow Depth:

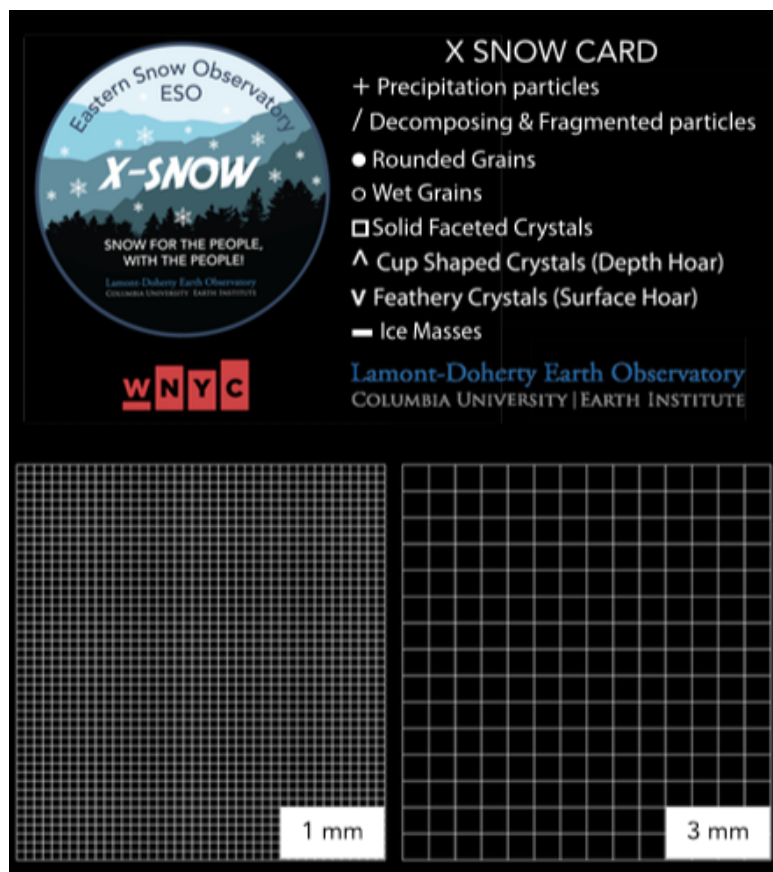
- Stick a ruler vertically into the snow. Record the measurement and take a photo of the ruler. You can make a few measurements in different locations.
- * *Ensure location is enabled on phone so the pictures are geotagged with your location!*



What you can do!

Snow Photos:

- Use your X-snow card to collect some snow.
- If necessary brush off some of the snow so that you can see individual crystals. (Try not to disturb the snow too much.)
- Take a photo of the snow on the card with a macro lens.



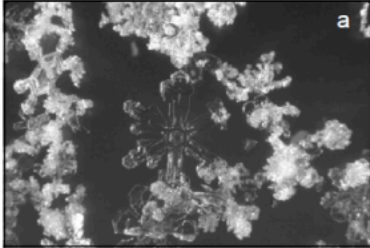
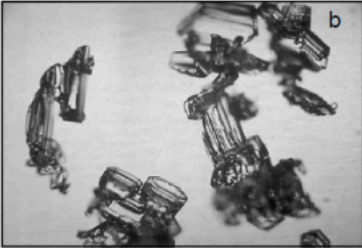
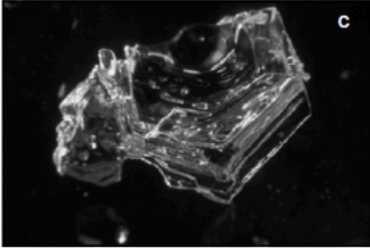
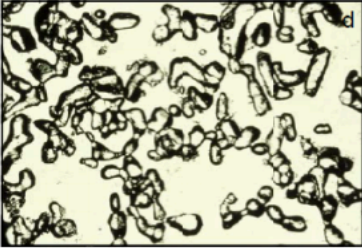
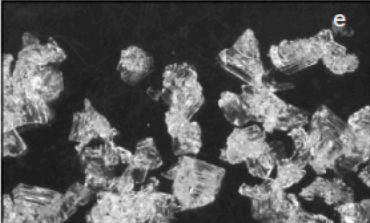
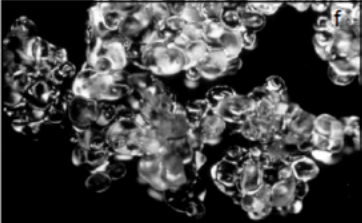
What you can do!

Snow Types:

X SNOW CARD

- + Precipitation particles
/ Decomposing & Fragmented particles
- Rounded Grains
- Wet Grains
- Solid Faceted Crystals
- ^ Cup Shaped Crystals (Depth Hoar)
- v Feathery Crystals (Surface Hoar)
- Ice Masses

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+			<input type="checkbox"/> Near surface faceted particles <input checked="" type="checkbox"/>
^			<input checked="" type="checkbox"/> ●
□			<input type="checkbox"/> ○ Clustered rounded grains ⊗

Snow, Weather and Avalanches (American Avalanche Association, 2004)



Share your Data!



X-Snow Data Form

Thank you for participating in the X-Snow project! Please enter your contact information here, and then follow the directions to enter your measurements.

The name and photo associated with your Google account will be recorded when you upload files and submit this form. Not laurelzaima@gmail.com? [Switch account](#)

Name

Your answer

Institution

Your answer

Next



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What More Can You Do?

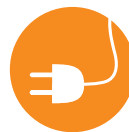
Make A Commitment to Do More to Reduce
Your Contribution to Climate Change. I will:



Walk, ride your bike,
take the bus



When leaving the room
I will turn off the lights!



Unplug! Play games,
play outside, read



Turn off your computer
when done



Take a 5 minute warm
short shower, not fill up a
hot bath



Turn down the heat at
home and wear a sweater



Pack a lunch in a cloth
bag and use refillable
containers



Skip the dryer, hang dry
your laundry



Talk to my Friends about
what I do to help! Be an
Example!



Reuse! Reduce!
Recycle!



COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK



Team X-Snow | **_____**
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Welcome to the team

From drinking water to rising sea levels, snow has a huge impact on all life on our planet. For this reason scientists are looking at snow very carefully, using satellites, drones and computer models to collect and analyze data. But these have their limitations. This is where you come in. We need you to join Team X-Snow and help us take measurements in the field. Together we can begin to unlock the secrets in snow.

Support

[Donate and help support](#) our field campaign in the Catskills, NY. The funding will be used to cover student participation, data analysis, equipment purchase, transportation and other fieldwork-related activities.



PlastiX-Snow Project



Marco Tedesco, Patrick Alexander, Laurel Zaima,
Paolo Colosio, Elizabeth Fischer, Shujie Wang, Raf
Antwerpen,

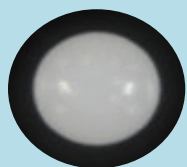
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Microplastics

Microplastics are a widely observed form of plastic pollution ranging from

1 micron to < 5 mm in size. They can be broadly categorized into two subgroups:

Primary: Objects that are originally manufactured as small particles



Microbeads

Hard sphere

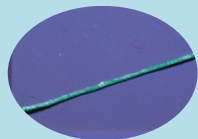
Source: Personal Care Products



Nurdle/Pellet

Hard, rigid, fixed shape.

Source: Virgin pellets for plastic manufacturing processes



Microfiber

Long thin

Source: Synthetic Textiles



Plastic Media Blasting (PMB)

Ground up plastic fragments

Source: Abrasive Blast Cleaning

Secondary: Formed from the degradation of macro-plastics through physical fragmentation, oxidation, bacteria, or photodegradation from the sun.



Fragment

Unidentified, hard, may have waxy texture



Foam

Soft, irregularly shaped



Film

Flimsy, thin sheets



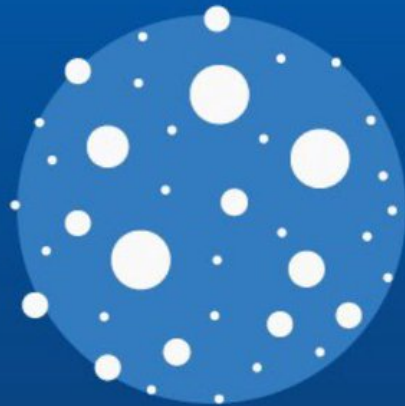
Cluster of Microplastics

Many microplastic pieces stuck together

Microplastic Major Sources

Where Do the Oceans' Microplastics Come From?

Distribution of sources of microplastics in the world's oceans



Synthetic textiles
35.0%



Car tires
28.0%



City dust
24.0%



Road markings
7.0%



Marine coatings
3.7%



Personal care products
2.0%



Plastic pellets
0.3%

Plastic Polymers

Plastics are made from a wide range of synthetic or semi-synthetic organic compounds. Typically, plastics are made of chemical compounds derived from petrochemicals or **oil**. There are many types of **plastic polymers**:



POLYAMIDES (PA) OR NYLONS

Fibers, toothbrush bristles, tubing, fishing line and low-strength machine parts such as engine parts of gun frames.



POLYCARBONATE (PC)

Compact discs, eyeglasses, riot shields, security windows, traffic lights, and lenses



POLYESTER (PES)

Fibers and textiles



POLYETHYLENE (PE + HDPE + LDPE + PET)

A wide range of inexpensive uses including supermarket bags and plastic bottles



POLYPROPYLENE (PP)

Bottle caps, drinking straws, yogurt containers, appliances, car fenders (bumpers) and plastic pressure pipe systems



POLYSTYRENE (PS + HIPS)

Foam peanuts, food containers, plastic tableware, disposable cups, plates, cutlery, compact disc (CD) and cassette boxes.



POLYURETHANES (PU)

Cushioning foams, thermal insulation foams, surface coatings and printing rollers: currently the sixth or seventh most commonly-used plastic, for instance the mostly commonly used plastic in cars



POLYVINYL CHLORIDE (PVC)

Plumbing pipes and guttering, shower curtains, window frames and flooring



POLYVINYLIDENE CHLORIDE (PVDC)

Food packaging, such as: Saran



ACRYLONITRILE BUTADIENE STYRENE (ABS + PC/ABS + PE/ABS)

Electronic equipment cases (e.g. computer monitors, printers, keyboards) and drainage pipe

How much plastic is there?

ALL PLASTIC EVER CREATED STILL EXISTS

One of the biggest design flaws in history...

- Plastic has been used worldwide for single use products. However, they chose to create single use products out of a material that **never biodegrades**.
- Instead of “**breaking down**,” it “**breaks up**” into tiny pieces of microplastics
- Microplastics have be **ubiquitous** in all reaches of the world.



Plastic Pollution

Milky Way Galaxy

Pieces of Plastic in our Ocean

~5.25 Trillion

13X more pieces of PLASTIC in the OCEAN
than STARS in the GALAXY



Microplastic Transportation

- Distribution via ocean circulation
- Bioaccumulation through the food web
- Atmospheric deposition: rain, wind, snow

Plastic...
Invaders of the air and sea





PlastiX-Snow



Research Question:

- How much microplastic is deposited by snow in various parts of the United States?
- What types of microplastics are being transported?

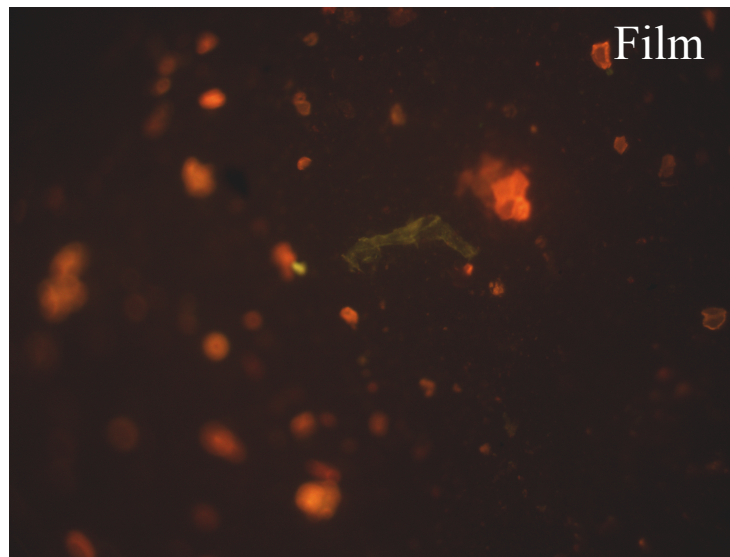
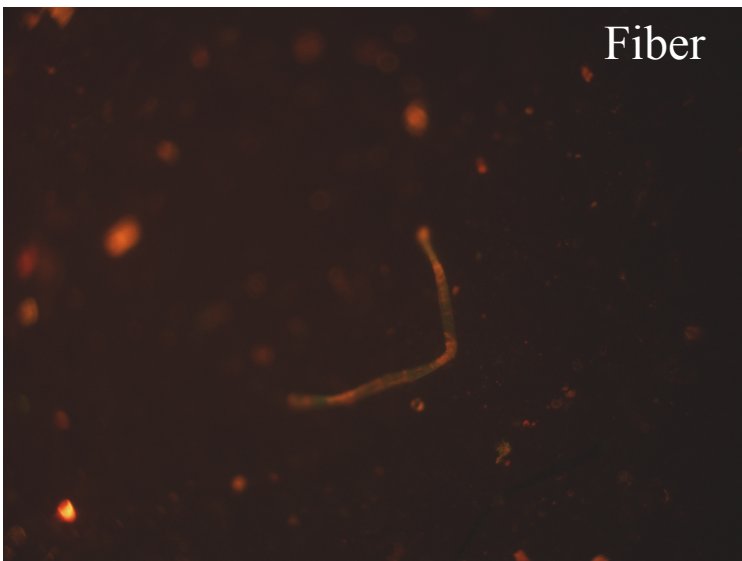
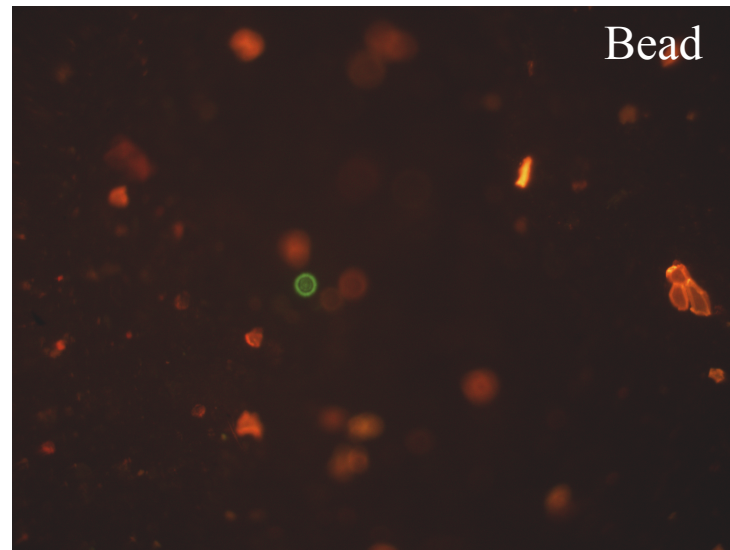
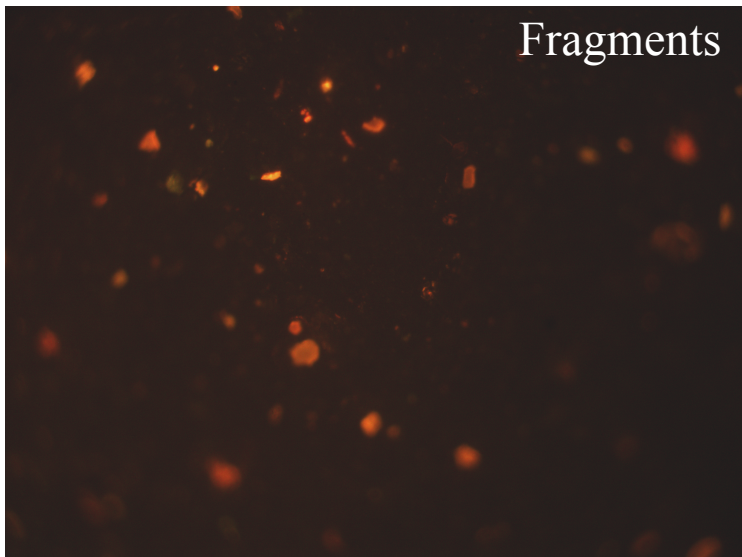
Hypothesis:

- High urban areas will have more snow deposited microplastic than rural areas.
- Microfragments are the primary source of snow deposited microplastic pollution.

Goals:

1. Collect data for a deeper understanding of microplastics disseminated by snow
2. Teach the public about the dangers of microplastics and share potential solutions
3. Engage communities, students, educators, and the public to participate in groundbreaking, relevant scientific research.

Preliminary look...



PlastiX-Snow

Projected Start: Winter 2020-2021

We will need your participation!

Snow Stewards will:

- Collect snow samples in their local area using a special snow collector
- Filter snow melt with a glass fiber filter to isolate microplastics from the melt water
- Analyze the microplastics in the sample
- Observe, quantify, and photograph the microplastics
- Send the filters back to us to analyze in our lab!



Source: CoCoRaHS



Interested?

Project Start: Winter 2020-2021

Audience: MS/HS/Undergraduate students preferably.
We can cater this project to K-5 students as well!



Source: Pevovarga/Shutterstock

If you are interested in participating or being on our mailing list, please contact us!

Personal Pledge:

The plastic problem ends with us! Make a pledge to stop using single use plastics:

- Make a conscious effort to bring **reusable bags** to the grocery store.
- **Refuse straws, plastics cutlery, and cups** when you're out to eat. Instead bring your own!
- Purchase **detergents without plastic particles** in it.
- **Hang dry your clothes** instead of using the drier.
- Shampoo, conditioner, and body **soap bars** instead of plastic bottles

These are a couple of ideas of how to reduce your plastic consumption, but please feel free to share other ideas with us!



X-Snow Social media:

Share photos of your site, snowflakes and data using the hashtag #xsnow2019

You can find us on Instagram: **@columbia_x_snow**

Email:

X-Snow Email: teamxsnow@gmail.com

PlastiX-Snow Email: plastixsnow@gmail.com

Website:

For more information and to donate, visit us at:

<http://xsnow.ldeo.Columbia.edu>

<https://www.plastixsnow.com>

QUESTIONS?

Or contact us later:

Carine Verschueren (cv2343@tc.columbia.edu)

Laurel Zaima (Lzaima@ldeo.columbia.edu)

Patrick Alexander (pma2107@ldeo.columbia.edu)



THANK YOU

Please visit

www.tc.columbia.edu/sustainability

