# going with the flow

## *exploring ecotechnologies in practice*

Acer saccharum, cameras, Christoforos Pappas, computers, Daniel Kneeshaw, data loggers, dendrometers, electricity, heat, humidity, Gisèle Trudel, Manon Huberland, maple grove, Marie-Eve Morissette, médiane, microphones, Québec, rain, Sainte-Émélie-de-l'Énergie, sap flow sensors, SmartForests Canada, software, soil, sugar bush, sun, time, touch designer, water, wind & 60 frames per second – March 23, 2023

*• climate • living matter • sensors • trees • engineering • data visualization • fluids • ecology • immersive • exploration*

Trees, scientists, artists, and their instruments sense how water flows. Trees take risks during the growing season by boosting transpiration (sap flow) or they hold back. Veins expanding, contracting. Water is pulled upwards from the soil to the air, passing by tree stems. But if drought occurs, trees could die.

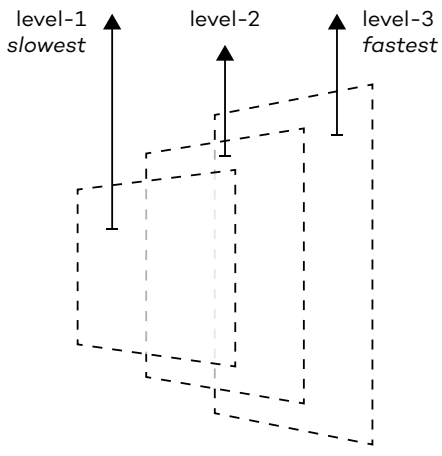
Scientists and trees are both sensing in tandem with environmental conditions. Because of its regular fluctuations, the process can be compared to the pulse of a heart. During daytime, trees transpire, resulting in stem water movement. This decreases from the outer to the inner sapwood, and because of dehydration, stem shrinkage ensues. During the night, the stem swells due to rehydration and water recharge. Pulling, funneling, decreasing, expanding. The pulsing relays these functions in relation with light and atmospheric humidity.

Scientists monitor the tree stem with heated needles, and encircle the tree trunks with straps and machines. A dendrometer quantifies the changes in the stem's size due to swelling, shrinkage, and growth, rendering it in microns. On July 3, 2020, for a mature sugar maple tree, its diameter was 355000.13 micrometers at 3:00 pm and 355062.47 micrometers at midnight. On the same day and for the same tree, a sap flow sensor combined with a data logger and algorithms reported the transpiration in centimeters per hour: 1.05 cm/h at 5:00 am and 14.89 cm/h at 2:00 pm. The sampling concurs, the tree is constantly changing. The tree's experience is shared with humans. Building together, from experience, the knowledge *about* and *in* changing climates, opening up to multiplicities, embracing ecotechnologies in practice: the tree's own, the instrumentation and the milieu of co-occurrence. Visualizations weave relations *of* this meeting between quantitative and qualitative sensing, an interoperability with computers. Is this data fidelity? Here, sap flow becomes a series of dots, densifying, the tree water deficit is inferred by the changing dimensions of the intervals between lines, pointing to local changes and changes in the tree. Still. Flowing. On.

This contribution was published on www.able-journal.org in a scroll.able format:

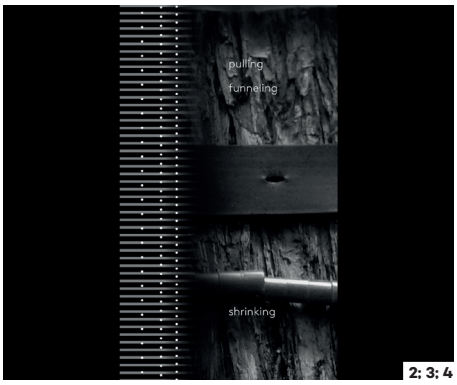
www.able-journal.org/en/going-with-the-flow

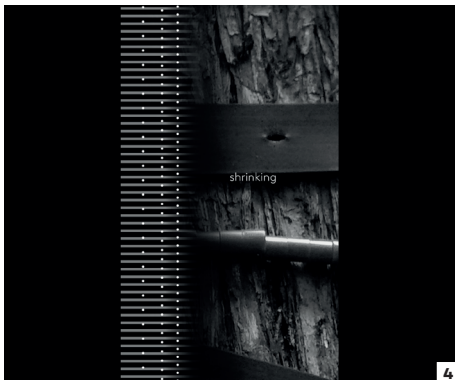
When the user scrolls, each image layer moves up or down at different speeds giving an impression of depth in the page.




Sugar Maple Tree
— July 2020
1

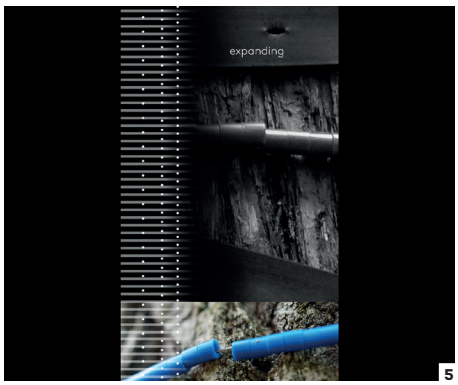

pulling
2

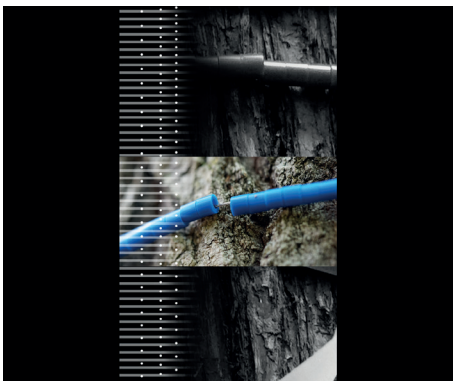

pulling
funneling
shrinking
2; 3; 4

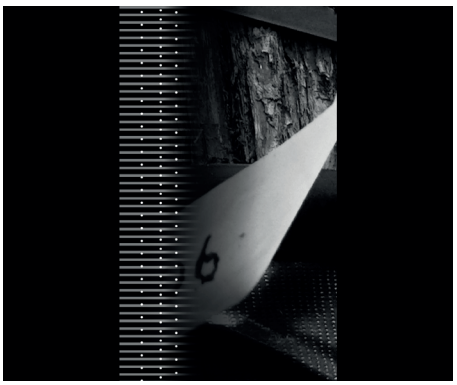

shrinking
4

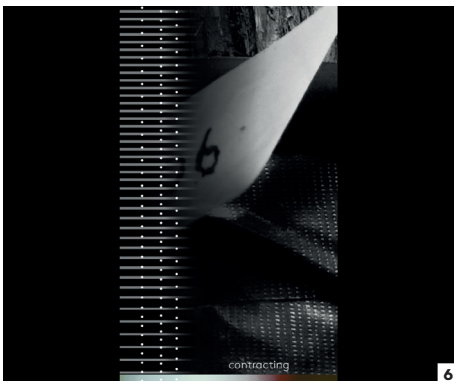

shrinking
expanding
4; 5

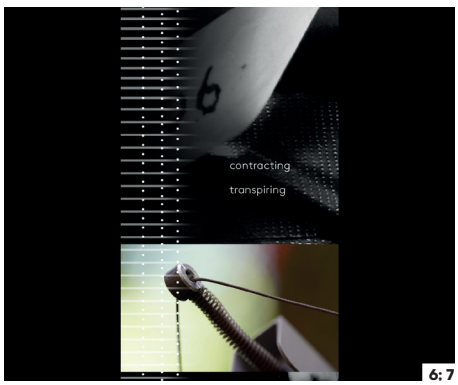

expanding
5

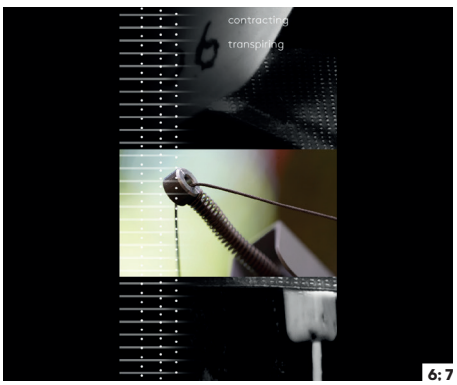

expanding
5

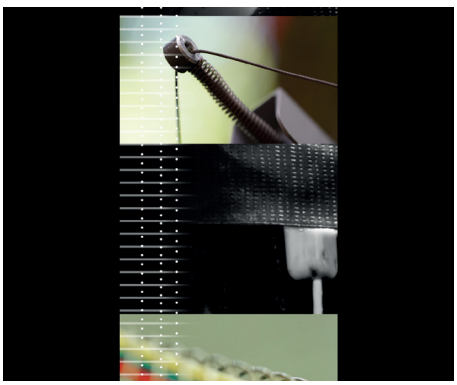


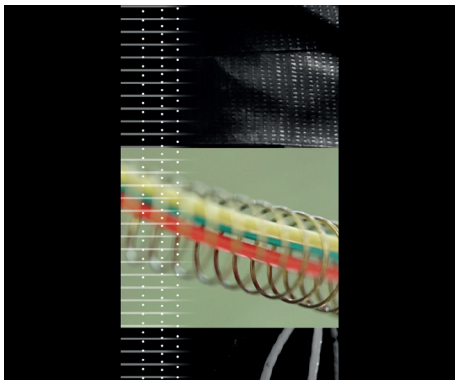
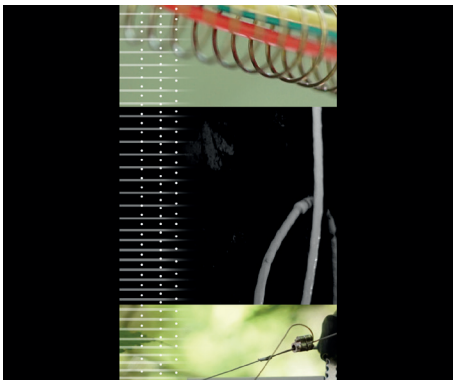
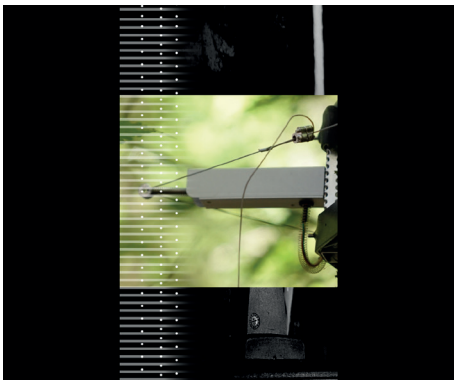
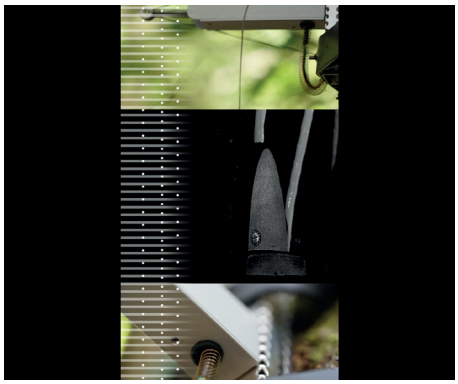
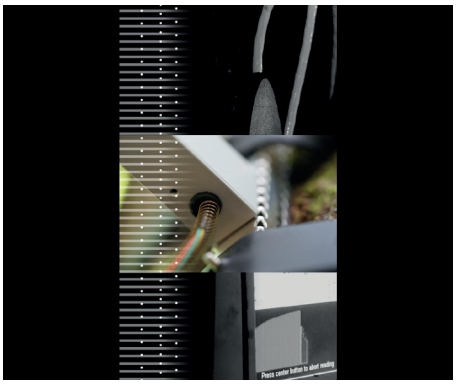



contracting
6


contracting
transpiring
6; 7


contracting
transpiring
6; 7



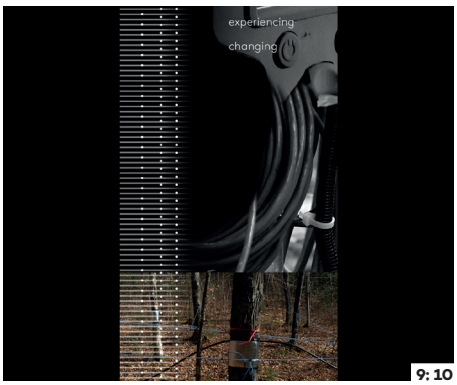







8

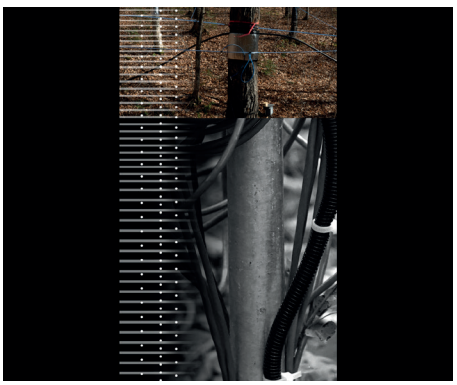
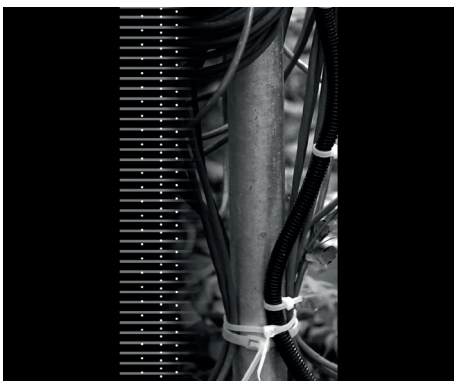

8

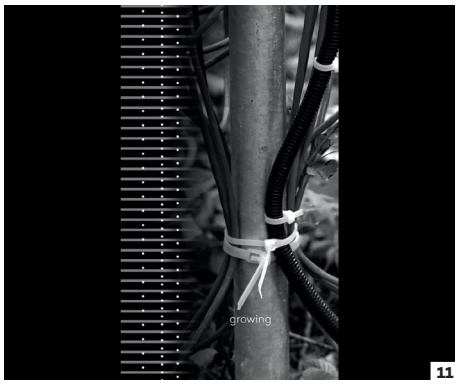

8

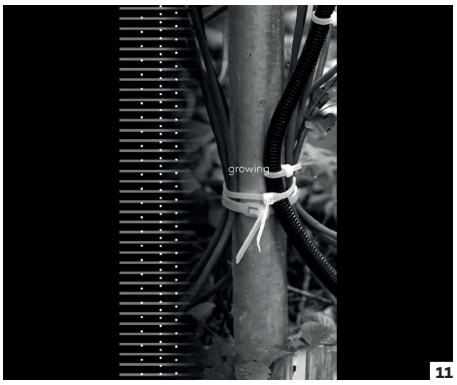
9: 10

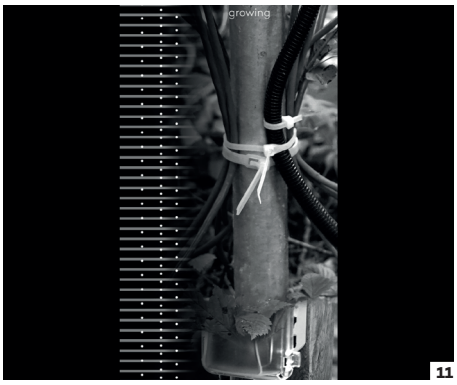

9: 10


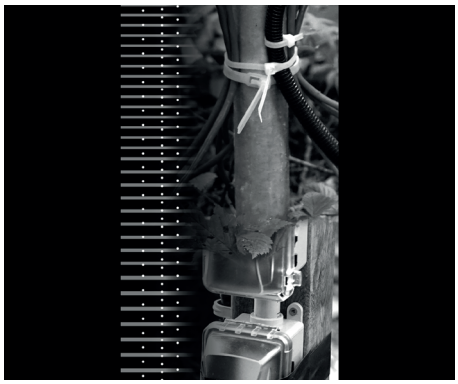
9: 10

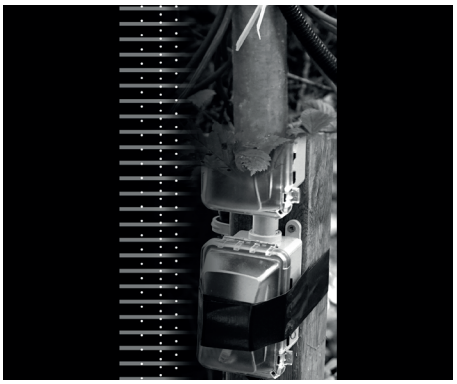



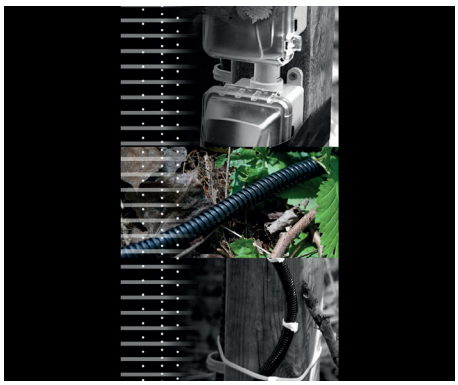






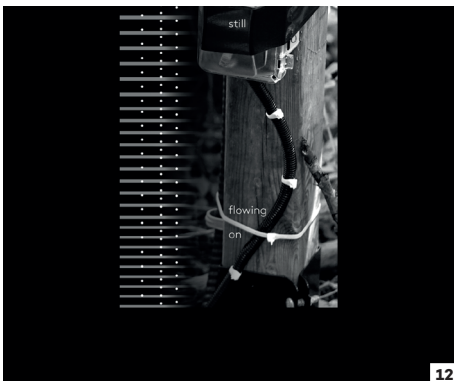




**image captions**

**1.** Sugar Maple Tree - July 2020

**2.** pulling

**3.** funneling

**4.** shrinking

**5.** expanding

**6.** contracting

**7.** transpiring

**8.** sensing

**9.** experiencing

**10.** changing

**11.** growing

**12.** still flowing on

# credits

**website:** mediane.uqam.ca

**instagram:** @medianeforestsensing

**authors:**
Daniel Kneeshaw, forest ecologist and professor
Marie-Eve Morissette, designer and master's student in digital design
Christoforos Pappas, civil engineer, researcher and professor in geosciences
Gisèle Trudel, artist and professor

**designers:** Gisèle Trudel, Marie-Eve Morissette

**project manager:** Manon Huberland

**editorial mediator:** Jean Dubois

**financial support:** The Social Sciences and Humanities Research Council of Canada, the Canadian Foundation for Innovation, the Fonds de recherche du Québec – Société et culture.

**acknowledgments:** Université du Québec à Montréal (UQÀM in Tiohtiá:ke/Montreal) is situated on the traditional territory of the Kanien'kehà:ka, a place which has long served as a site of meeting and exchange amongst many First Nations including the Kanien'kehá:ka of the Haudenosaunee Confederacy, Huron/Wendat, Abenaki, and Anishinaabeg.

# about the authors

**Dan Kneeshaw** (PhD) is a forest ecologist interested in the effect of climate change on our forests. He and his team measure the response of trees to water stress, temperature, and pests. They are trying to determine which tree species and populations are resilient and which are vulnerable to climate change.

**Marie-Eve Morissette** has a master's degree in environmental design, a Specialized Graduate Diploma event design from UQÀM and is pursuing a master's digital design at NAD-UQAC. Her research focuses on the concept of interface encounters in installations that mobilize materiality, haptics, and sound. She works with the MÉDIANE research chair (UQÀM) and Mimesis (NAD-UQAC).

**Christoforos Pappas** (PhD), a civil engineer by training, has more than ten years of research experience in the geosciences, including academic appointments in Switzerland and Canada. His research addresses pressing questions regarding natural and urban landscapes, with cross-disciplinary engineering and science-based solutions that require accurate spatiotemporal characterization of the underlying phenomena.

**Gisèle Trudel** (PhD) is an artist and professor at the École des Arts Visuels et Médiatiques, Université du Québec à Montréal. With her Canada Research Chair, she collaborates with SmartForests Canada, to explore artistically in outdoor media installations how scientific research about climate change affects the boreal forest as a dialogue with publics.

https://mediane.uqam.ca
https://aelab.com

# rights and references

## illustration rights and references



## bibliography and references

Ælab. 2021. "Ælab. bois eau métal. (2021). Installation artistique au Jardin botanique de Montréal: Documentation of the art installation entitled bois eau métal by Ælab, produced by MÉDIANE Canada Research Chair in Arts, Ecotechnologies of Practice and Climate Change and in collaboration with SmartForests Canada."
Vimeo video: https://vimeo.com/597377505.

Boisclair, Louise, and Enrico Pitozi. 2019. *Art immersif, affect et émotion. L'expérientiel 1*. Paris: L'Harmattan.

Boisclair, Louise. 2020. "ART IMMERSIF, AFFECT ET ÉMOTION. L'expérientiel 1 – expériencier, cartographier, événementier", YouTube video: https://www.youtube.co/watch?v=53HPmnm2uW0.

Boisclair, Louise. 2021. *Art écosphérique : de l'anthropocène… au symbiocène. L'expérientiel 3*. Paris: L'Harmattan.

Gabrys, Jennifer. 2020. "Smart forests and data practices: From the Internet of Trees to planetary governance", *Big data & society 7*, no 1: https://doi.org/10.1177/2053951720904871.

Pappas, Christoforos, Nicolas Bélanger, Yves Bergeron, Olivier Blarquez, Han Y. H. Chen, Philip G. Comeau, Louis De Grandpré, Sylvain Delagrange, Annie DesRochers, Amanda Diochon, Loïc D'Orangeville, Pierre Drapeau, Louis Duchesne, Elise Filotas, Fabio Gennaretti, Daniel Houle, Benoit Lafleur, David Langor, Simon Lebel Desrosiers, Francois Lorenzetti, Rongzhou Man, Christian Messier, Miguel Montoro Girona, Charles Nock, Barb R. Thomas, Timothy Work, and Daniel Kneeshaw. 2022. "Smartforests Canada: A Network of Monitoring Plots for Forest Management Under Environmental Change." In *Climate-Smart Forestry in Mountain Regions. Managing Forest Ecosystems*. Edited by Roberto Tognetti, Melanie Smith, and Pietro Panzacchi. Cham: Springer. https://doi.org/10.1007/978-3-030-80767-2_16.

# to cite this article

Saccharum, Acer, Daniel Kneeshaw, Marie-Eve Morissette, Christoforos Pappas, Gisèle Trudel, et al. 2023. “Going with the Flow: Exploring Ecotechnologies in Practice.” *.able journal*: https://able-journal.org/en/going-with-the-flow

| | | |
|---|---|---|
| MLA | EN | Saccharum, Acer, et al. “Going with the Flow: Exploring Ecotechnologies in Practice.” *.able journal*, 2023. https://able-journal.org/en/going-with-the-flow |
| ISO 690 | EN | SACCHARUM, Acer, et al. Going with the Flow: Exploring Ecotechnologies in Practice. *.able journal* [online]. 2023. Available from: https://able-journal.org/en/going-with-the-flow |
| APA | EN | Saccharum, A., et al. (2023). Going with the Flow: Exploring Ecotechnologies in Practice. *.able journal*. https://able-journal.org/en/going-with-the-flow |